CAMEROON
MINISTRY OF AGRICULTURE
AND RURAL DEVELOPMENT

CAMEROON
PREPARATORY SURVEY
OF RURAL INFRASTRUCTURE
IMPROVEMENT PROJECT
IN
CAMEROON

FINAL REPORT

FEBRUARY 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

NTC INTERNATIONAL CO., LTD.
EARTH AND HUMAN CORPORATION CO., LTD.

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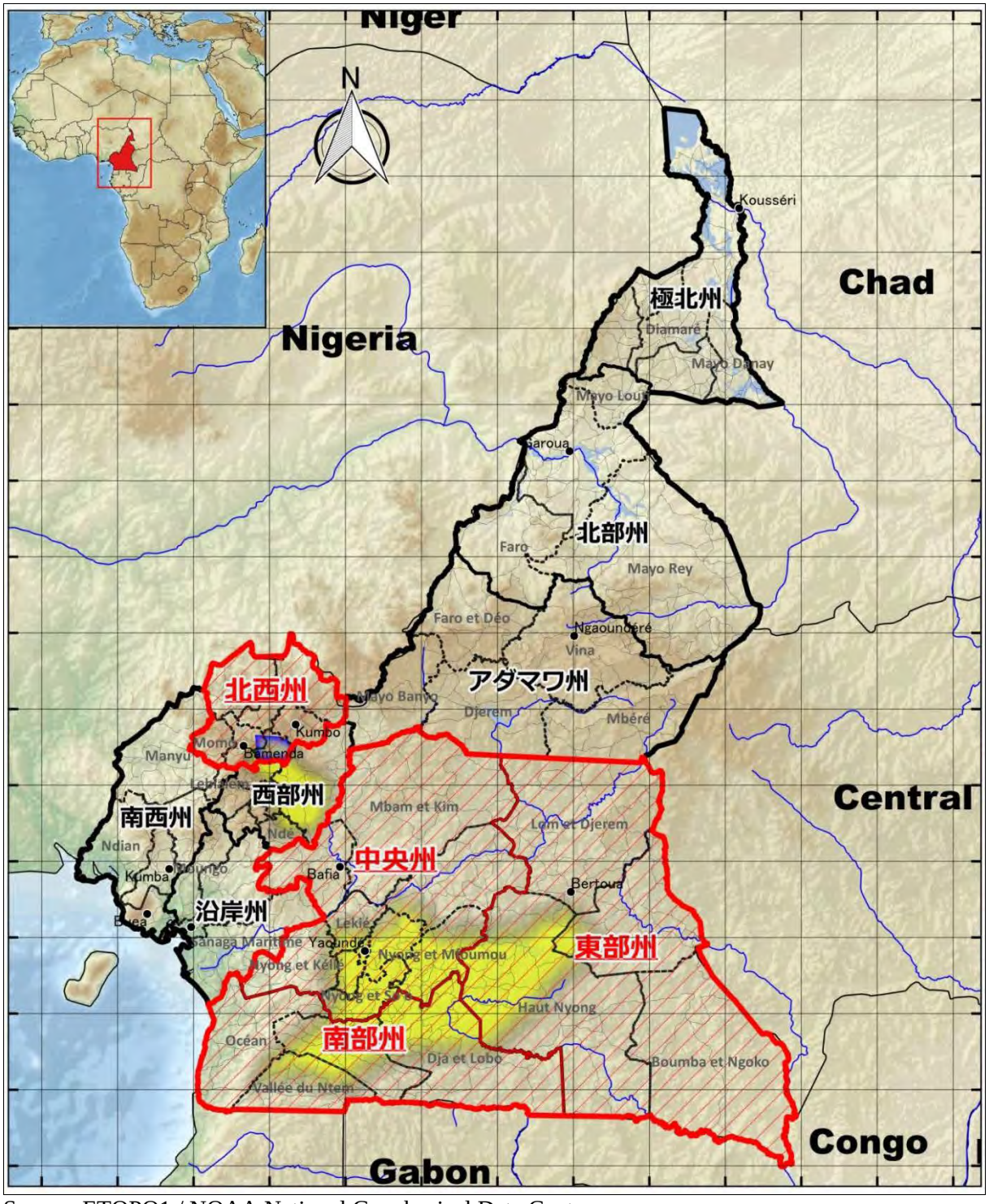
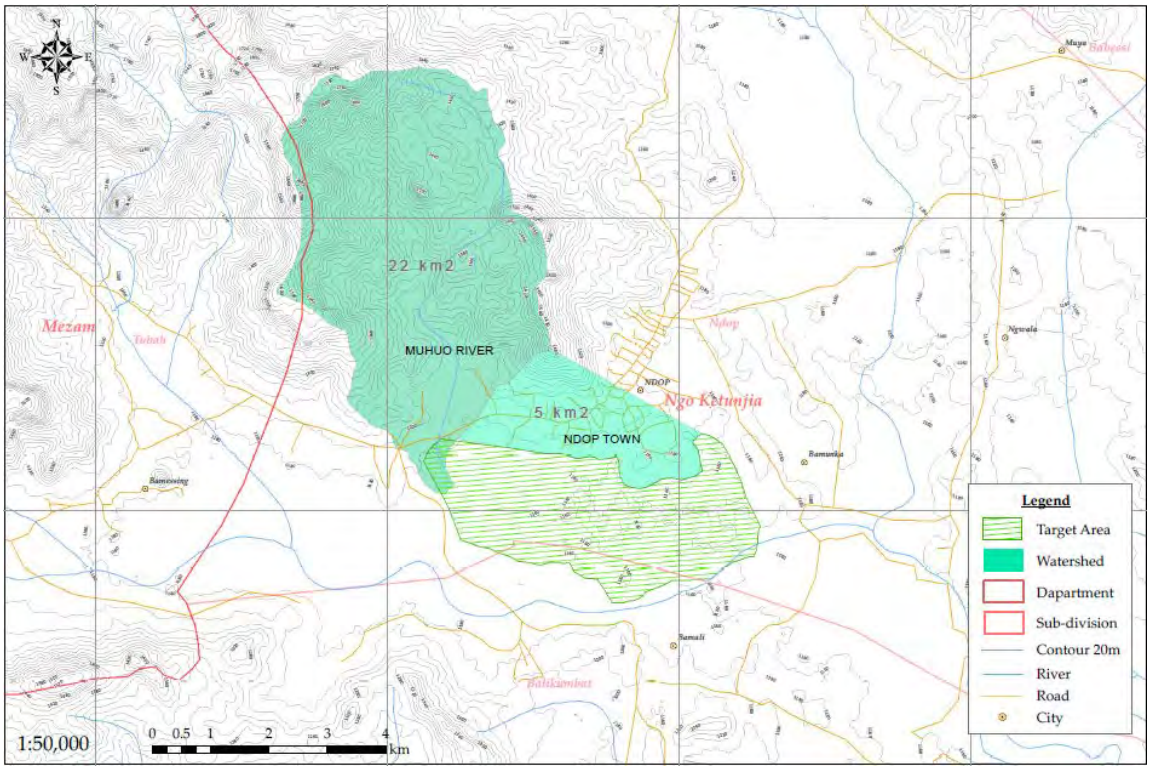
Map of Study Area

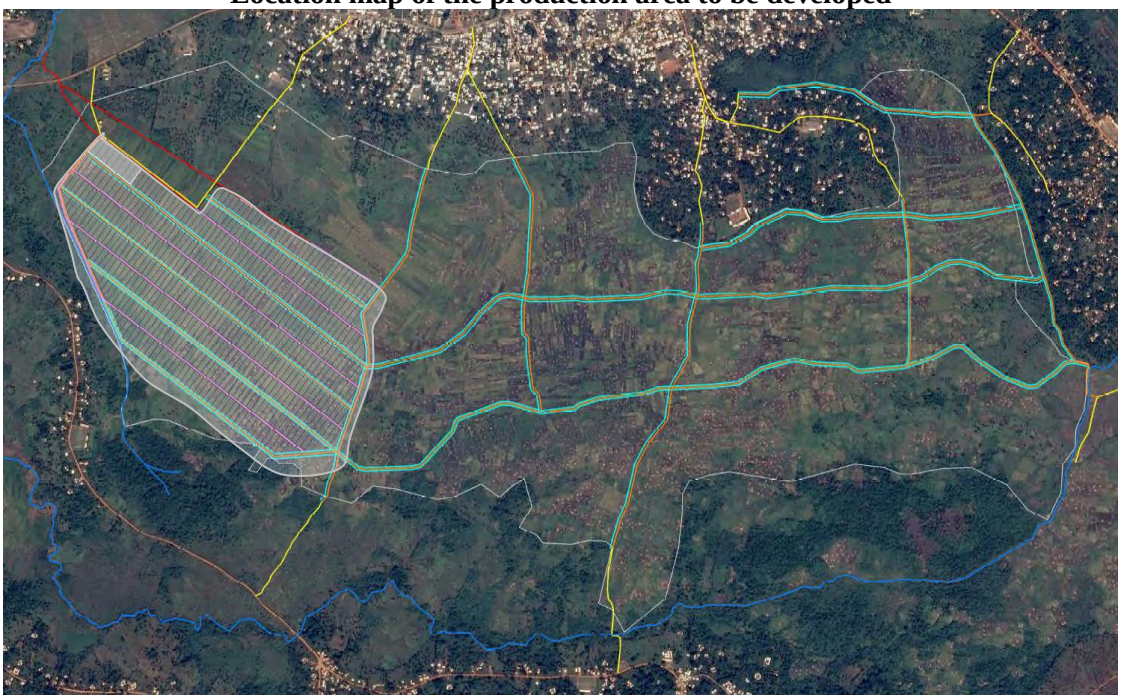


Source: ETOPO1 / NOAA National Geophysical Data Center

Location map of the regions covered by the study



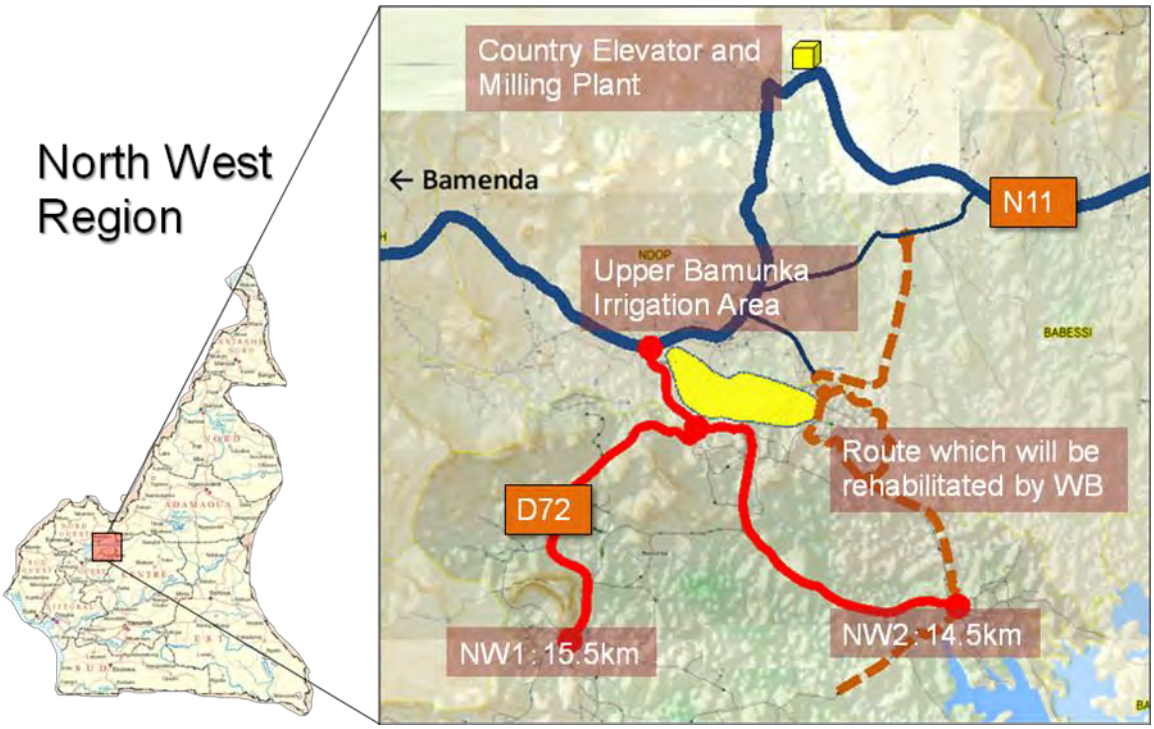
Location map of the production area to be developed



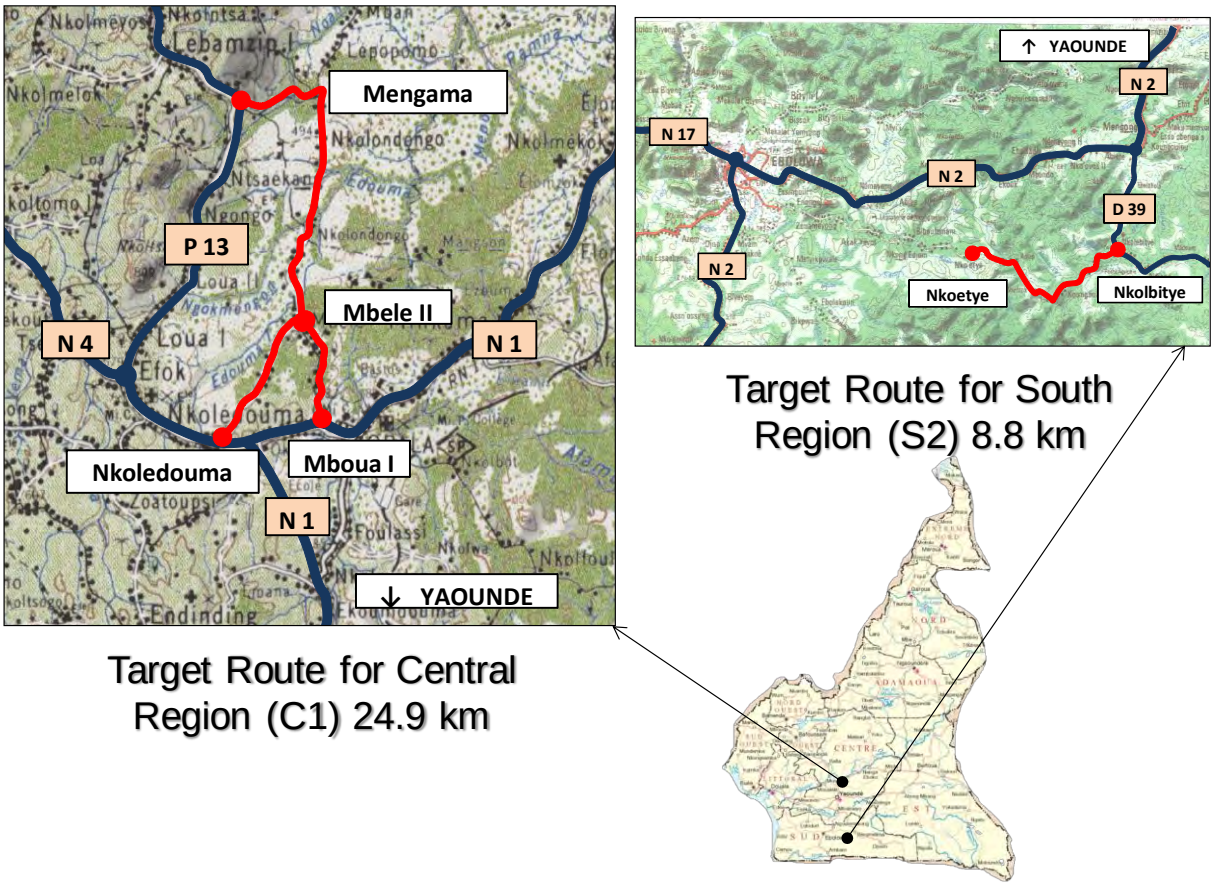
Development of Drainage Channel…46.34 km
Development of Internal Farm Road…28.22 km
Development of Irrigation Channel…7.43km
Rehabilitation of Existing Irrigation Channel…0.04 km
Others such as Bridge, Culvert and Approach Path

: Existing Road
: Existing Irrigation Canal
: River
: Drainage Canal
: Internal Farm Road
: Irrigation Canal
: Land leveling & Farmlot integration

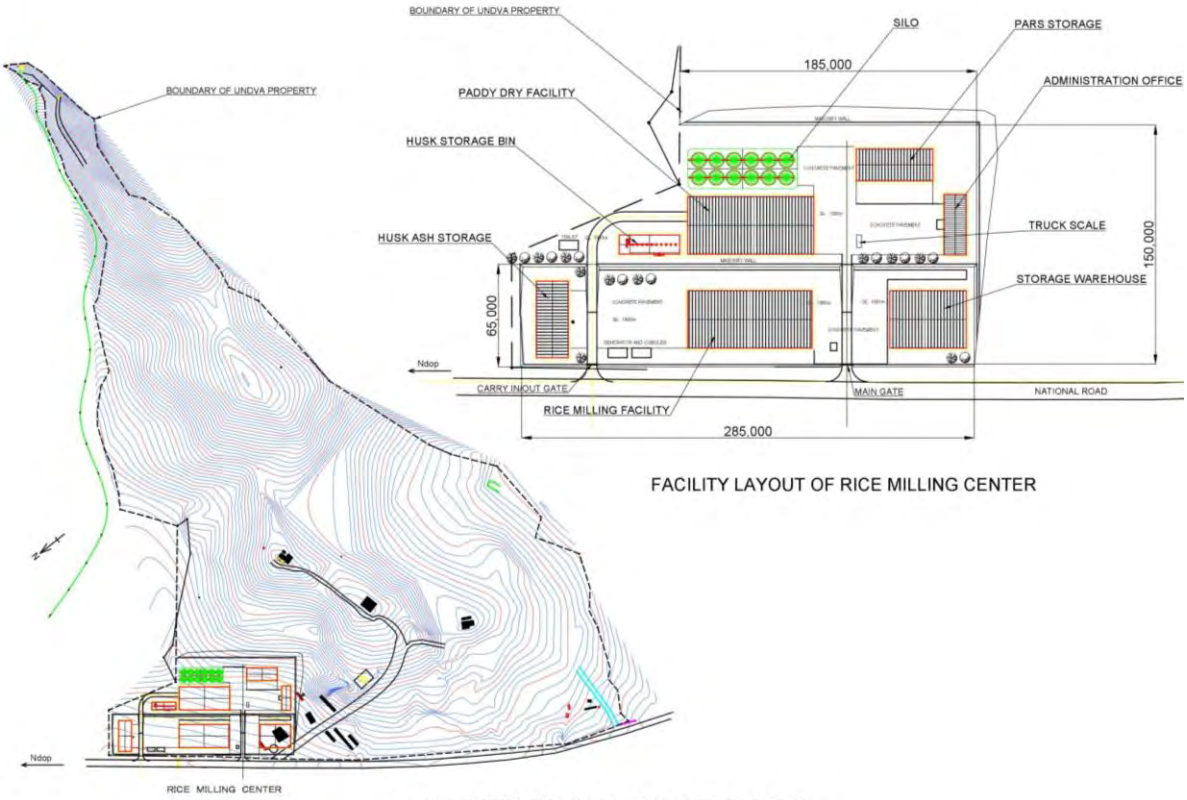
Plan for development of hydro-agricultural



Location Map of farm roads to be developed in the north-west region



Location maps of agricultural roads to be developed in the central and south regions



Map and installation plan of the rice milling center

Plan of rice milling center

Preparatory Survey of Rural Infrastructure Improvement Project

in Cameroon

Final Report

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Abbreviation

Abbreviation	French	English
ACE	Attestation de Conformité Environnementale	Attestation of Conformity
AFD	Agence Française de Développement	French Development Agency
AFDB	Banque Africaine de Développement	African Developpment Bank
CARD	Coalition pour le Développement du Riz Africain	Coalition for African Rice Development
CENEEMA	Centre National d'Etudes et d'Experimentation du Machinisme Agricole	National Center for Studies and Experimentation of Agricultural Machinery
CBR	Californie Ratio de Roulement	California Bearing Ratio
CCE	Certificat de Conformité Environnementale	Environmental Conformity Certificate
C/P	Homologue	Counter Part
DBST	Double Bitumineuse Traitement de Surface	Double Bituminous Surface Treatment
DDA	Direction du Development de l'Agriculture	Direction of Agricultural Development
DEPC	Direction des Etudes, des Programmes et de la Coopération	Department of the Studies, the Programs and Cooperation
DGRCV	Direction du Génie Rural et de l'Amelioration du Cadre de Vie en Millieu Rural	Direction of Agricultural Engineering and Improvement of Rural Environment
DOPA	Direction des Organizations Professionelles Agricoles et de l'Appui aux Explotations Agricoles	Direction of Professional Agricultural Organizations and Agricultural Support Exploitations
DRCQ	Direction de la Reglementation, du Controle de Qualite des Intrants et Produites Agricoles	Direction of the Regulation and Quality Control of Agricultural Inputs and Products
EES	Evaluation Environnementale Stratégique	Strategic Environmental Assessment
EIA	Evaluation de l'impact Environnemental	Environment Impact Assessment
EIES	Etude d'impact Environnemental et Social	Environmental and Social Impact Assessment
EIRR	Économique Taux de Rendement Interne	Economic Internal Rate of Return
EU	Union Européenne	European Union
FAO	Organisation pour l'Alimentation et l'agriculture	Food and Agriculture Organization
FAOSTAT	Base de Données pour l'Alimentation et l'Agriculture d'Entreprise Statistique	Food and Agriculture Organization Corporate Statistical Database
GDP	Produit Intérieur Brut	Gross Domestic Product
GESP	Document de Stratégie pour la Croissance et l'Enploi	Growth and Employment Strategy Paper
GPS	Système de Positionnement Global	Global Positioning System
ICB	Appel d'Offres International	International Competitive Bidding
IDB	Banque Islamique de Développement	Islamic Development Bank
IEE	Evaluation Environnementale Préliminaire	Initial Environmental Examination
IFAD	Fonds International de Développement Agricole	International Fund for Agricultural Development
IMF	Fond Monétaire International	International Monetary Fund
IRAD	Institut de Recherche Agricole pour le Développement	Institute of Agricultural Research for Development
JICA	Agence Japonaise de Coopération Internationale	Japan International Cooperation Agency
KRC	Corée du Rural Community Corporation	Korea Rural Community Corporation
MATGENIE	Parc National de Matérial de Génie Civil	National Civil Engineering Equipment Pool
MDGs	Objectifs de Développement du Millénaire	Millennium Development Goals
MINADER	Ministère de l'Agriculture et du Développement Rural	Ministry of Agriculture and Rural Development
MINAS	Ministère des Affaires Sociales	Ministry of Social Affairs

Abbreviation	French	English
MINDCAF	Ministère des Domaines, du Cadastre et des Affaires Foncières	Ministry of State Property, Survey's and Land Tenure
MINEE	Ministère de l'Eau et de l'Energie	Ministry of Water Resources and Energy
MINEPAT	Ministère de l'Economie, de la Planification et de l'Aménagement du Territoire	Minister of the Economy, Planning and Regional Development
MINEPDED	Ministère de l'Environnement et de la Protection de la Nature et du Développement Durable	Ministry of Environment, Protection of Nature and Sustainable Development
MINEPIA	Ministère de l'Elevage, de la Pêche et des Industries Animales	Ministry of Livestock, Fisheries and Animal Industries
MINFI	Ministere des Finances Cameroun	Ministry of Finance
MINFOF	Ministère des Forêts et de la Faune	Ministry of Forests and Wildlife
MINRESI	Ministère de la Recherche Scientifique et de l'Innovation	Ministry of Scientific Research and Innovation
MINSANTE	Ministère de la Santé Publique	Ministry of Public Health
MINTP	Ministère des Travaux Publics	Ministry of Public Works
NGO	Organisation Non Gouvernementale	Non Governmental Organization
NIE	Notice d'Impact Environnemental	Environmental Impact Statement
NRDS	Stratégie Nationale de Développement du Riz	National Rice Development Strategy
ODA	Assistance de Développement Officiel	Official Development Assistance
OJT	Sur le Tas de Formation	On the Job Training
PIDMA	Projet d'Investissement et de Développement des Marchés Agricoles	Agricultural Investment and Market Development Project
PMU	Unité de Gestion du Projet	Project Management Unit
PMC	Consultant Gestionnaire du Projet	Project Management Consultant
PNDP	Programme National de Développement Participatif	National Participatory Development Programme
PRSP	Document de Stratégie de Réduction de la Pauvreté	Poverty Reduction Strategy Paper
PRODERiP	Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale au Cameroun	Upland Rice Development Project of the Tropical Forest zone in Cameroon
PRODERIP	Projet de Développement de la Riziculture Iriguée et Pluviale	The Project for the Development of Irrigated and Rainfed Rice Cultivation
PSC	Comité de Pilotage	Project Steering Committee
R/D	Compte Rendu des Discussions	Record of Discussion
RSDS	Stratégie de Développement du Secteur Rural	Rural Sector Development Strategy
SDEE	Sous-Direction des Évaluations Environnementales	Division of Environmental Assessment
SDPGE	Sous-Direction des Plans Gestion Environnementale	Division of Environmental Management Plan
SEMRY	Societe d'Expansion et de Modenisation de la Rizculture de Yagoua	Yagoua Rice Cultivation Development and Modernization Authority
SEA	L'Evaluation Environnementale Stratégique	Strategic environmental assessment
SSA	Afrique Sub-Saharienne	Sub-Saharan Africa
STEP	Conditions Spéciales pour le Partenariat Economique	Special Terms for Economic Partnership
TOR	Termes de Référence	Terms of Reference
TOT	Formation de Formateurs	Training of Trainers
UNVDA	Société de Développement de la Uppere Vallée du Noun	Upper Noun valley Development Authority

Abbreviation	French	English
USDA	Ministère de l'Agriculture des États-Unis	United States Department of Agriculture
WB	Banque Mondiale	World Bank

Summary

Objective of the Study

This study aims to conduct necessary investigation for the irrigation development, access road development and installation of agricultural equipments as the component of Yen-loan project in the area where the activities of PRODERiP and PRODERIP has been conducted for the promotion of rainfed and lowland rice cultivation.

Current condition and Challenges of the Target Sectors

Irrigation and rice cultivation sector: The main rice cultivation area in Cameroon is Far-North region, North region and North-West region. Since Far-North and North regions are located in far from the major rice consuming area such as Duala and Yaoundé, the stable supplement of the rice to those cities is difficult in terms of the transportation cost. Thus, it is necessary to promote the rice cultivation in the areas close to the rice consuming cities such as North-West region, Central region and South region. Besides, the fierce competition has been caused between domestic rice and imported rice in Cameroon. Currently, the domestic rice is inferior to the imported rice in quality and price. Therefore, it is necessary to establish the rice producing and processing system for the supplement of the rice which fulfils the needs and demands of citizens in terms of its quality and price.

Access road sector: The total length of access roads are 80,000 km approximately, which covers 71 % of entire roads running in Cameroon and most of those access roads are paved by the raterite. Although the procurement of the raterite, construction and maintenance of the raterite pavement roads are relatively easy, the road surface of raterite paved road is deteriorated immediately in the area that have a large amount of rainfalls. Besides, the rehabilitation works for the existed access roads are conducted only by the leveling of road surface and the repairment of ditches by the motor-grader, which is insufficient due to the lack of raterite supplement and rolling compaction. Moreover, according to the direction of rural roads in MINTP, the technical capacities of local contractors consigned for the rehabilitation of those roads are lacking especially in terms of the basic knowledge and techniques for the road development.

Agricultural equipments sector: The local farmers in Cameroon rarely own the agricultural equipment. Thus, most of them use the custom work service provided by the CENEEMA, UNVDA and private companies for the land tillage before planting. In general, the capacities of the governmental staffs and local farmers are generally low for the management of the agricultural equipments. In addition, the maintenance and management system of those equipments are not well functioned.

Current Situation of the Target site of the Rice Value-chain Improvement Project in Cameroon.

Irrigation Component: The upper Bamunka area locating in the southern part of Ndop commune, North-west region is selected for the target site of irrigation component. The total beneficial area is 918 ha. Based on the topographical survey, the slope gradient of upstream area is 0.8 %, while that of middle and downstream area is 0.17 % in the target area. Besides the average slope gradient in the target area is 0.34 %. According to the soil physical survey, the utilization of tractors and combines can be available if the effect of the development of drainage canal is considered.

Access Road Development Component: The candidate roads proposed by MINADER is the roads running in the North-west, Central, South and East region which is counted for 98 roads and 1,958km in total. From these candidate routes, the routes that contribute to the expansion of market circulation volume of agricultural products especially for rice were selected and set as the target routes for the survey. The selected routes are 3 routes in North-West region, 2 routes in central region and 2 routes in south region. The land survey, traffic volume survey, geological survey and CBR survey were conducted for these 7 routes.

Installation of Agricultural Equipment Component: UNVDA is selected for the aid target organization

from the perspective that there are not private enterprises having sufficient capital and technical strength, and to promote the rice cultivation based on the national policy. As a result of the field survey, the land in Babungo managed by UNVDA was selected as the candidate site for the installation of post-harvest facilities for rice. The local farmer's needs on the agricultural equipments are power tillers, tractors and harvesters for men and tractor, excavators and rice planting machines for women. Currently, UNVDA owns 19 tractors, 1 combine and milling plant. However, the sufficient services on the plowing and rice milling are not provided to the local farmers since those equipments managed by UNVDA are already deteriorated or failed.

Social and Environmental Consideration

1. Items to be considered for the social and environmental consideration

The priority projects for the access road component, rural roads in several regions, have been carried out for the North-West Region (detailed ESIA), the Central Region (ESIA), and The Southern Region (ESIA summary). As the TORs of the ESIAs of the three regions were to be approved by the Cameroonian environmental authorities, they were drawn up in accordance with the Environmental Protection Decree No. 0001 / MINEPDED 2007, which stipulates the contents of the ESA TORs. Based on the TOR, various surveys including the stakeholder meeting were conducted for this preliminary survey. Besides, based on the results of the survey, the environmental impact assessment, mitigation, social and environmental management plan and social and environmental monitoring plan were formulated.

2. Land Acquisition and Relocation of the Populations

2.1 Necessity of Land Acquisition and Relocation of the Populations

In the irrigation development component and installation of agricultural equipments component, this project does not involve the acquisition of land and the relocation of the populations. In the access road development component, the acquisition of land will be required in certain areas where the road is to be extended in accordance with Cameroonian standards. According to the results of the study, there will be no land acquisition accompanied by physical movement, residents are in favor of rehabilitating the road, and all people affected by the acquisition of land have confirmed their consent. In order to avoid expropriations, it is possible, if necessary, to make the road less wide than the standard width. In the field study, it was confirmed that the rehabilitation of the road in accordance with the standard will not involve the involuntary resettlement of any of the inhabitants.

2.2 Implementation procedure and schedule of RAP

The compensation procedures will be started on the request of the establishment of the Commissions of Observation and Special Evaluation to the MINDCAF by the promoter of project (MINADER). By the instructions of the MINDCAF, the Commissions of Observation and Special Evaluation of the localities concerned on the basis of the principle of compensation within the framework of the project. As well as the DUP process, the Constant and Special Assessment Committees carry out field investigations to determine the amount of compensation. Completion of the detailed study of this project is foreseen in May 2019, that the field surveys will be completed by the Commissions in July 2019. The payment of the indemnity is the fact that at the end of 2019, it is necessary to carry out budgeting during the year 2018 by the MINADER.

2.3 Costs and sources of funding

The compensation costs for the NW1, NW2, C1 and S2 roads implemented under this project is estimated at FCFA 149,238,125 (about 25.65 million yen at the rate of 0.1719 FCFA/JPY of October 2016 adjusted by JICA. The compensation costs for this project are the subject of an administrative decision based on the results of the field study carried out by the commission of assessment and valuation. The amount of compensation subject to an administrative decision by ministerial decree will be paid by the assessment and evaluation commission after the establishment of the budgetary provision by MINADER.

Plan of Rice Value-Chain Improvement Project

1. Overall Concept of the Project

Considering the fact that 80 % of total consumed rice in Cameroon depends on the imported rice, it is indispensable to produce and supply the domestic rice having sufficient competitiveness against those imported rice from the perspective of its quality and price. Thus, this project focuses on the improvement of agricultural infrastructures such as irrigation facilities, access road and agricultural equipments in order to produce the highly competitive rice under the cooperation with the PRODERIP. In addition, the capacity development of the human resources is required for the continuous production of high quality rice and further development of producing area; thereby increase the rice sufficiency ratio in Cameroon. Therefore, this project also proposes to include the soft components which focus on the capacity development of human resources who takes responsibility for the O&M and management of the facilities and equipments introduced through this project and for the extension of the development model created through this project.

2. Project Summary

The table below shows the summary of this project

Table Outline of the Project

Items	Contents
(1) Civil Works for Irrigation Development	1) Construction of drainage channel: 46.34 km 2) Construction of internal farmroad: 28.22 km 3) Construction of irrigation channel: 7.43 km 4) Land leveling and integration of small farm lots: 164.3 ha 5) Rehabilitation of existing irrigation channel: 0.04 km 6) Construction of bridge: 2 7) Construction of other facilities such as culverts, tractor passages and inlets
(2) Civil Works for Access Road Development	1) Rehabilitation of the route of Bamali (N11) - Bamali 3 Corners – Balikumbat (15.5km) : width of road is 9m including 2m road shoulder, asphalt pavement. 2) Rehabilitation of the route of Bambalang - Bamali 3 Corners (14.5km) : width of road is 6m including 1m of road shoulder, laterite pavement. 3) Rehabilitation of the route of Mboua I (N4) - Mbele II – Edokassi, Mbele II - Bilon – Nkoledouma, Mbele II – Nkolndongo – Mengama - Nyeannam J.C. and Mengama – Ntsaekang (24.9 km) : width of road is 6m including 1m of road shoulder, DBST (7.4km) and laterite pavement (17.5km). 4) Rehabilitation of the route of Nkoetye – Nkolbitye (8.8 km) : width of road is 6m including 1m of road shoulder, DBST pavement.
(3) Architecture Works and Procurement of Agricultural Equipment	1) Construction of the building for the Rice Milling Center: Administration Office, Storage Warehouse, Rice Dry Facility, Rice Milling Facility, Parts Storage and Husk Ash Storage. 2) Procurement and Installation of Agricultural Equipments: Country Elevator, Rice Milling Facilities, 10 Tractors (40HP), 10 Harvesters and 2 Road Stabilizers
(4) Consulting services	1) Detailed Design 2) Tendering Assistance 3) Construction Supervision and Technical Assistance for the Operation, Maintenance and Management of the facilities procured. 4) Facilitation of Implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)
(5) Soft Component	1) Training for the O&M and management of water use and irrigation facilities. Training for the Planning, Designing and Supervision of irrigation facilities 2) Training for the O&M and management of Stabilizer, Training for the management and maintenance of access road 3) Training for the O&M and management of country elevator , milling plant, tractors and harvesters 4) Training for the administration of milling plant , Training for Marketing

3. Project Cost

The total project cost is estimated at 158.25 million yen. JICA will bear 116.33 million yen, while the cost of 41.92 million yen will be beard by Cameroon government.

Project Implementation Plan

1. Related Organizations and Their Capacity of the Project
The related organization of this project is MINADER, UNVDA, MINTP and MATGENIE. Based on the evaluation of technical and financial status, these organizations have sufficiently capacity for the implementation of this project.

2. Project Implementation Structure
The executing organization of this project is MINADER. After the sighing of L/A, MINADER establishes Project Steering Committee (PSC) and Project Management Unit (PMU). The member of PSC is consisted of the representative of related ministries. In contrast, PMU consists of 1) National Coordinator, 2) Expert for Civil Engineer, 3) Expert for Agricultural Machinery, 4) Expert for Monitoring and Evaluation, 5) Expert for Socio-Environment and 6) Expert for Administration and Finance of which is selected by MINADER. The selected consultants by the International Competitive Bidding (ICB) support the entire activities of the project as Project Management Consultant (PMC). Major implementation body is differed depending of the target region. The district office of MINADER and MINTP will bear the project activities in North-west region while the district office of MINTP will bear the project activities in Central and South regions. Besides, the staff of UNVDA and MINTP will be dispatched as focal point of the technical issues on the component of irrigation development and installation of agricultural equipment and the component of access road development respectively. The major role of each organization is as follows.

PSC: PSC is the decision making body at national level. Its role is to give advices to the project staffs so as to follow the national policy. Besides, PSC will approve the annual activity plan and budget plan submitted by PMU.

PMU: PMU is the project management body at national level. The Procurement of the consultants and contractors will be conducted by PMU. In addition, PMU will prepare the annual activity plan, budget plan, progress reports and manage the project budget.

PMC: PSC will be in charge of the project management and monitoring in cooperation with PMU. PMC will conduct the detailed design, procurement of contractors, supervision of construction works and soft component. PSC will also prepare the annual activity plan, budget plan, progress reports in cooperation with PMU.

MINTP (focal point): MINTP will be in charge of giving the advices to PMU for the detailed design and construction plan of the rehabilitation of target roads in this project, while it also implement the monitoring and inspection of the construction works.

UNVDA (focal point): UNVDA will be in charge of giving the advices to PMU for the detailed design and construction plan on the irrigation facilities and agricultural equipments in this project, while it also implement the monitoring and inspection of the construction works.

Implementing body of the regional activities: The regional activities such as the monitoring and trouble shooting of the project will be conducted by the regional governmental office of MINADER and MINTP.

3. Project Schedule

The signing of L/A of this project will be conducted in June 2017 and be terminated by February 2023.

Project Evaluation

The plan on three project components (irrigation, access road and agricultural equipment) proposed by this survey was evaluated in terms of economical, financial and socio-economical aspects. The economical evaluation was conducted based on the EIRR of entire components. As a result of the sensitivity analysis, the EIRR was 12.3 % when the increase and decrease of benefit and cost was 0%.

Besides, the B/C and NPV is 1.03 and 1,166 million FCFA when the discount rate is 12%.

Procurement Plan

1. Procurement of Consultant
The consultant will be selected based on the ICB. Since this project will apply the STEP scheme, the selected consultants should be Japanese consultants. The selection method will be QCBS.

2. Procurement of Contractor
One package deal contract with consortium of trading company as a lead partner, makers of agricultural equipments and civil engineering company will be assumed for this project. The selection of the contractor will be conducted based on the evaluation of technical and financial proposal.

Conclusion and Recommendation

Cameroon is currently depending on the importing rice for the domestic consumption. In order to cast off this situation, it is stated in NRDS that the national rice production in Cameroon shall be increased up to 970,000 t/year by 2018. However, according to FAOSTAT, the national rice production in Cameroon is reported as 203,000 t/year at 2014, indicating that there is a considerable gap between the goal and the reality. It is indispensable for increasing the national self sufficiency of rice to prepare and implement the necessary plan to solve the constraints impeding the increase of national rice production. It is concluded that the implementation of this project has higher appropriateness and would contribute the promotion of domestic rice production in Cameroon. Therefore, the JICA study teams strongly recommend implementing this project by Cameroon government. Besides, based on the result of quantity survey, the procurement cost for the Japan-made agricultural equipments and engineering services exceeds 30% of total construction cost, which satisfy the condition of STEP. The merits for Cameroon side to apply the STEP are 1) lower interest rate and 2) longer period for the redemption and deferment compared with other yen loan scheme. Considering the fact that the introduction of Japan-made agricultural machinery would promote the highly competitive rice production and its distribution to the domestic market, it is indispensable to proceed the discussion between Cameroon and Japan side for the application of STEP until the signing of L/A. As a supplement, this project would be the first case of the STEP applied project in agricultural sector for JICA, this project is expected to be the model for other similar project in the future.

Chapter 1 Background of the Project

1.1 Background and Objective

In Cameroon, the agriculture occupies 60% of the active population and represents 20% of gross domestic product. It is an important platform of supplying agricultural products to the neighboring countries such as Nigeria. Furthermore, due to the drastic increase in rice consumption, especially in urban areas, the rice import from Asian countries has highly affected the national economy. However, most of domestic rice is exported to the neighboring countries which make it difficult to satisfy the domestic demands in Cameroon. Thus it is imperative to develop local rice production, strengthen rice distribution networks and develop certain infrastructures of which its current condition is leading to the significant losses in post-harvest agricultural products. In the "Growth and Employment Strategy Paper 2009" (GESP), the Government of Cameroon places rice in the list of capital commodities to ensure the country's food security and therefore grants great importance to promoting the cultivation of rice. Moreover, a National Rice Development Strategy (NRDS) was formulated within the framework of the "coalition for the development of agriculture in Africa" (CARD) initiated by the Japanese government. The increase in rice productivity through the extension of agricultural equipments, improvement of production techniques, processing and distribution network are the principle issue of this strategy. To this end, the Japanese government has started technical cooperation project to extend the rice production techniques since 2011. It is also considered the implementation of loan project to settle irrigation network systems, develop rural roads and extend agricultural mechanization in the regions covered by the technical cooperation to increase the volume of domestic rice distribution in Cameroon. The present survey aims at studying the implementation of a technical cooperation as loan from the results of the « Upland Rice Development of the Tropical Forest Zone in Cameroon (PRODERiP) which was conducted from 2011 to 2016 as well as the action plan of «Project for the Upland Rice and Irrigation Rice Development" (PRODERIP) which was started from 2016. The analysis of the implementation framework, goals and content, the verification of the project technical and economic relevance will highlight the optimal scope of the project as well as the methodology to be adopted, costs, achievement, operating, management and maintenance structure, environment and social considerations and the possibilities of using Japanese technology.

Table 1.1.1 Outline of the Project

Content of work	
Goals	The objective of the Rice Value-Chain Improvement Project in Cameroon is to increase the rice sufficiency ratio in the Cameroon as well as to improve food security within central Africa through regional distribution, by 1) improving access roads connecting on-farm and markets to expand rice distribution network, 2) promoting irrigated farmland development and 3) disseminating agricultural equipment to improve quality and quantity of rice productivity, thereby contributing to the sustainable food security in Cameroon.
Contents	1) Civil engineering works: rehabilitation of irrigation networks (drainage canals, land development, internal farm roads) rehabilitation of rural roads, promotion and extension of agricultural equipments. 2) consulting services (detailed design, preparation of tender documents)
Targeted area	North West, Centre and South regions

Source: JICA Study Team

In fact, this preparatory survey was set to investigate in North-West, Central, South and East regions. However, the East region was not included for the target site of loan project due to the results of subsequent investigation. Thus, the target sites of this “Project” indicate North-West, Central and South regions.

1.2 Contents of the Study

The following items are conducted for this study.

【1】Preparation of inception report
【2】Confirmation of the scope and validity of the project
【3】Data collection regarding the development plan and basic information of each target sector
【4】Confirmation of the validity of the project implementation and contents
【5】Implementation of the survey for the component of irrigation development
【6】Implementation of the survey for the component of access road development
【7】Implementation of the survey for the component of installation of agricultural equipments
【8】Formulation of overall concept of the project
【9】Preparation of interim report
【10】Preparation of the basic design of facilities and construction plan
【11】Formulation of the plan of soft component
【12】Implementation of the survey regarding the information on the procurement
【13】Formulation of the project implementation plan
【14】Proposition of the activities for the consideration of gender issue
【15】Implementation of the survey for socio-environmental consideration
【16】Estimation of the project cost
【17】Confirmation of the burden of Cameroon Government
【18】Preparation of the project evaluation and project performance indicator
【19】Preparation of the recommendation
【20】Preparation of the draft final report
【21】Submission of the final report

1.3 Contents of Final Report

The table below shows the contents of final report.

Table 1.3.1 Contents of final report

Chapter	Contents
Chapter 1	The background, objective and contents of the study are described.
Chapter 2	The social and natural condition of Cameroon, the existed development plan and the results of the JICA project are described.
Chapter 3	The current condition and issues regarding the target sectors including irrigation, rural road and agricultural equipments are described.
Chapter 4	All the results of the survey for the target sectors conducted until December 2016 is described.
Chapter 5	The results of the survey regarding the socio-environmental consideration are described.
Chapter 6	The development plan formulated based on the results of this study is described.
Chapter 7	The project implementation plan for the project proposed in chapter 6 is described.
Chapter 8	The results of project evaluation and project performance indicators are described.
Chapter 9	The procurement plan of the consultant and contractor is described.
Chapter 10	The conclusion and recommendation derived from this study is described

Source: JICA Study Team

Chapter 2 Description of Target Area, Existed Development Plan and Outcomes of Previous Survey

2.1 Natural conditions

2.1.1 Climate

North West region and Centre, South and East regions in Cameroon belongs to different climate zone. The former belongs to equatorial climate while latter belong to Guinean type of equatorial climate. The equatorial climate in Cameroon has 8 months rainy season and short dry season. Thus, this climate zone has more precipitation than other zones. In contrast, Guinean type of equatorial climate has 2 rainy seasons and 2 dry seasons. The annual precipitation in this climate zone is lower than the equatorial climate zone. The figure below shows the average precipitation, temperature and humidity in the capital city of each target region. The irrigation area in Ndop starts the maize cultivation from March due to the beginning of rainy season. The rice cultivation starts from June and the harvesting are conducted in November which is the end of rainy season. On the other hand, the rainfed rice cultivation is conducted from July to November in Central, South and East region since this period has more rainfall than other period.

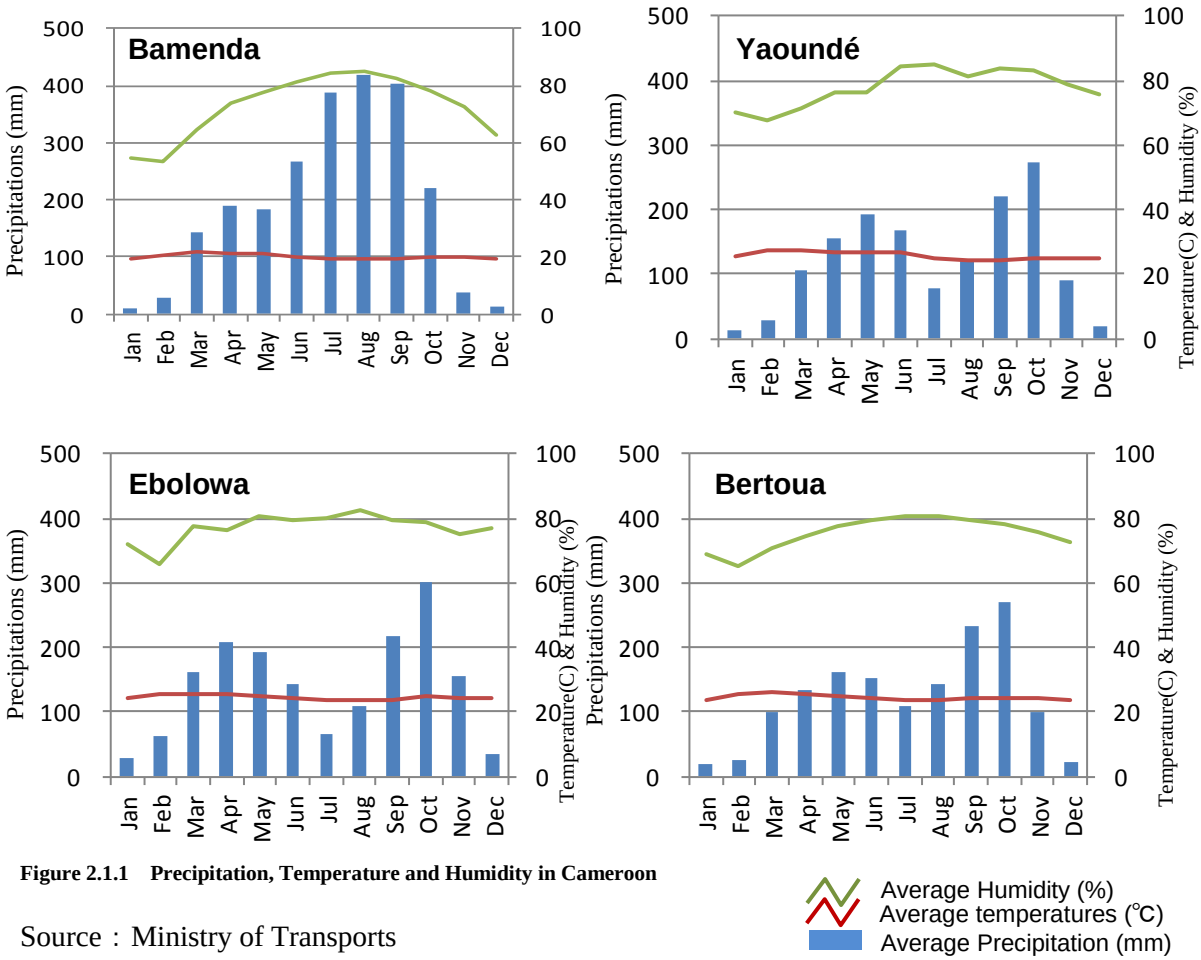
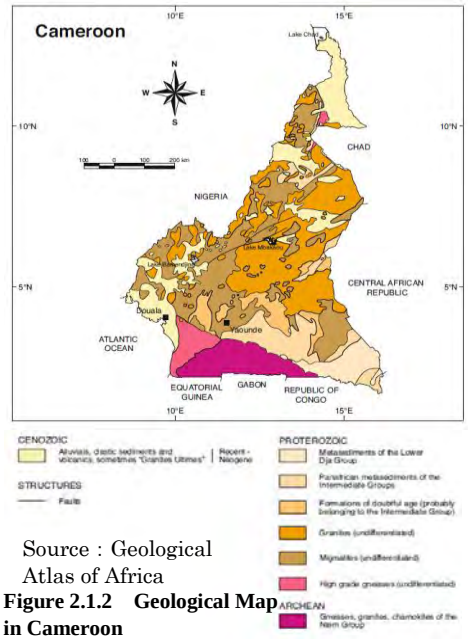


Figure 2.1.1 Precipitation, Temperature and Humidity in Cameroon

Source：Ministry of Transports

2.1.2 Topography and Geology

Cameroon's geological status is composed of Precambrian rocks, Cretaceous and Cenozoic sediments and volcanic rocks. Precambrian rocks are mainly composed of gneiss and migmatites. Cretaceous sediments in north of Cameroon are continental although it is marine-derived in the coastal region. Rocks from the second half of the Proterozoic are made up of metamorphic sedimentary rocks, granite, gneiss and migmatites which are covered in Centre and East regions. The south region is covered with Precambrian old gneiss, granite and Charnockite. In Ndop of North West region is covered with alluvial layer, sedimentary and igneous rocks.



Source：Geological Atlas of Africa

Figure 2.1.2 Geological Map in Cameroon

2.1.3 Hydrology

The Cameroon watersheds basins cover about 2% of the national territory which is about a million hectares. It is consisted of flood plain (550,000ha), lake (300,000 ha) and river (150,000 ha). The water system is classified into Atlantic, Congo, Benue (Niger) and the Lake Chad Basin. (See figure at the right). The Atlantic basin is made up of 3 watersheds (the western basin shed, south and Sanaga). The Sanaga River is the largest river in Cameroon (920 km of length) with a catchment area of 140,000 km². It supplies four dams and one of the dams is the Bamendjing dam in North West region.

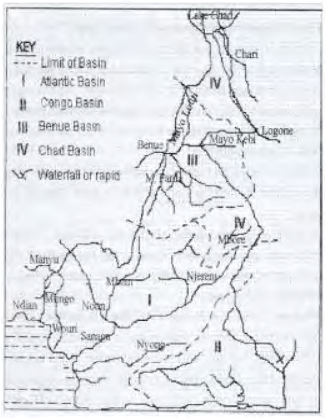


Figure 2.1.3 Water System in Cameroon

Source: Ernest and Cornelius, climate, hydrology and water resources in CAMEROON

2.1.4 Soil

Soil in Cameroon is shown in the map at the right. The Centre, South and East regions of the project are covered with ferralsols which was formed by erosion under the effect of high temperatures and abundant rainfall and low fertile soil with less plant nutrient. The soil in the Central region, on part of the South and North West region around Ndop is vertisols which contains significant amounts of clay which make it difficult to cultivate. However, they are regarded as fertile soil since it is rich with a high retention capacity for nutrients.

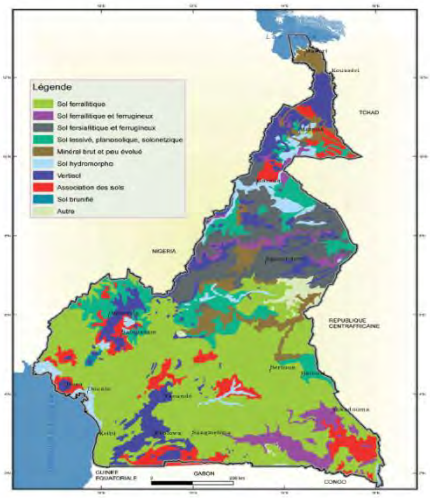


Figure 2.1.4 Soil in Cameroon

Source：National Atlas of Physical Development of Cameroon

2.2 Socio-economy

2.2.1 Administrative Structure

The local government in Cameroon is classified into civil polity and local administrative organization. The territorial division of civil polity is composed of 10 regions, 58 deparments and 360 districts. The state governor, provincial governor and district headman who are appointed by the president are dispatched in region, department and district respectively. In contrast, the minimum territorial unit of local administration is the municipality. There are 360 municipalities parallel to the number of districts. The head of municipality is elected by the universal election and conducts the local administration with municipal assembly under the supervision of the nation. The table below shows the administrative structure of the target regions of this project.

Table 2.2.1 Administrative Structure of Cameroon

Region	Regional Capital	Department	District or Municipality
Centre	Yaoundé	10	70
South	Ebolowa	4	29
East	Bertoua	4	33
North West	Bamenda	7	34

Source：Cameroon Statistical Yearbook (2013)

2.2.2 Population

According to statistical projections of the 2005 population survey, the population of Cameroon in 2013 was estimated at 21.1 million. The pyramid shows a high proportion of young people under 20 years (see table below). Besides, the rate of working population dominates 51.4 % in 2005 while that in 2013 is 52.1 %. Moreover, as shown in the table below, the age composition of population indicates the pyramid type which indicates that the working population in Cameroon will increase gradually in the future, even the average life expectancy is assumed to be increased. Cameroon is in a period of demographic dividend, high urbanization, increase in revenues due to industrialization and dynamic consumption, and therefore has all the potentialities of having a strong economic growth. The population is mainly clustered in the Centre, Far North and Littoral regions. (See table below). The population density tends to increase throughout the national territory; it was 38 inhabitants / km² in 2005, which, according to projections, expected to be around 45 inhabitants / km² in 2015.

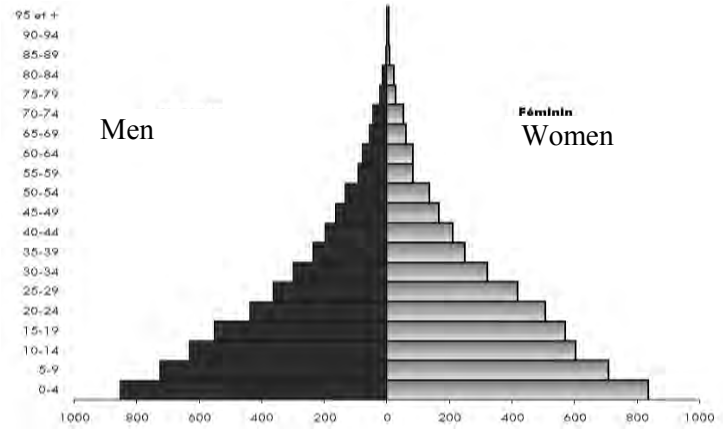


Figure 2.2.1 Age Composition of Population in Cameroon (2005)

Source：Cameroon Statistical Yearbook (2013)

Table 2.2.2 Population of Each Region in Cameroon

Region	1976	1987	2005	2010*	2013*
Adamawa	359 334	495 185	884 289	1 031 903	1 131 978
Centre	1 176 743	1 651 600	3 098 044	3 580 006	3 919 828
East	366 235	517 198	771 755	805 317	824 204
Far-North	1 394 765	1 855 695	3 111 792	3 525 773	3 803 138
Littoral	935 166	1 352 833	2 510 263	2 909 318	3 174 437
North	479 158	832 165	1 687 959	2 089 924	2 311 179
Northwest	980 531	1 237 348	1 728 953	1 816 580	1 900 547
West	1 035 597	1 339 791	1 720 047	1 795 308	1 865 394
South	315 202	373 798	634 655	698 227	731099
Southwest	620 515	838 042	1 316 079	1 395 931	1 481433
Cameroon	**7 663 246**	**10 493 655**	**17 463 836**	**19 648 287**	**21 143 237**

Source：Cameroon statistical yearbook (2013) *Projections as from the 2005 population survey

2.2.3 Economy

The table below shows the transition of economic and financial indicators of Cameroon between 2013 and 2016. Despite the fall in crude oil prices and high security threats, Cameroon's economic growth is maintained. It is estimated at 5.8% for 2015 due to the quantitative increase in crude oil exports and stronger public investments. The inflation rate is estimated at 2.8% which indicates less impact of sharp increase in fuel prices (15%) in 2014 than expected. The annual budget of the state would increase although the deficit would also increase due to the fact that crude oil prices remain low and imports such as raw materials, steel materials and intermediate materials still increase, thereby the financial deficit would reach 7.2% in 2016. On the other hand, the exporting volume of the major exporting products such as cacao and woods in Cameroon are stable. Thus, 4-5 % of economic growth is forecasted in Cameroon, although the stagnation of economic growth in Nigeria is forecasted.

Table 2.2.3 Economic and Financial Situation in Cameroon

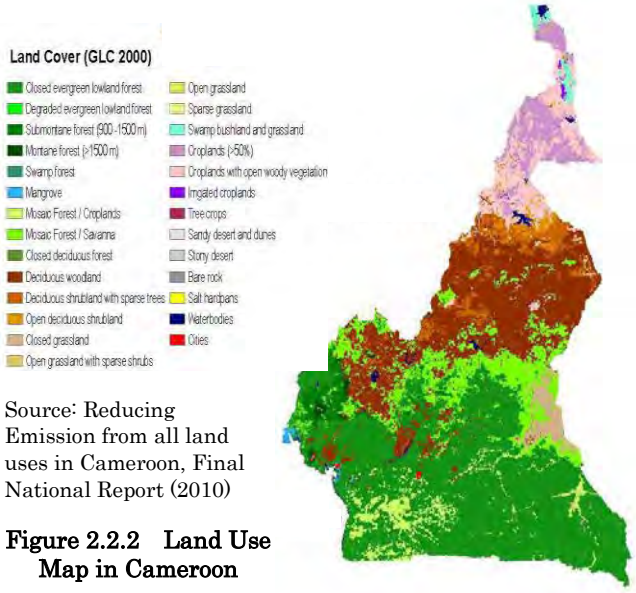
	2013*	2014**	2015***	2016***
GDP at constant level	5.6	5.9	5.8	5.2
Inflation rate	2.1	1.9	2.8	2.2
Exports quantity	7.1	17.6	13.0	4.7
Imports quantity	2.1	15.0	10.3	4.8
Total revenue	17.6	18.1	17.4	16.5
Total expenditures	21.9	23.1	23.0	23.9
Total budgetary balance	-4.4	-5.1	-5.7	-7.4
Public debt	19.0	26.6	32.6	36.8

Source: 2015 Article Consultation-Press Release; Staff Report; and Statement by the Executive Director for Cameroon
*real figures**approximate figures***Previsions

2.2.4 Land Use

(1) Current situation of the land use

According to FAOSTAT, the area of Cameroon is 472,710 km², of which 9.75 million ha of cultivated land, of which 21% of the national territory. The land-use map shows that the national territory is mostly occupied by forests. Cultivated land is mainly concentrated in the Far North region. The regions targeted by the project (South, East and West) are almost covered with forests.



Source: Reducing Emission from all land uses in Cameroon, Final National Report (2010)

Figure 2.2.2 Land Use Map in Cameroon

(2) Rice Producing Area

The main rice producing area in Cameroon is Maroua and Kousseri council in Far-North region, Ndop council in North-West region and Santhou council in West region. Those areas are under jurisdiction of SEMRY (Societe d'Expansion et de Modenisation de la Rizculture de Yagoua) for Far-North region, UNVDA for North region and MIDERIM (Mission de Développement de la Riziculture dans la Plaine de Mbo) for West region. The annual total production in those areas dominates more than 80 % of total national rice production. On the other hand, although its rice production amount is not much, the rainfed rice cultivation is conducted at many areas in Cameroon. In particular, the rainfed rice cultivation for self consumption is conducted in the target areas of PRODERiP which promotes the rainfed rice cultivation in Cameroon.

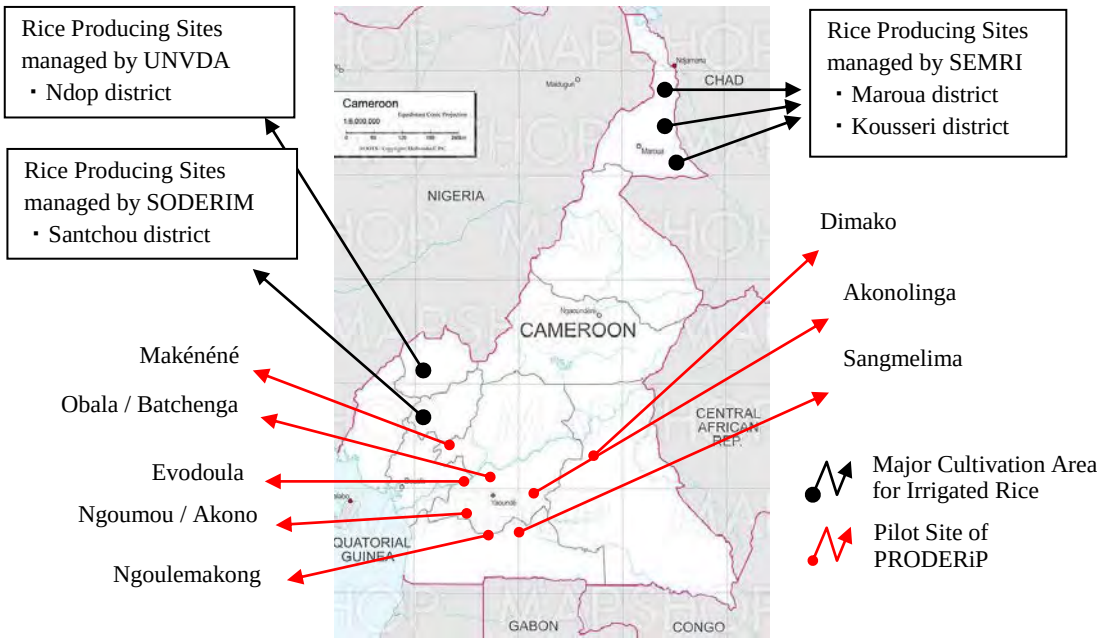


Figure2.2.3 Rice Producing Area in Cameroon

2.2.5 Legal System of Water Use

In Cameroon water rights and royalties are governed by the laws but traditional habits still prevail nowadays, as in the case of the implementation of the irrigation project with source the river (Project A) and new upstream irrigation project (Project B), in fact, all project B drainage will be returned to the river. It will not be difficult to obtain the understanding of sector farmers because after the introduction of the new project, water intake volumes in the river in their sector will not highly decrease.

2.2.6 Legal System of Land Use

(1) Summary of Land Law in Cameroon

The statute law and customary law are used as land law in Cameroon. In the statute law, the land is classified as private land, public land and national land. The private land is admitted by law through the registration. The highway and parks are classified as public land which is owned by country. The land except for private and public land is classified as national land. The statute law also admits the ownership right, the use right and lease right for the land. The ownership right is entitled to the land owner who has registered the land to the country. The land use right is entitled to the citizens who are using the national land although the land belongs to the national property. The land lease right is entitled to the parties in interest by the mutual agreement. According to the country report of Cameroon reported by USAID, there are approximately 125,000 properties registered as private land

and most of those are the properties located in big cities such as Yaoundé or Duala whereas only 3% of total areas are registered in regional area. The constraints of increasing the registered land in Cameroon are the complex registration procedures and its cost. In general, it needs 93 days for the land registration and the cost equivalent to the 18% of land value. In contrast, the customary law is exercised by the tribe chief of each region. In customary law, it basically admits the ownership right of the land. Thus, the land owners are able to lease or rent the own land to others although it is prohibited to sell the land to the outside of the community that he (or she) belongs to. In addition, depending on the region, there are some unique rules such as the restriction of the land use scale for annual crop production or even to prohibit the fruit cultivation in order to ensure the land mobility.

(2) Land Ownership for Agriculture

According to the law on landholding established in 1974 (Ordinance No.74), registration of the land is necessary to get land ownership (including farmland), and all the lands of non-registration belong to the government.

However, there are few farmers that have done the registration. This is because the farmers have been running agriculture traditionally in the unregistered land. And also the registration process takes many steps such as filling documents and conducting measurement with a certain amount of registration charge. Moreover, they don't even know the existence of the land registration law, especially in the country side.

As a result, almost all the farmlands belong to the government technically. Although, it is not necessary to pay farm rent to the nation even if it is said that it belongs to the government.

(3) Compensation for the Land User

As described above, almost all the farmlands are not registered and belonging to the government. Therefore, compensation for farmlands is not needed in a legal aspect.

On the other hand, there are regional customs for compensation for land users. For example, in the district of under jurisdiction of UNVDA, UNVDA has developed the following custom. When roads or irrigation canals are newly built or expanded in UNVDA area, the system called the equal reduction of farmlands would be applied. This is to say, not only farmers who get a smaller area due to the road constructions but also all farmers in the project area get less farmlands in an equal ratio. Under the leader of Production Department in UNVDA, extension officers make arrangements with the management committee of the water users association named "Farm" and let them conduct the relocation of the farmlands. It is the custom that UNVDA has been running traditionally based on equal principle.

(4) Regulation for Construction Works

There is not any law to regulate construction works during planting periods in Cameroon. However, the construction works in the farming area is only possible until the end of May from January in the jurisdiction of UNVDA. After raising seedlings of rice begins in June, the constructions must be stopped, and will restart in January in the next year because rice is the primary crop in UNVDA area. On the other hands, construction works can be conducted except for the rice cropping period even though the other crops are cultivated in the field according to UNVDA.

2.3 National Development Plan

The Growth and Employment Strategy Paper (GESP) of Cameroon, established in 2009 and amended in 2013, is the reference framework of highest level of policy and government action. It is consisted of following seven chapters:

- Review of development policies
- Development goal and vision
- Growth strategy
- Employment strategy
- Governance and state strategic management
- Macroeconomic and budgetary framework
- Institutional framework, the mechanisms of implementation and monitoring

The improvement of productivity in the industrial sector, improvement of the environment from energy problems, measures to tackle financial crises, measures to ensure food security, improvement of the unemployment and poverty rate are the issues to be considered. It also describes the importance of increasing the food production especially rice.

2.4 Region and District Development Plan

In Cameroon, there is no development plan for the regions or districts. Apart from the development program at the level of the municipalities provided in the National Participatory Development Programme (NPDP) of the World Bank, there is a seed distribution program to develop rainfall rice on a part of the councils of the centre, South and Northwest regions of the project, the PRODERiP. A summary of this program is given below for the Ndop sector. The development strategy of the agricultural sector contains 2 parts entirely related with the project: "the modernization of agricultural production" and "the development of mechanization."

Table 2.4.1 Outline of the NDOP Council Development Plan

	Detail
Vision	Encourage industrial promotion based on dynamic socio-economic activities
Goals	1. Clarify the development problems of the council with participatory methods 2. Define the potential of the municipality for the profit of the local economy development. 3. Analyse the capabilities of the municipal council, assess its strengths, weaknesses, opportunities and problems 4. Write all issues on the development by sector 5. Establish the strategic development plan
Agricultural sector development strategy	Modernization of agricultural production and development of mechanization
Goal by agricultural and rural sector	1. Improve access to agricultural machinery and inputs 2. Improve access to advanced agricultural techniques 3. Improve the competitiveness of each agricultural product 4. Stabilize farmers 5. Train excellent groups who master high-level agricultural techniques 6. Promote development of participatory communities 7. Improve basic village infrastructures 8. Improve access to information 9. Organize land use in rural areas 10. Ensure farmers' technical support 11. Strengthen agricultural marketing capacity

Source: Ndop council development plan (2012)

2.5 Outline of the Previous Study

2.5.1 Preparatory Study on the Formulation of Rice Cultivation Promotion Program in the Federal Republic of Nigeria and the Republic of Cameroon

This is a first study carried out in 2009 simultaneously in the Federal Republic of Nigeria and the Republic of Cameroon; both countries were selected by the support group of the CARD (Coalition for Rice Development in Africa) during its first meeting in October 2008. The goal was to study the

guidelines for cooperation and to seize the situation of the rice sector in each of these two countries. Both projects presented below and this project is based on the results of this study, to which Cameroon has achieved the following actions:

- ✓ Collection of basic information on the rice sector of Cameroon
- ✓ Realization of a field study to understand the situation of rice culture in Cameroon
- ✓ Study of orientations of cooperation from the results of the field study

The field study took place in the Far North, Northwest, South and Centre regions. In the North West, the study also included the Ndop irrigated sector which is under the UNVDA territory. The problems faced by the UNVDA in its management is given in the report such as unpaid rents of land by rice farmers and the dependence of the budget on state subsidies. Proposals for cooperation in terms of promotion of rainfed rice cultivation were made on the basis of its results and Upland Rice Development of the Tropical Forest Zone in Cameroon Project was elaborated.

2.5.2 Upland Rice Development of the Tropical Forest Zone in Cameroon (PRODERiP)

This project conducts various activities in Centre, South and East regions of Cameroon in order to increase the number of farmers who conducts rainfed rice cultivation. The outline of this project is shown in the table below.

Table 2.5.1 Outline of the PRODERiP

Sector	Detail
Main goal	Rice production amount is increased in the target three regions
Project goals	The number of the farmers who conducts the rainfed rice cultivation is increased in the pilot project area.
outcomes	Outcome1：Selection of seeds and cultivation techniques that will be disclosed from experiments conducted on the plots of the project Outcome 2：training of extension workers and stakeholders from different levels to popularize rainfall rice Outcome 3：Development of rainfall rice on pilot sites of the three project regions Outcome: Improve post- harvest processing techniques at level of the farmers on sites where rainfall rice is well advanced in the pilot project areas

Source: Evaluation report of the final rainfall rice development project in forest areas (2014)

2.5.3 Project for the Upland Rice and Irrigation Rice Development (PRODERIP)

This project is the subsequent project of PRODERiP. The detailed study for this project was conducted in September 2015 and February 2016. The difference from PRODERiP is to include the lowland rice cultivation and thus, the North-West region was selected for the aid target region. The outline of this project is shown in the table below.

Table 2.5.2 Outline of the PRODERIP

	Detail
Main goal	Increase rice self-sufficiency rate of Cameroon
Project goals	Increase quality and white rice production quantities on the project regions
outcomes	Outcome 1 : Increase of the production of high quality seed on the project areas Outcome 2 : Improve technical capacities of farmers in terms of irrigated rice cultivation on the UNVDA sectors Outcome 3 : Improve technical capacities of farmers on the Centre, South and East regions. Outcome 4 : Improve harvesting techniques for plants and postharvest processing techniques

Source: Report of study for the project detailed preparation plan for promoting rice in Cameroon (2015)

Chapter 3 Present Condition and Challenges of the Target Sectors

3.1 Present Condition and Challenges of the Rice Cultivation Sector

3.1.1 National Plan related to Rice Sector

Growth and Employment Strategy Paper (GESP), Rural Sector Development Strategy (RSDS) and National Rice Development Strategy (NRDS) are the 3 main important strategies in relation to the rice sector in Cameroon. The outline of these strategies is as follows.

(1) Growth and Employment Strategy Paper (GESP)

This document was prepared by the Cameroonian government for the years 2010 to 2020 in 2009 equivalent to the poverty reduction strategy paper (PRSP). This strategy focused on infrastructure development, agricultural development, increased investments in the mining industry and information technology (IT) and better growth, represents the priority axis of development of the country, which will be included to aim at improving governance and decentralization. The main contents are as follows.

1) Targets of Growth and Employment

- Achieve the 5.5% annual growth rate from 2010 to 2020
- Reduce the underemployment rate from 75.8% to 50% in 2020
- Reduce the poverty rate of 39 9% in 2007 to 28 7% in 2020
- Achieve the Millennium Development Goals in 2020

2) Main Areas

- Infrastructure development (energy, public works, transport, Information and communication, urban development, water and sanitation etc.,)
- Modernization of the production structure（agriculture, mining, industry etc.）
- Human Development (health, education, social protection, etc.,)
- Regional integration and trade diversification

(2) Rural Sector Development Strategy (RSDS)

During last 30 years, Agriculture sector is an important industry driven national economy with oil, which still holds 60% of the active population and accounts for 20% of GDP. In this way, even today, agriculture is the major industry in Cameroon

As for the development of agriculture and the rural sector, 4 Ministries are related deeply such as the Ministry of Agriculture and Rural Development, the Ministry of Livestock and Fisheries, the Ministry of Forestry and Wildlife, the Ministry of Environment of the Nature Protection and Sustainable Development. Therefore, the country's agricultural policy is based on the Rural Sector Development Strategy (RSDS) in 2002 formulated by the cooperation with 4 Ministries.

Table3.1.1 Outline of RSDS

Five goals to be achieved	Five maine areas
① Ensure household food security	i) Modernization of agricultural machinery
② Contribute to economic growth through agriculture, and especially the trade and employment promotion	ii) Restructuring of the institutional framework
③ Increase the income of producers	iii) Natural resource management
④ Improve the living standards of rural people	iv) Research of national and international markets for agricultural products
⑤ Manage soil and water resources sustainably and efficiently	v) Promoting employment especially for youth and women
Actions toward the above goals	
Actions to be achieved for the five main areas a) Sustainable development of agricultural production and supply b) Sustainable management of agricultural resources by the irrigation development and soil erosion prevention measures c) Regional and community development through the rehabilitation of rural roads d) Development of financial system e) Job creation and training for young people f) Management of predictable food crises on sites unsuitable for agricultural production g) Arrangement of implementation system for ensuring the capacity of development officials	

Source: prepared by JICA study team based on RSDS

In 2006, the target year of the rural sector development strategy has been renewed to 2015. The 4 new objectives were added in 2012.

- Capacity building of the public and private sectors
- Improvement of agricultural sector and strengthening competitiveness
- modernization of rural infrastructure
- Sustainable management of natural resources

Among the added objectives, the following challenges related to the marketing of agricultural products were identified.

- Lack of access routes between production and market sites
- Undeveloped farm road
- Lack of commercial facilities and equipment
- Poor capacity of processing and storage
- Lack of market information
- Poor competitiveness of agricultural products (price and quality)
- Poor management of farmers' organizations
- Underdevelopment of the market system

(3) National Rice Development Strategy（NRDS）

The government of Cameroon established the National Rice Development Strategy (NRDS[1]) in 2009, as the first group of countries to receive assistance from the CARD. The aim is to achieve self-sufficiency in local rice, reduce the strong trend of rice imports to increase from year to year and increase local rice consumption. The forecast is to increase production volumes by 9.7 and from

[1] In Cameroon, the term of National Rice Development Strategy is not applied. But the term of National Strategy for Rice Growing is applied instead.

100,000 tons in 2008 (converted to white rice) to 970,000 tons in 2018.

Table 3.1.2 Numerical Targets by 2018 Proposed in NRDS

	2008					2018（target year）				
	Area		Production		Yiled	Area		Production		Yield
	ha	%	t	%	t/ha	ha	%	t	%	t/ha
Irrigated rice	14,300	32	50,000	50	3.5	33,000	10	165,000	17	5.0
Lowland rice	10,000	23	20,000	20	2.0	30,000	9	105,000	11	3.5
Rainfed rice	20,000	45	30,000	30	1.5	279,000	81	697,500	72	2.5
Total	44,300	100	100,000	100	2.3	342,000	100	967,500	100	2.8

Source: prepared by JICA Study Team based on NRDS

To achieve these targets, the strategy gives a particularly important role in promoting upland rice. With respect to the proportion of upland rice in the total rice production in 2008 indicates in the range of 30%, in 2018 the proportion is planned to 72%. Moreover, it is planned to allocate 18,700 additional hectares to the irrigated rice by 2018 and multiply by 1.4 for yields to move them to 5.0 t / ha.

The strategic target of achieving these goals : (i) Promotion of certified seed production ; (ii) modernization of the production materials by mechanization and the efficient use; (iii) promotion of producer organizations and Organization of producers and formation of the rice sector's platform consisting of stakeholders ; (iv) sustainable water resources and land management through the promotion of good agricultural practices; (v) coverage of national needs and the conquest of border and regional markets through the quality improvement of rice ; (vi) promotion of rural employment in particular for women and young people.

In addition, as a necessary support to marketing of rice and agricultural infrastructure for domestic rice promotion, the following items are listed in the strategy.

- Improvement of market access through assistances for the construction of storage house and rice mills
- Strengthening competitiveness of local rice by reducing costs of production and distribution
- Reduction of transport costs through the development of access road between production sites and market
- Financial assistance for the production and marketing

3.1.2 Related Administrative Bodies and Their Roles

(1) MINADER

The organization chart of MINADER is shown in the chart below. The number of the staffs and the budget amount of each bureau are shown in the table below.

1) Organization

The organization of MINADER is reported below, while the number of officers and the ministry budget are shown in Table below (as of October 2015).

The department of studies, programs and cooperation (DEPC) of MINADER is responsible for conducting the agriculture-related studies, coordinate external agricultural development programs, and establish agricultural development programs to promote the investment projects in agriculture. The DEPC is the main counterpart of this study and will be the main counterpart of the proposed project (hereinafter "the Project"). In PRODERiP and PRODERIP, DEPC director is appointed as a supervisor of the project coordination unit (PCU).

The department of agricultural development (DDA) is responsible for the planning of agricultural

development policies/programs, the development of seedlings and seed production. In PRODERIP, DDA is involved in the field of seed production.

The department of agricultural organizations and support to farms (DOPA) is responsible for extension of agricultural techniques, structuring organizations and agricultural cooperatives and their approval, agricultural mechanization. In the "PRODERIP", DOPA will continue to involve in extension of upland rice following PRODERiP. Agricultural technical extension is responsible for the agricultural extension service (sub department: SDVA). In addition, DOPA is also in charge of agricultural mechanization up to harvest with respect to rice cultivation. The department of Agricultural Engineering and the improvement of rural living environment (DGRCV) take over for the mechanization of post-harvest rice.

The department of regulation, quality control of agricultural products and inputs (DRCQ) establishes for the distribution of fertilizers and plant protection programs and other agricultural inputs, analyzes the seeds and seedlings, agricultural products and records varieties.

The department of agricultural engineering and the improvement of rural living environment (DGRCV) mainly deal with the development of rural infrastructure and improvement of rural living environment, also for irrigation and water management. As for the necessary survey in the irrigation development, in the case of small-scale irrigation DGRCV can do initial survey, investigation, topographic mapping, in the implementation of large-scale irrigation and feasibility study DGRCV may entrust to the consultant firm. DGRCV is also the contact point for environmental impact studies in MINADER. In environmental impact studies of major agricultural development projects, DGRCV is responsible for implementation of environmental impact studies with the Ministry of Environment.

2) Finance

The budget of administrative organization can be divided into two parts. One is operational budget which includes labor costs, maintenance costs of cars and office. And another is investment budget includes budget for new businesses and new projects. This can be applied to MINEDER’s budget (The table below). From the table, followings are found.

38% of total budget was investment budget and the rest of 62% was operational budget in 2015. On the other hand, in 2016, 30% of the total budget was investment budget and the rest of 70% was operational budget. We can see that the portion of investment budget decreased. However, this is because the data of 2016 is not completed yet. When it is completed, the percent may be closer to the ones in 2015. Therefore, it is concluded that about 40% of total budget is secured as the investment budget, and it allows MINADER to invest to new projects stably.

Regarding the investment budget in 2015, DDA, DEPC, DESA, DOPA, DRFP and DGRCV are ranked respectively. In 2016, the trend is almost same.

Table 3.1.3 Staffs and Budget of MINADER (2015 and 2016)

Department	No. of staff	Budget in 2015 (1,000 FCFA)			Budget in 2016 (1,000 FCFA)		
		Investment budget	Operational budget	Total	Investment budget	Operational budget	Total
Division de l'Enseignement et de la Formation Agricoles, Cooperatifs et Communautaires (DEFACC)	45	200,000	81,500	281,500	-	82,000	82,000
Direction du Development de l'Agriculture (DDA)	72	6,826,500	81,800	6,908,300	4,608,000	-	4,688,000
Direction du Development Local et Communautaire (DDLC)	58	45,000	77,500	122,500	-	67,000	67,000
Direction des Resources Financieres et du Patrimoine (DRFP)	68	1,310,000	265,000	1,575,000	2,335,000	337,200	2,672,200
Direction des Resources Humaines (DRH)	-	10,000	26,961,500	26,971,500	-	29,331,000	29,331,000
Direction des Enquetes et des Statistiques Agricoles (DESA)	62	2,450,000	71,500	2,521,500	250,000	67,000	317,000
Direction des Etudes, des Programmes et de la Cooperation (DEPC)	102	2,690,000	90,000	2,780,000	3,553,000	70,000	3,623,000
Direction du Genie Rural et de l'Amelioration du Cardre de Vie en Milieu Rural (DGRCV)	65	550,000	67,000	617,000	241,000	67,000	308,000
Direction de la Reglementation, du Controle de Qualite des Intrants et Produites Agricoles (DRCQ)	79	500,000	66,500	566,500	355,000	66,000	421,000
Direction des Organizations Professionelles Agricoles et de l'Appui aux Explotations Agricoles (DOPA)	92	2,140,000	90,000	2,230,000	1,604,500	86,000	1,690,500
MINADER Total	643	16,721,500	27,852,300	44,573,800	12,946,500	30,173,200	43,199,700

Source: JICA Survey Team

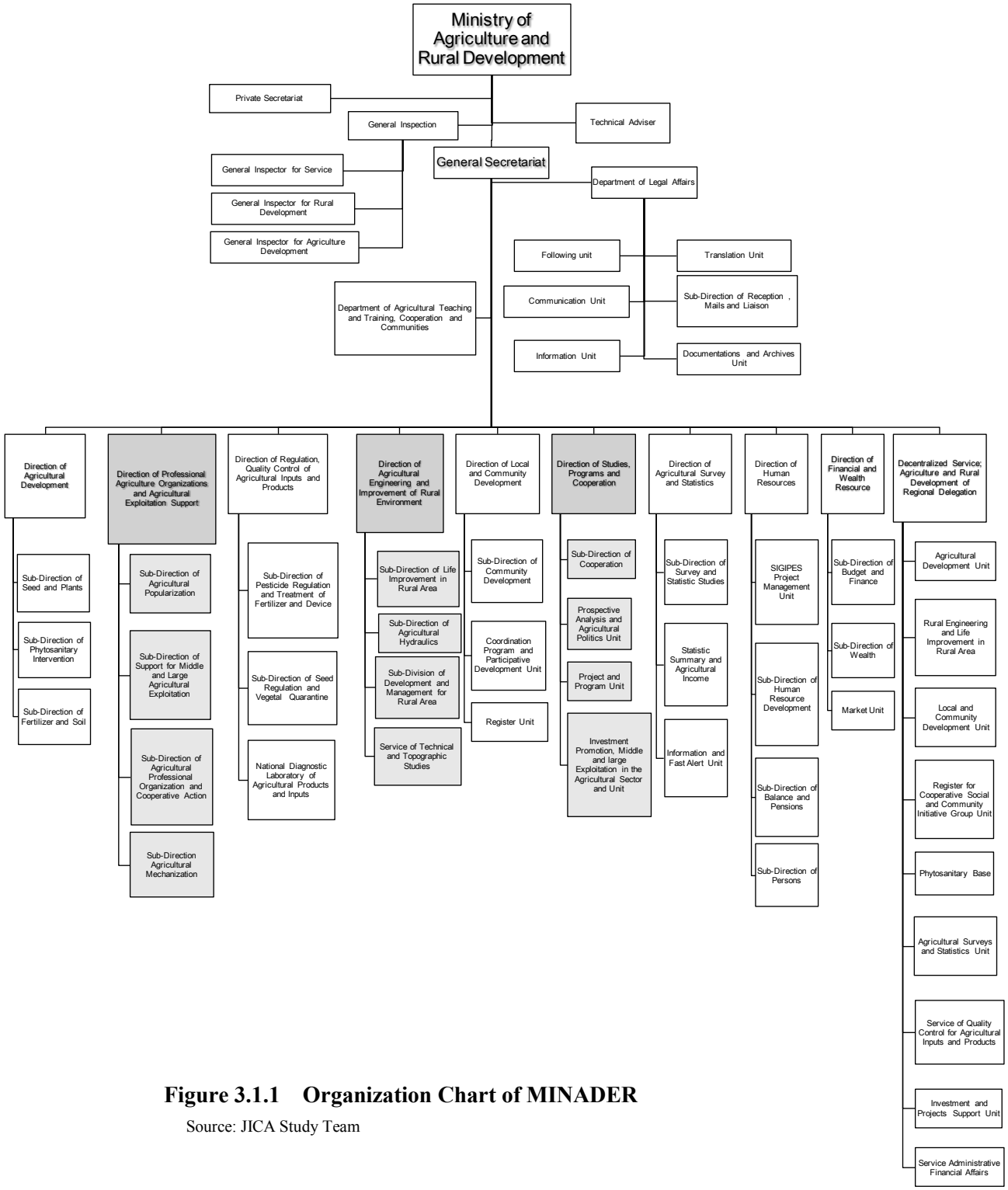


Figure 3.1.1 Organization Chart of MINADER

Source: JICA Study Team

(2) Upper Noun Valley Development Authority (UNDVA)

1) Introduction

The UNDVA is a public corporation primarily based in Ndop in Ngokeunjia department. It was created in 1970 with the main objective to develop rice cultivation in the plains of Ndop. Today UNVDA works on the basis of the UNVDA establishing law (No.78 / 157 of 11 May 1978). Its role is mainly to regulate rice producers at the production, development of farmland, post-harvest and marketing of rice. In other words, UNVDA is responsible for promoting domestic rice production.

Between 1978 and 1986, 3,000ha or more of irrigated farmland have been developed, but the results are seen in rice production, the income of farmers was improved was up to 1986. Thereafter, economic crisis against the backdrop of the collapse of crude oil prices and export agricultural goods (irregular subsidy from government) caused that UNVDA cannot fulfill the original mission. As a result, farmers temporarily abandon the rice cultivation, irrigation facilities were devastated. After 2002 UNDVA began to rehabilitee the rice perimeters, but the results are not satisfactory.

2) Objectives of the UNVDA

- Promote the processing and marketing of agricultural products
- Improve production volumes and land productivity (especially rice)
- Encourage farmers' access to agricultural infrastructure
- Provide data to development partners

3) Main Activities of the UNVDA

- Construction and maintenance of irrigation/drainage facilities
- Construction and maintenance of farm road
- Provide agricultural materials and inputs (improved seeds and fertilizers etc.)
- Provide agricultural extension services
- Post-harvest of rice

4) Organization of the UNVDA

The UNVDA consists of 4 departments. The technical departments are department of Agricultural Engineering (DGR), department of agricultural production (DPA) and department of marketing (DC) without department of administrative and finance. In October 2015, the UNVDA had 144 staffs including 51 persons in the service of the DGR machinery park (maintenance and operation of agricultural machinery and construction machinery), 23 persons in extension service of DPA and 13 persons in the service of the post-harvest of rice of DC. (See the figure below)

The UNVDA working areas are divided into 5 Sectors (Upper Bamunka, Lower Bamunka, Babungo, Bangolan Language and Monoun). A chief extension officer is assigned in each Sector and an extension officer covers 5 FARMs (irrigation unit under sector). Each FARM has an FARM Committee (FC) equivalent to farmer’s management committee. In the villages there are farmers groups called Community Initiative Groups (CIG). The activities of these groups cover agricultural and non-agricultural activities which are consist of many fields up to mutual assistance. The extension officers are carried out dissemination of farming such as irrigation and drainage, facilities maintenances through these farmers' organizations. The research and development service of DPA is in charge of the seed production. Workers in the seed production are recruited among farmers. The Infrastructure and facility service of the DGR employs 7 staff including 2 engineers of civil engineering.

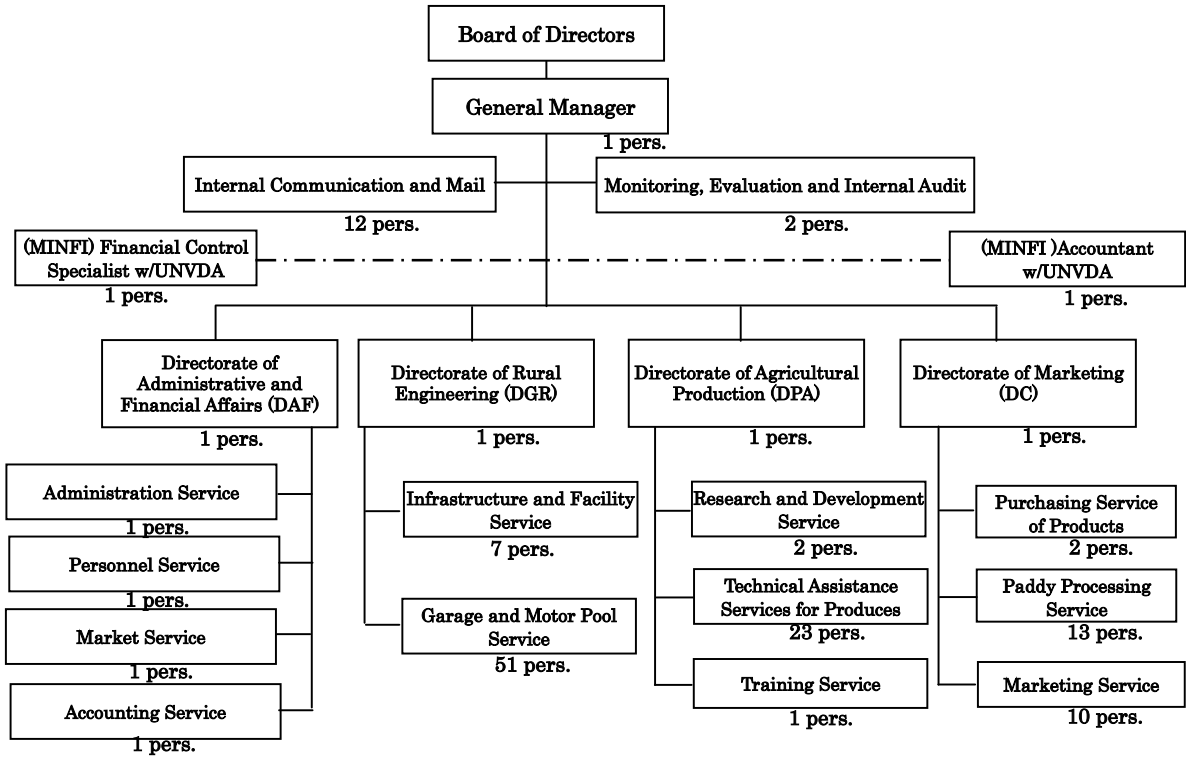


Figure3.1.2 Organization Chart of UNDVA

Source: prepared by JICA Study Team based on UNVDA document Note: The number of agent from the figures in 2014

5) Budget of UNVDA

The provisional budget for 2015 UNVDA consists of two positions:

- Operating costs: salaries, equipment, office supplies, agricultural extension
- Investment Budget: financing of restructuring, development of rice-growing areas, development of rice fields, construction / rehabilitation of irrigation systems and agricultural infrastructure (cost of implementation activities plan based on contract programs State / UNDVA 2013 -2015).

The provisional budget for 2015 is as follows:

Table 3.1.4 Provisional Budget of UNVDA (2015)

tems	Amount（FCFA）
Operating costs	1,147,360,000
Investment costs	2,226,400,000
Total	3,373,760,000

Source: prepared by JICA Study Team based on UNVDA document

The budget of the UNDVA is funded by grants from MINADER and MINFI, and its own funds from the sale of rice etc., in the following proportions:

Table 3.1.5 Funds Source in UNVDA

Source of finds	Amount（FCFA）
UNVDA own funds	1,405,260,000
Grant for operating costs	300,000,000
Grants for public investment	1,668,500,500
Total	3,373,760,000

Source: prepared by JICA Study Team based on UNVDA document

In addition, grant for public investment of the above is composed of a grant from the MINADER and MINFI, the breakdown is as follows.

Table 3.1.6 Subsidies for Public Investment in UNVDA

MINDEF grants for public investment	Montant（FCFA）
MINDEF subsidy for public investment	961,500,000
MINFI subsidy for public investment	707,000,000
Total	1,668,500,500

Source: prepared by JICA Study Team based on UNVDA document

Operating costs include salaries and staff allowances, fees for capacity building of officers and farmers, the costs of participation in fairs and exhibitions and sales promotion, the cost of opening outlets, the agricultural products storage costs of rice, repair and maintenance costs of buildings, machinery, rice fields and the maintenance costs of vehicles, fuel costs, purchases of equipment and office supplies.

6) Business Plan of UNVDA for 2013-2017

UNVDA has developed a business plan of the 5-year period (2013-2017) in order to overcome the problem of increase of domestic rice production. The necessary budget plan for its implementation requires enormous financial resources of 32 billion FCFA. This business plan was formulated on the basis of the government guidelines due to the increase in agricultural production (especially rice production increase). The purpose of this business plan is to break away from UNVDA unstable financial situation, to contribute to the reduction of rice imports, and to further improve the farmers' income in the business area, to stabilize the agricultural activities. This plan should improve the rice production of Upper Noun Valley and bring the following results:

- Creation of direct employment in the maintenance of infrastructure
- Develop and improve 15,000 ha of rice perimeters
- Harvest 75 000 tones of rice
- Develop and promote regional agriculture

In addition, the business plan is to accelerate the improvement of land productivity in UNVDA within the business area, with the aim of achieving the rice yield 5ton / ha, and the growth and increase farmers' income of production amount. The participation of small operators will activate the economic activities of the region, and create opportunities to obtain a wage for temporary employment workers. With regard to job creation, 27,000 rice farmers would be temporary employment. Development of human and social resources through training and capacity building of farmers' organizations is positioned in one of the most important matters, even in the business plan. The development of these human resources is essential to the development of the regional economy by farmers' organizations under the supervision of UNVDA

(3) Agricultural Research Institute for Development (IRAD）

1) Organization

Agricultural research Institute for Development (IRAD) is an independent agency created in 1996 and reformed in 2002. It is under the Ministry of Scientific Research and Innovation (MINRESI). In

December 2013 more than 1,000 agents working in operational structures IRAD including 107 administrative staff 169 researchers, 397 technicians and 439 support staff. the office is located in Yaoundé, the structure is completed by 5 regional centers, one for each of the 5 agricultural areas, center specialized research in regional and international vocation installed in 3 regions, 12 multipurpose agricultural research stations, 4 specialized agricultural research stations and 33 research stations.

The rice research is part of the Cereal Research programs, the number of 20, which are part of the scientific research department on annual crops of the direction of scientific research. The management of recovery and innovation is responsible for the production of pure seed.

2) Budget

In 2009 the annual budget of IRAD was 41 billion FCFA francs. He was reduced to 22 billion in 2012 is almost halved. The 2013-2021 strategic plan for agricultural research established in 2013 by IRAD estimates its operating budget to 600 million FCFA, which is an ambitious figure but IRAD proposes to finance by applying to the State and to national and international aid agencies,

3) Work Plan

In the work plan 2013-2021 IRAD fixed overall objective of strengthening the competitiveness of sustainable agriculture in Cameroon by developing a range of techniques. It sets the objectives, activities, outcomes and indicators in each of the 6 areas ① annual crops ② multiannual crops ③ livestock and fishing ④ forest soils and the environment ⑤ production networks, economics, ⑥ Agricultural society promoting the application of research results, technical innovations,

- Objectives: Increased production of food crops and of annual industrial crops, increased competitiveness (extension selection, conservation and development of seeds and seedlings
- Results: increase crop boosting the agro-food, improved food security
- Indicators: Supplies of pure seed of improved varieties have been increased by at least 5% and at least 1,000 farmers or processors per year have developed good techniques.

3.1.3 Assistance of Donors

(1) International Fund for Agricultural Development (IFAD)

The IFAD realizes the SUPPORT PROJECT DEVELOPMENT OF AGRICULTURAL UNITS (PADFA) which mainly concern rice and onions in the North, Far North, West and Northwest regions. The project is spread over a period of 7 years, from 2010 to 2017 with a total investment of about 24.3 million dollars. The project components are listed as follows:

- Assistance for the production of rice and onions: rice and onions producers groups capacity building, assistance for the training of rice production and onions specialists, visit of producers excellence groups, exchange visits between producer groups, assistance to set up small irrigation units,
- Commercialization capacity building's assistance of rice and onions: improvement of post-harvest processing techniques (conservation of harvest crops , research programmes processing and management techniques,) and capacity building commercialization of targeted producers groups,
- Support for project management: management and monitoring by the project coordination units and regional offices, strengthening of the monitoring system, encouraging the sharing of knowledge.

(2) Islamic Development Bank (IDB)

IDB realizes the Mount Mbappit Rural Development Project in the Northwest region. The first phase was conducted over the 2007-2013 period, the second phase spans over the 2016 to 2021. The overall project cost is estimated at 11 $ million for the first phase and $ 32 million for the second phase. The first phase consisted to develop agricultural production infrastructures and namely rice production (irrigation network), strengthening agricultural extension and technical training of farmers in targeted regions, to train supervisory officers communities, providing agricultural inputs (seeds, fertilizers, pesticides, agricultural machinery). The second phase involves the construction of irrigation systems for irrigated rice in the Northwest region an area of 752 ha,

(3) Korea Rural Community Corporation (KRC)

The KRC realizes the construction project to build a training centre (establishment of an educational research centre for the use of mechanized rice production in Cameroon) over a period of 40 months between September 2014 and December 2018 for an amount of $ 2.7 million. The project goals are listed as follows:

- Ensure the transfer of rice cultivation and mechanization techniques to improve farming techniques and farmers' incomes
- Improve the livelihoods and productivity of Rural Areas of Cameroon with the rural development experience and farming techniques from the Republic of South Korea,
- Strengthen ties between South Korea and Cameroon

To achieve these goals, the project carries out the following activities: 1) development of rice farming infrastructure, 2) construction of the training centre, 3) sending of experts, 4) training in South Korea 5) training of farmers in Cameroon, 6) supply of machines and inputs

3.1.4 Present Condition of the Rice Cultivation Sector

(1) Evolution of Rice Consumption and Local Rice Production

To understand the present situation of rice production in Cameroon, it is necessary to see the relation consumption and local production. Today, rice is, with cassava, maize and plantain, a leading products widely integrated in Cameroonians. All of products cover the needs of the country, except the rice sufficiency rate was estimated at less than 20% after 2000, according to USDA statistics, so that 80% of consumption is imported.

The figure below shows the evolution of consumption and local production of rice in Cameroon between 1960 and 2014. We see that from 1980 consumption greatly exceeds production; periods of 1997-1998 and 2007-2008 periods in particular are two hinges where consumption has experienced a sudden change. These periods correspond to a sharp rise in food prices worldwide. Rising prices of rice and wheat in international markets has led to a severe food crisis in Cameroon and all the countries of sub-Saharan Africa. Cameroon has then released the imports to meet demand for rice of cities that accompanied the food crisis. In 2013 the consumption volume reached at the maximum of 722,000 tones, while production stagnated around 122,100 tones (white rice).

Roughly three factors were involved in increasing rice consumption in Cameroon. 1) local production has not arrived to catch the increased demand concentrated in cities; 2) Many of the rice produced from the extreme North and North regions where are major rice production area in Cameroon, are exported to Nigeria etc., 3) Rice cheap dumped on international markets by producing countries in Asia following the "green revolution" that allowed them to increase their productivity; 4) the rise in grain prices on international markets, which has affected the markets of sub-Saharan Africa and Cameroon because of the globalization of food transactions.

Thus, the possibilities for action of demand country side (such as Cameroon) at Level 1) and addresses issues of local production and distribution. We will speak later of the current situation of local production and distribution.

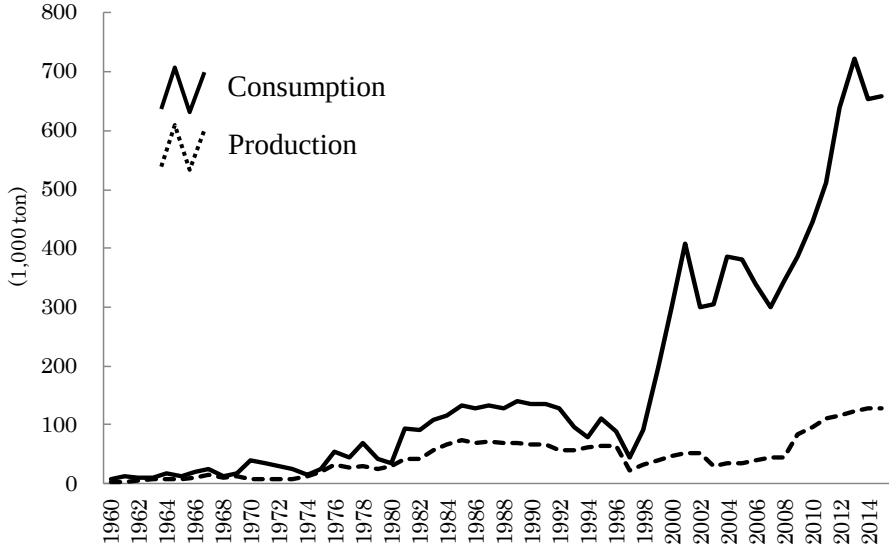


Figure 3.1.3 Evolution of Production and Consumption of Rice in Cameroon

Source：prepared by JICA Study Team based on Data of USDA

(2) Production

1) Promotion of Rice Production

The government of Cameroon has started to develop rice production after 1960; the production was focused on irrigated agriculture in the north and west. From 1970 irrigation networks have been built in the Far North (Yagoua, Maga, and Kousserie) and North West (Ndop) and boards in charge of irrigation development were created. In the 1960s Taiwan has achieved an aid project in Mezam Valley and the Mechum valley, in the northwest, in the 70 and 80 of South Korea has made aid projects in the plain of Baigom in the West from 2006 Islamic Bank provided assistance as a loan for the rural development project of the plain of BIGOM (PDRM 2006 A2010) which also includes a development component of irrigation systems.

2) Rice Cultivation Environment and Rice Production

We have seen that the rice development goals set in the National Rice Development Strategy (NRDS) based on three types of crops that are irrigated, lowland culture and tea culture. According to this document, the rice growing areas were 44,300 ha in 2008, of which 14,300 ha under irrigation, 32% of the total area, 23% in lowland rice and 20,000 ha or 45% in upland rice . Annual production of white rice was 100,000 tones.

3) Production Areas

The main production areas are located in the three regions of the Far North, West, and North, which cover 90% of total production (see table below). The Far North region covers 60% of national production with large scale irrigation system and the traditional rice lowlands. Then comes the Northwest region with irrigated areas of UNDVA and lowland rice cultivation and the northern region, part of which is irrigated rice but mainly practice the traditional rice lowland and upland rice of plateau, and finally the Central region that practice mainly rainfed rice.

Table 3.1.7 Local Rice Production by Region (2009-2011)

Region	2009		2010		2011	
	Tones	%	Tones	%	Tones	%
Far North	91 157	64, 0	98 474	61, 0	106 818	62, 0
North	16 495	11, 0	20 002	12, 0	23 347	13, 0
Adamaoua	287	0, 2	440	0, 3	395	0, 0
North west	23 705	16, 0	27 108	16, 0	25 556	15, 0
South west	1 407	0, 9	1 947	1, 3	1 874	1, 0
West	2 946	2, 0	3 393	2, 2	4 012	2, 3
Center	7 080	4, 9	9 588	6, 0	10 164	5, 9
East	314	0, 2	373	0, 2	402	0, 0
South	1 247	0, 8	1 728	1, 0	1 491	0, 8
Littoral	21	0, 0	25	0, 0	30	0, 0
Total	141 713	100, 0%	159 685	100, 0%	170 077	100, 0%

Source : prepared by JICA Study Team based on CountrySTAT Cameroon
(http://countrystat, org/home, aspx?c=CMR&tr=21)

(3) Distribution

1) Characteristics of the Rice Distribution in Cameroon

Two flow systems coexist in Cameroon with the distribution of local rice and that of the import rice. From the point of view of consumption, they are characterized by:

- The majority of volumes sold consist of rice imported from the fact that 80% of rice consumption relies on imports.
- Local rice account for 20% of the total distribution, but most passed to neighboring Nigeria and therefore not consumed locally.
- The consumer centers are located in the two major cities of Douala and Yaoundé (75% of imported rice is consumed in these cities[2]).
- Two major production regions are remote from consumer areas making it difficult the flow of local rice.
- It is rare to see local rice in major local markets (except in the production regions) and in the markets of two major consumer sites. Thanks to the marketing efforts of UNDVA you find your local rice in some shops in Yaoundé, Douala, Bafoussam and Bamenda.
- Local rice is of lower quality than the major rice and not at all competitive in price.

2) Rice Distribution Flows in Major Rice Production Area

i) Far North Region[3]

The Far North region is subject to a semi-arid climate where sorghum and millet are the staple food; Rice is rather a cash crop. Rice produced in Yagoua and Maga (SEMRY sector I and II and neighbors) 90% of production is up to Nigeria in the form of white rice (borono Region). The remaining 10% 5% is consumed locally. The situation is the same in Kousserie (formerly SEMRY III) with a very large percentage of elapsed rice to Chad whose capital is very close. Long-term investments focused on promoting rice having been made on a region that has the aforementioned diet and which is remote from major urban centers, the market for local rice has

[2] The Study Report for the detailed planning of the upland rice development project in the forest regions of Cameroon , p.11 January 2011 JICA.

[3] Reference: The preparatory study report for the rice development project in Cameroon and Nigeria, JICA September 2010.

led from the start to Nigeria rather and inside.[4]

ii) North West Region

In the Northwest Region, the main food is corn so that the rice is important as a cash crop as well as the Far North Region. The UNDVA sells 20% of its production areas to major urban centers; outside the UNDVA, 60% of the overall market is up by individuals. 20% of the distribution is handled by private rice mills after machining to the Nigerian market.

The main rice producing areas and the main distribution channels for imported rice are shown in Table below. Transaction networks listed in the table are the most common in general; in reality there are various cases of collection of production.

Table3.1.8 Rice Distribution Flows in the Major Rice Production Area

Production areas (regions)	Target Market	Distribution flows	Remarks
Far North SEMRY	Nigeria	Producer → middleman→ Nigerian buyer	It is estimated that 95% of production is directed to Nigeria and Chad
	Tchad	Producer → middleman→miller→ Tchadien buyer	
	Locak market	Producer →miller→wholesaler・retailer→consumer Producer →miller →wholesaler・retailer→consumer	
North West UNVDA (NDOP)	Local market (major cities)	Producer →miller（UNVDA）→wholesaler・retailer →consumer Producer →miller（UNVDA）→consumer	Around 20% of the production of UNVDA sites are directed to Nigeria by the private millers UNVDA markets to the 17 urban cities
	Local market (Bamenda) (Bafoussam)	Producer →miller→wholesaler・retailer→consumer Producer→middleman→miller→wholesaler・ retailer→consumer	
	Nigéria	Producer →miller（parboiled rice）→ Nigerian buyer	
Mezam Valley	Local market (Bamenda) (Bafoussam)	Producer →middleman→miller →wholesaler・ retailer→consumer	
	Nigeria	Producer →middleman→miller→middleman→ Nigerian buyer	
West (small production)	Marché intérieur	Producer →miller →consumer（market） Producer →miller →wholesaler・retailer →consumer	
Imported rice	Local market (major cities)	Importateur →wholesaler (central）→wholesaler・retailer (local）→consumer	75% of imported rice is consumed in Douala and Yaoundé

Source: prepared by JICA Study Team based on the Study Report for the detailed planning of the upland rice development project in the forest regions of Cameroon and the filed observations.

3) Rice Import

According to FAO statistics, we see that rice imports represented a total of $ 285,171,000 in 2011, representing nearly 500,000 tones (Table below). USDA data provide import figures of 530,000 tones for 2014.

Table 3.1.9 Rice Import in Cameroon（2004-2011）

Year		2004	2005	2006	2007	2008	2009	2010	2011
Quantity	Tonnes	301,101	446,466	436,125	470,920	427,310	469,450	363,823	494,712
Amount	'000 US $	85,227	141,038	138,203	183,203	252,228	251,234	195, 166	285,171

Source: FAOSTAT Note: Quantity is converted to white rice.

The table below shows the volumes imported by exporting countries. We see that imports from Thailand are particularly high since 2008, and they represent half of total imports in 2011. After Thailand come in the order of importance of the volumes Vietnam, Pakistan and Burma.

[4] Evaluation des contraintes et opportunités pour une production durable du riz au Cameroun, Journal de recherche des sciences biologiques et agronomiques 4(6) : 734-744 2008

Table 3.1.10 Rice Import Volumes by Countries(2004-2011)

Year	2004	2005	2006	2007	2008	2009	2010	2011
Thaïlande	137,424	73,738	73,738	161,824	192,722	238,269	212,634	253,713
Vietnam	31,964	134,938	72,785	52,647	72,663	127,981	74,618	105,341
Pakistan	10,048	60,115	100,637	38,488	45,241	36,518	45,259	73,684
Birmanie	—	15,500	6,000	—	25,313	42,803	10,000	37,238
Chine	86,925	145	79,977	80,962	—	—	—	—
India	15,569	29,668	82,582	132,051	35,271	—	—	—
Brasil	—	—	—	—	2,490	164,490	—	—
USA	17,623	—	813	3,992	—	970	4,181	15,999
Others							17,131	8,737
Total	301,101	446,466	436,125	470,920	427,310	469,450	363,823	494,712

Source : FAOSTAT Note : Quantity is converted to white rice

4) Retail Price of Rice

In February 2008, Cameroon riots broke out following the explosion in the prices of 2007 international cereal markets, following which the government established the consultation meeting on the rice sector, the meeting where representatives meet periodically to Ministry of trade, Ministry of agriculture, the administrations concerned and importers, wholesalers, consumers, UNVDA, and SEMRY to discuss the retail price of rice and price stability on the whole country.

The price of imported rice and local rice on the Yaoundé market is shown in the following table for the periods from August 2010 to July 2016. The price of imported rice is the procurement of Yaoundé while local rice is found. We find rice produced by the sectors of UNVDA in retail stores but no rice produced by other sectors. We see from the table that the retail price of imported rice and local rice was stable over the period of 6 years, and undergoes no increase.

The Ministry of trade announced an adjustment of 5% of the import duty on rice from 1 January 2016, but professionals think that there will be no increase in consumer prices as inventories of importers will not be exhausted. Even after the current inventory, the impact on the price increase should not be very significant in relation to consumer protection.

Table 3.1.11 Retail Price of Rice (unit : FCFA/kg)

Market \ Date		August 2010 1)				11 July 2016 2)			
		5%	25%	100%	Import country	5%	25%	100%	Import country
Imporeted rice	MOKOLO	400	350	500	Thaïlande	400	350	500	Thaïlande
	MVOG-MBI	400	350	500	Thaïlande	400	350	500	Thaïlande
	MFOUNDI					400	350	500	India, Thaïlande
	EKOUNOU					400	350	500	Thaïlande
	ETOUDI					400	350	500	Thaïlande
Local rice	Yaoundé retailer Riz UNVDA	White rice				White rice	Brown rice	Parbiled rice	
		400				400	500	450	

Source : 1) prepared by JICA Study Team based on the Study Report for the detailed planning of the upland rice development project in the forest regions of Cameroon , 2) Data collected by JICA Study Team through interviews.

Note 1) the percentage shown in the table is the percentage of broken rice

Note 2) 100% broken rice is fragrant rice from Thailand

As we have seen, most of the rice production in Cameroon is produced in three regions: the extreme North, North and North West regions. The background of the development of three regions into the major rice production area in Cameroon today is largely due to the integrated support of irrigation facilities development and agricultural technical guidance by the public development corporations such as SEMRY and UNVDA. In other words, rice cultivation in Cameroon has developed through the promotion of irrigated rice cultivation supported by the public development corporations. On the other hand, the rice yield of farmers conducting low land rice and upland rice is inevitably unstable and extremely low productivities. Although irrigated rice production has high potential, the production technology at the field level is still low both of agricultural extension workers and farmers, and the marketing ability of the public development corporations is inadequate for securing of the quality of domestic rice to compete with imported rice. In order to improve this situation, it is essential for the public development corporations which have experience of developing rice cultivation, to establish modern irrigated rice production technology and improve marketing ability against imported rice.

3.1.5 Challenges of the Rice Cultivation Sector

In recent years, Cameroon's rice consumption has increased, while domestic production stagnates, about 80% of consumed rice is imported. Consumption of rice is rapidly increasing mainly in urban areas, and from the viewpoint of food security, promotion of domestic rice is an urgent task. Rice is now regarded as an important food in Cameroon. Since rice is consumed mainly in urban areas, rice is promising as a cash crop with high marketability because of the future economic growth of the country, further progress in urbanization, an increase in the middle income group, etc. In addition, in last decade, the rise in world food prices worldwide experienced several times caused a serious food crisis in SSA countries including Cameroon. Therefore, stable supply of rice through improvement of domestic self-sufficiency rate is essential policy.

The following actions are identified to promote domestic rice production.

(1) Promotion of Rice Production Close to Urban Areas

Currently, Cameroon's major rice production sites are the extreme North, North and Northwest regions, but the former two regions are far away from the two major consumption areas of Duala and Yaoundé and from the viewpoint of transportation costs, it is difficult to provide a stable supply. Therefore, it is conceivable that promotion of rice production will be planned in the areas around the largest cities such as Northwest, West and Central regions in the future.

(2) Improvement of Rice Quality

Like other SSA countries, even in Cameroon, domestic rice is subject to competition with imported rice, and at present it is inevitable to say that domestic rice is inferior in terms of quality and price. In terms of quality, it is necessary to focus on the quality in line with the consumer needs of the two largest cities in Cameroon as a target market for domestic rice in the future. Therefore, it is necessary to establish a system for stable supplying quality rice to meet the needs and preferences of urban consumers.

In the relationship between quality and price, the standards and grades of rice are important. Imported rice has been graded by the broken rate and set price, but UNVDA rice is not graded at the retail stage. For example, the price of imported rice is set by the ratio of including broken rice such as 5% broken rice 400FCFA/kg and 25% broken rice 350FCFA/kg for Thailand rice. Meanwhile, the UNVDA rice has no indication of the ratio of including broken rice, and it is sold at 400FCA / kg at any retail store. In one retail store in Yaoundé, which deals with both imported rice and UNVDA rice, the best selling rice is 15,500 FCFA / 50 kg of 25% broken in a bag selling of Thai rice. UNVDA rice is sold at 17,000 FCFA / 50 kg. In shopkeeper's evaluation of two rice, Thai rice and UNVDA rice, the quality of Thai rice is better than UNVDA rice even lower price. The shopkeeper said that if the quality of UNVDA rice is current level, the selling price is 12,500 FCFA / 50 kg is reasonable. In this way, it is

indispensable to improve the quality of UNVDA rice and the actual price setting and quality level of UNVDA rice should be reviewed.

(3) Improvement of Rice Productivity

According to the NRDS data, the present rice yield is low at 3.5 t / ha of irrigated rice, 2.0 t / ha of low lowland rice, 1.5 t / ha of upland. In order to achieve the NRDS production target by 2018, it is necessary to improve productivity by 1.4 times, 1.8 times, 1.7 times of the current yield respectively. In addition, the yield of irrigated rice in the Ndop area was 3.1 t / ha on average, according to the field survey results, which was lower than the yield of NRDS.

As for improving productivity, it is important to efficiently produce rice commensurate with the quality required by domestic consumers as well as quality improvement. In other words, improvement of productivity is achieved not only by improving cultivation technology and yield, but also by improving the entire value chain such as harvesting, drying, milling, storing and selling by appropriate machine use. Among the value chain, first of all, attention should be paid to securing, introducing and disseminating high quality seeds. In irrigated rice which can be expected to produce stably, it will be necessary to establish a highly productive irrigated rice with mechanization system in the future.

(4) Promotion of Upland Rice

NRDS plans to multiply by 9.7 the rice production in 10 years between 2008 and 2018 from 100,000 tons in 2008, the goal is to reach 970,000 tons in 2018. According to the breakdown of the targets listed in the NRDS, it is planned to raise 72% of the production from upland rice at the target year of 2018 (30% of total rice production was produced from upland in 2008). In other words, although the unit yield is low, the promotion of upland rice in the tropical rainforest area will be important for disseminating in the future.

(5) Promotion of Profitable Agriculture

Although strong continuous demand for rice can be expected on urban areas in the future, it is necessary to make farmers understand that rice cultivation is profitable agriculture. Rice farming management is a new agricultural management for many farmers, and they are not familiar with rice cultivation techniques and sales methods. Farmers decide whether to choose cultivated crops or nonagricultural activities by profitability and household labor availability, so it is important to demonstrate that rice is a profitable agriculture for disseminating.

(6) Rice for Self-Sufficiency

According to PRODERiP's experience, upland rice cultivation in the rainforest area of the southern part of Cameroon has verified the positive dissemination as home consumption. Even in areas where cocoa has already established as cash crops, it should use PRODERiP's approach such as the training of core farmers by agricultural extension workers and then disseminating to other farmers by core farmers.

3.2 Present Condition and Challenges of Irrigation Sector

3.2.1 Upper Level Plan for Irrigation Sector

(1) Irrigation Development Plan in the Central Government Level

In Cameroon, irrigation development plan for 2035 is under preparation at present. And there is no existing irrigation development plan. But in NRDS prepared in 2009, followings are referred for irrigation.

NRDS aims for improvement of productivity and competitive power for rice in country side, and deals

with the problems; 1) difficulty of getting fertilizer and agricultural chemical, 2) lack of improved seeds, 3) large loss after harvesting, and 4) bad accessibility to the market from rice producing area. Moreover, basic plan for irrigation development are supposed to be prepared and infrastructures for irrigation are also supposed to be developed. And especially in the northern part of Cameroon, following points are taken into consideration, namely, 1) repair of existing irrigation facilities, 2) development of lowland and floodplain, 3) introduction of rice cropping around planned dams, and 4) diversification of producing style for rice cultivation in lowland and rainfed area.

Also this strategy is planning to develop 18,900 ha of irrigated area by improvement of existing projects and to develop 33,000 ha including new projects by 2018. The yield is expected to be 165,000ton with 5ton/ha. Improvement of existing irrigation facilities and new construction of irrigation facilities has a high priority in NRDS, and the followings are supposed to be considered for execution.

- Population density, results and possibility of rice cultivation
- Facts that farmers has already carried out for rice cultivation
- Capacity of farmers to manage water
- Needs of introducing progressive facilities considering capacity of farmers
- Existence of the water for gravity irrigation, farmers' ability for participation
- Capacity of the private sector in the field of agricultural mechanization

(2) Irrigation Development Plan in Rural Level

In Cameroon between 1970 and 1990, they encouraged to do rice cultivation with irrigation projects to make the situation of food supply better in the higher density area (city side). As a part of its measures, UNVDA was established to develop the lowlands of upper side of Nun river in the Northwest region. UNVDA is working to reduce the import volume of rice and has developed 2,532 ha of governmental lands by 2012. In the future, they are planning to develop 22,500 ha.

UNVDA has prepared the Business Plan 2013-2017 which aims to produce 75,000 t of rice (5ton/ha) by 2017 with 15,000 ha development. In the plan, following items are supposed to be conducted to achieve its goal.

- Development and improvement of processing facilities
- Development and improvement of rice field
- Mastered to the production-process management of rice
- Capacity development of farmers association for rice
- Increase of rice productivities through improving unit yield of rice
- Systematization and proper management of projects

From the plan, UNVDA is finally going to achieve the followings in addition to the target above mentioned.

- Increasing rice unit yield from 2t to 5t per ha
- Processing and selling 45,000t of rice
- Increasing farmers' income
- Improving life of inhabitants through development of infrastructure such as roads and bridges
- Reducing unemployment and outflow of farmers to city area by job creation
- Developing the Northwest region

3.2.2 Related Administrative Bodies and Their Roles

Organization of UNVDA is described in this section. Main business of UNVDA is to promote irrigated agriculture (called Hydro-agriculture) and to promote rice production in Upper Num Valley,

and therefore, they are carrying out all the activities needed for promoting rice production. UNVDA is not a project for limited period of times but a permanent project based on the strategies of the Cameroonian government. 132 people (at January, 2016) belong to UNVDA, and they construct irrigation facilities, disseminate seeds, fertilizer, insecticide and agricultural machineries and conduct other activities. The other hand, local agency of MINEDAR also exists in the jurisdiction of UNVDA. And the agency promotes agriculture widely except for rice promotion and irrigation facilities as UNVDA exists. Main departments of UNVDA for irrigated agriculture are described in the followings.

4 staffs belong to "the Infrastructure and Facility Service section" which is under "the Directorate of Rural Engineering (DGR)", they are mainly in charge of planning & implementation of irrigation projects and maintenance of the projects. In addition, 58 staff belongs to "the Garage and Motor Pool Service section" which is also under "DGR", they are mainly in charge of management of the agricultural machineries.

3 staffs belong to "the Research and Development Service section" under "the Directorate of Agricultural Production (DPA)", they carry out the study of seeds and others. In addition, "the Service of Technical Assistance to Producers section" under "the DPA" provides technical guidance to farmers, and there are 26 staff. They sell fertilizers and pesticides at the market price, and have adopted the way to give things before collecting money considering farmers' convenience. In addition, "the Training Service section" provides trainings to farmers although only 1 staff belongs to the section. "The Market Service section" is in charge of all the contracts such as constructions, and there is 1 staff.

3.2.3 Assistance of Donors

Regarding assistance of donors in the irrigation sector, France Development Agency (AFD) settled a national strategy for the irrigation sector in February, 2016 in addition to IFAD, IDB, and KRC which were described in "the rice sector". AFD pointed out 2 things for the irrigation sector as shown in the followings.

- It is extremely important who takes the maintenance of the irrigation system after the construction. It is more likely to be dead end if the government is in charge of it.

- Rice from Thailand and Vietnam are already circulated in the domestic market. To create maintenance cost for irrigation system or agricultural machineries, it is necessary to build a structure which creates profit from rice production, for instance, to impose the tariff on foreign rice.

3.2.4 Present Condition of the Irrigation Sector

According to the country report prepared by MINADER (Brief Presentation of the hydraulic agriculture in Cameroon), the present situation of the irrigation sector in Cameroon is as follows.

(1) Water Resources

In Cameroon, water resources are abundant and various, and there is large difference depending on regions. The surface water resources which can reproduce in Cameroon are estimated to be 268 billion m^3 per year. On the other hand, the groundwater resources are estimated to be 100 billion m^3 per year.

- Logone River and its tributaries: 11% of the country
- Benue River and its tributaries: 19% of the country
- Kadei River and its circumferential area: 20% of the country
- Main rivers at the middle western area: 50% of the country

(2) Organization in Charge of Irrigation

The irrigation system is provided mainly by MINADER. MINADER takes responsibility for 1) policy and strategy for irrigation water development, 2) design of irrigation projects and monitoring of their implementation, 3) development of irrigation management programs and monitoring of their implementation, 4) setting up of the quality standard for irrigation water and its monitoring. In addition, MINADER supervises public corporations in rural area. UNVDA is the one of such public corporations, and UNVDA is in charge of construction and management of irrigation facilities and assistance to farmers for their farming in the jurisdiction of UNVDA.

(3) Irrigation and Crops

Irrigation water is most frequently used for rice, and tree crops, especially banana, are the next. In addition, irrigation water is also used for horticultural crops (tomato, onion, carrot and pepper), maize and sorghum. There is a possibility to develop irrigation for wheat or corn although the Cameroonian climatic condition enables them rainfed cultivation.

(4) Large-Scale Scheme

SEMRY-II, Lagdo-I and SEMRY-I are main double-cropping area of rice. SEMRY-II and Lagdo-I have 360 million m^3 and 400 million m^3 of storage capacities respectively (Mega dam and Lagdo dam), and there is enough water sources. Regarding SEMRY-I, pumping use is restricted by an international agreement.

On the other hand, area under the jurisdiction of UNVDA and Mbappit PDRM are the main single-cropping area of rice with supplementary irrigation. In these areas, the crops such as Maize and others are cultivated in the dry season. There are no large dams in these areas, and water supply is performed through a small dam or directly from a river.

Characteristics of the double-cropping area and single cropping area are summarized in the following table. In these areas, it is said that jobs of farming are provided to about 20,000 farmers in total.

Table 3.2.1 Actual Situation of the Large-Scale Irrigation Scheme

	Main double cropping area	Main single cropping area	Main cropping area (Total)
Harvesting area [ha]	18,640	2,540	About 21,000
Crop density [%]	80	70	-
Rice production [ton/year]	90,000	17,000	About 113,000～70,000
Rice unit yield [ton/ha]	4.8	4	-

Source: JICA Study Team based on the document which MINADER provides

The characteristic of the irrigation for banana export is considerably different from the above, and three main business company groups perform irrigated agriculture in three sites. The total area of those productions is 8,000ha, and the annual yield is 270,000ton. These businesses are managed effectively, but on the other hand, it is said that they are facing some problems for sustainability (There is no description for the details).

(5) Middle-Scale Scheme

Middle-scale schemes have been promoted as specific projects of MINADER for ten years. There are projects focusing on rice or maize productions and intending crop diversification combining vegetables with cereals. These schemes are located mainly in northwest area, and their covering areas are less than 1,000ha each. However, it is said that the impact to the area is large.

(6) Small-Scale Scheme

The other, there are small schemes using small regional rivers. These schemes are conducted in very small area (5-10ha). However, there are large numbers of schemes and these schemes are supporting vegetable production. Especially they are located in suburbs of big cities such as Douala or Yaoundé.

3.2.5 Challenges of the Irrigation Sector

As described in the past sentences, there is no irrigation development plan and design standard in Cameroon although UNVDA has the Business Plan in the district. And, there is not any law to regulate water rights or water tariff. Furthermore, the observation systems of climate data or water resources are insufficient, and there is the case that the reliability of data is dubious even if data exist. Detailed project reports including calculation of water requirement, economic assessment and basic design are not prepared well. That's why it is hard to say that a policy and a system for promoting irrigation are well prepared.

In addition, quality of construction needs to be improved. For example, joint venture of local small construction companies accepts an order for irrigation projects in the jurisdiction of UNVDA. However, the quality of concrete is not high. Actually, in the irrigation canal of the Upper Bamunka area, big damages were observed in some points. In addition, the Cameroonian construction companies can be ranked by capital, but most of the companies with rank C or the less don't have construction machines by own and are facing problems for cash flow. These companies tend to cause delay in construction.

3.3 Present Condition and Challenges of Rural Road Sector

3.3.1 Upper Level Plan for Rural Road Sector

GESP which is the reference framework for the government action over the period 2010 – 2020, states that the Government's medium and long-term strategic guidelines in the road sub-sector aim to expand the tarred road network from 10 to 17 per cent by 2020. The idea will be to tar an average of 350km of roads per annum.

Although the Government emphasis on the improvement of tarred road network in the country, the new policy for the operation and maintenance of rural road which is mostly paved with earth materials such as laterite, is announced in 2010. It seeks to transfer the responsibility and financial source of rural road management from MINTP, MINADER and Road Fund to municipalities in order to encourage better management of the rural road network, and is bolstered by the decentralization process. With such decentralization budgets, some of the municipalities have already started rehabilitation and maintenance work for the rural road in their town.

The table below shows the budget and results of rural road maintenance and management of MINTP in 2014 and 2015.

Table 3.3.1 Budget and Performance of Rural Road O&M of MINTP (billion FCFA)

Year	Budget	Performance	Road Fund	Achievement / Road Fund (%)	Budget Execution Rate (%)
2014	14.1	14.1	44.3	31.8	100
2015	24.4	22.9	48.8	46.9	94

Source: Interview for MINTP

3.3.2 Related Administrative Bodies and Their Roles

(1) MINTP

MINTP is the governmental organization responsible for the entire road running in Cameroon. It is responsible for the technical assistance such as provision of guidance for detailed design, supervision of construction works and maintenance and management of road network in Cameroon. MINTP

composed of 879 employees as of May 2016 and has abundant knowledge and experience on procedure of Loan projects related to the road development. The current financial statement of the Ministry is as follows.

Table 3.3.1 Annual Budget of MINTP (1,000 FCFA)

	Investment	Operation	Total
2013	46,300,000	22,400,000	68,700,000
2014	44,300,000	21,600,000	65,900,000
2015	48,800,000	22,900,000	71,700,000
2016	47,800,000	21,500,000	69,300,000

Source: Interview for MINTP

MINTP controls from national route to rural road in the current road administration system in the Country. Relevant divisions to the survey will be outlined with the organization chart of MINTP.

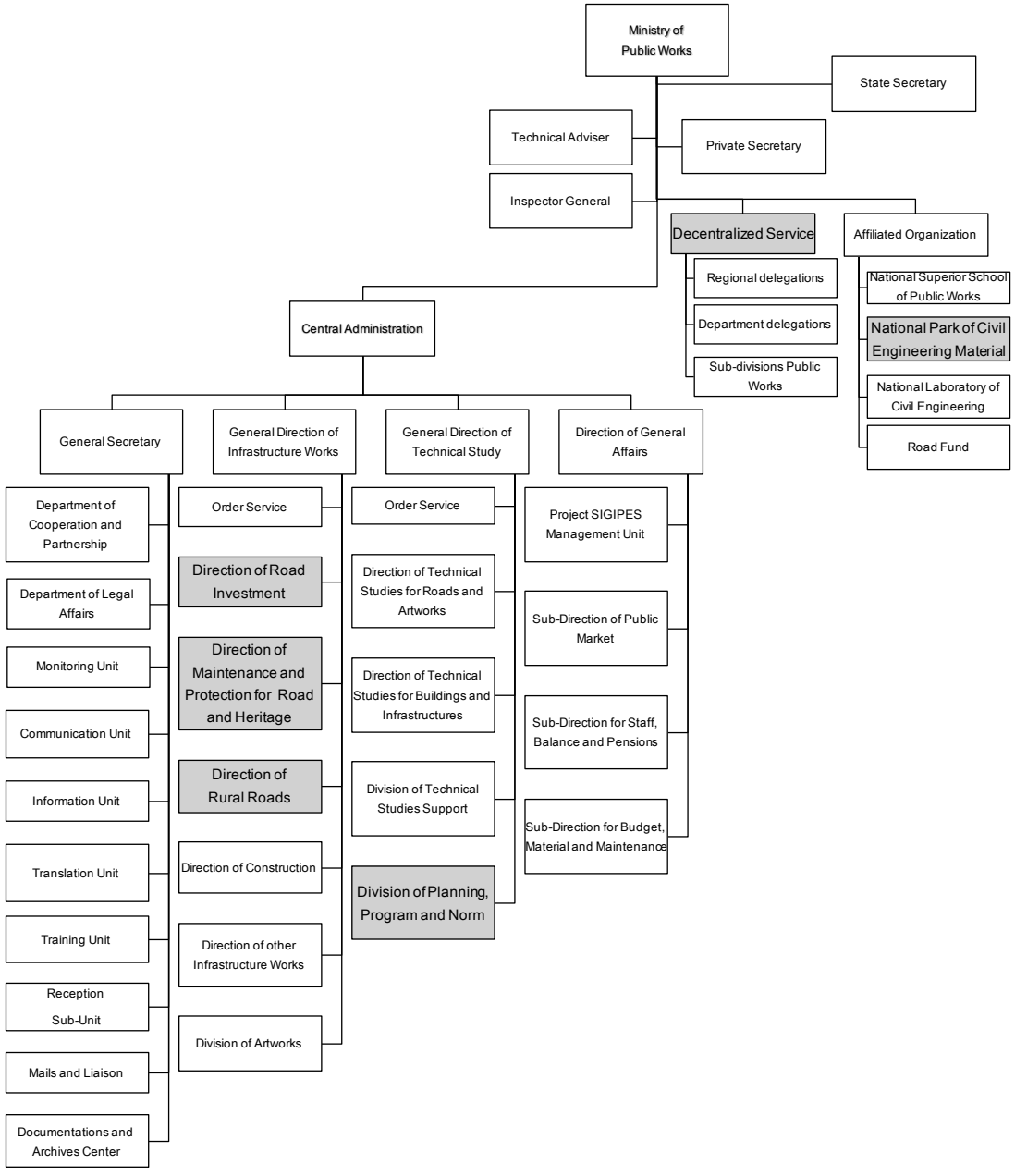


Figure 3.3.1 Organization Chart of MINTP

1) Central Government

i) Division of Cooperation and Partnership

The division is established under the Secretary General, and responsible for preparation, follow up and monitoring on bilateral and multilateral cooperation with other Ministries, the government of foreign countries, and donor agencies. In conjunction with the MINEPAT, the division also promotes the development of infrastructures, public buildings and road networks. It has provided operational coordination for every aspect of the preparatory survey related to access road component in the project.

ii) Division of Rural Road

The division is established under the Department of Infrastructure, and responsible for supervision of the every related work for rural road including construction, maintenance, and rehabilitation. In conjunction with other related division, it is tasked with examining the technical specification of rural road and road related structures. The division provides technical support to the O&M of rural road by MINTP Departmental offices and Communes. It also encourages the decentralization process of rural road management to Communes. The information of ongoing project by other donor agencies is also aggregated into the division.

iii) Division of Road Related Structure

The division is established under the Department of Infrastructure, and responsible for monitoring and controlling of construction, rehabilitation and maintenance of road related structure including bridge, culvert and so on. It is also tasked with inspecting and supervising the technical specifications and drawing of the structures with relevant departments.

iv) Division of Planning, Programming and Standards

The division is established under the Department of Technical Studies and responsible for drafting a master plan for infrastructure development, revising road map, and implementing related experiment, research and information collection of a new building materials and construction technology.

2) Local Government and Affiliated Organization

i) MINTP Departmental Office

The MINTP Departmental Office is established at each department under the MINTP Provincial Office. The Departmental Office is one of the main O&M bodies of target routes in this project. The office is responsible for followings:

- ✓ O&M of departmental roads and rural road networks.
- ✓ Conclusion of contracts concerning road maintenance and construction works and its quality control.
- ✓ Advice on local construction and O&M works implemented by Communes.
- ✓ Monitoring and supervision of local public works in accordance with related laws, guidelines, etc.

The table below shows the correspondence between MINTP Departmental Offices, target routes and related Communes.

Table 3.3.2 Target Routes and Related Municipalities

MINTP Departmental Office	Target Route	Municipalities
MINTP Ngo-Ketunjia	NW1 (Departmental Road), NW2 (Rural Road)	Ndop・UNVDA
MINTP Lekié	C1 (Rural Road)	Obala, Sa'a
MINTP Mvila	S2 (Rural Road)	Biwong Bulu

ii) MATGENIE

In Cameroon, although international contractors and leading local contractors own construction equipments and operator, small and medium-sized local enterprises ensure necessary equipment and operator from MATGENIE. In the following, the business content of MATGENIE is outlined.

a) Basic Information of the Organization

MATGENIE was established in 1967, and has been responsible for leasing construction equipment to local construction company in Cameroon. Originally, the organization had been implemented with the national budget, and had been run by a self-supporting accounting system since 1970. The organization transformed into the public joint stock company in 2015. Major role of MATGENIE is as follows:

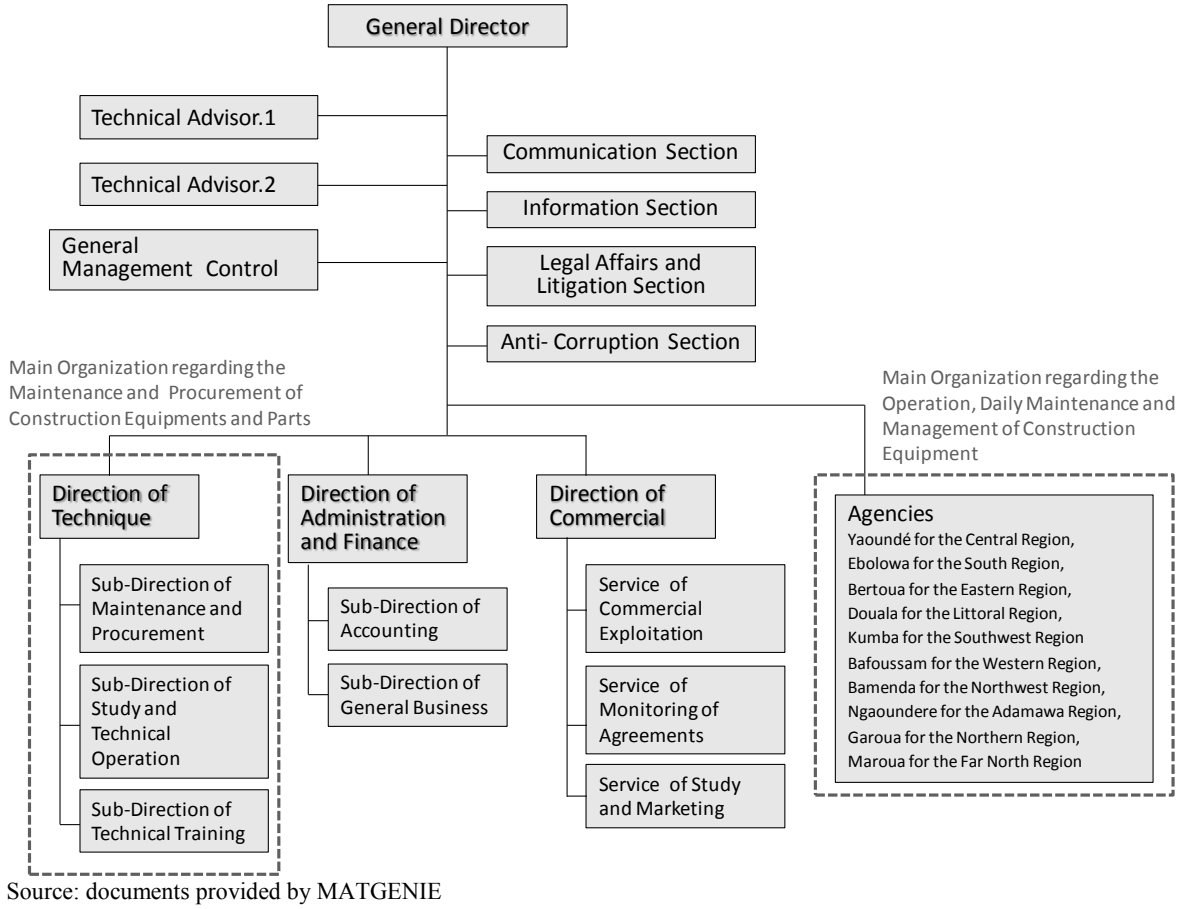
・Lending construction equipment with operator
・Approval of prototype vehicles and machineries
・Training of mechanics and operators
・Maintenance of equipment

b) Structure of the Organization

The figure below shows the organization chart of MATGENIE. The competent department for rental service and maintenance service of construction equipment is the Direction of Technique (DT). The role of DT includes:

・Procurement of construction equipment
・O&M of construction equipment
・Management of training programs for O&M of construction equipment.

There are 10 regional offices, and staffs in such branches are tasked with handling the lease of construction equipment to local contractors.



Source: documents provided by MATGENIE

Figure 3.3.1 Organization Chart of MATGENIE

(2) MINADER

Even though MINTP has been recognized as a competent authority for the whole road administration in Cameroon, MINADER also have been implementing renovation works of existing rural roads in their own budget. The following is an outline of the related divisions with the preparatory survey of target roads.

1) DGRCV

The division is responsible for the improvement of rural living environment through infrastructure development. It includes farm land consolidation, irrigation water development, rural road improvement, and agricultural mechanization. As concerns the rural road improvement, the maintenance of the existing roads has become a main work, and the construction of new road is not generally carried out by DGRCV. The division requests cooperation to MINTP if road engineering knowledge is required for the work. Please also refer to 3.1.2 (1) for more details of work content and budget situation of MINADER and DGRCV.

2) Department of Rural Engineering in UNVDA

This is the one of the divisions in UNVDA which is established for the purpose of promoting irrigated rice cultivation in the North Western region. The division is tasked with implementing construction, rehabilitation, and maintenance of irrigation structures, rural roads and road incidental structures. It owns technical personnel, construction equipments and operators. With these human resource and equipment, the department implements the civil engineering works mentioned above with the budget from MINADER. Please also refer to 3.1.2 (2) for more details of work content and budget situation of UNVDA.

3) CENEEMA

CENEEMA is a public corporation supervised by MINADER. It is responsible for implementing trial manufacture of agricultural machinery, technical training to operators, and test of imported agricultural machinery. In recent years, the institution has started to utilize owned equipments for the rural infrastructure improvement.

3.3.3 Assistance of Donors

(1) African Development Bank (AFDB)

AFDB is implementing the agricultural value chain construction project (Projet de Développement des Chaines de Valeurs Agricoles: PD-CVA) with MINADER as the counterpart organization (Approval Date: 20/Jan/2016). The target regionss are Central, East, South, Litoral and Southwest regions. Project's total budget is 115.1 billion EUR. Prior to PD-CVA, AFDB carries out renovation of main roads such as national road and prefectural road (Bamenda-Mamfé-Ekok, Kumba-Mamfé, Batchenga-Ntui-Yoko, Ketta-Djoum, etc.) in these five regions. Project period of PD-CVA is about 5 years from 2016, and it consists of the following four components, which contribute to the formation of the value chain of banana, coconut oil and pineapple, among others.

- Development of infrastructure contributing to the agricultural values chain
- Development of agricultural entrepreneurship to build the value chain
- Assistance to stakeholders of the agricultural values chain
- Project Management

The infrastructure development component aims the new construction and rehabilitation of 1,500 km of rural roads. The road selection criteria are listed as follows: 1) location on high growth potential sectors; 2) recipient in large number; 3) roads to strengthen the of banana, palm oil and pineapples value chains. In May 2016 the roads involved in the project schemes do not play a double role with those that are planning to be rehabilitated by AFDB.

(2) World Bank

The World Bank carries out an investment and development project of agricultural markets over five years as from 2015. The project is around 3 components aiming at promoting maize, sorghum and cassava.

- Production, processing and marketing of agricultural products Support
- Production of seeds and distribution system with a transfer of technology
- Project coordination and management

The maintenance of 1,550 km of roads is planned within the component (1) , including 500 km of rural roads 100% financed by the project , of which 100 km to be paved . In May 2015 the World Bank had not yet decided whether it would finance the remaining 1050 km of roads itself. A local consulting firm is currently conducting a feasibility study for the rehabilitation of 1550 km.

Table 3.3.3 Road to be Rehabilitated by the World Bank Project

Targeted production basins	Councils / roads to open	Estimation distance (km)
Diamaré	Maroua – Bogo	29
Bénoué	Pitoa – Bibemi	56
	Touroua – Ngong	66
Lekié	Evodoula-Mbebe (Kikot)	27
	Batchenga-Edzendouan-Nkoayos	65
Sanaga-Maritime	Mbebe-Nyaho'o-Nyanon-Ndom	50
Noun	Foumbot – Kouoptamé	20
	Foumbot – Maladen	28
	Maladen – Massangam	25
Bamboutos	Mbouda –Galim	17
Ngokentundjia	Balikumbat – Ndop	22
Dja and Lobo Mvilla and Ntem Valley	Minlamizibi – Bitsogmam jusqu'au pont à Memougou	13
	Ngoulemakong - Oveng - Oteloa - Obang - Ngoekele Falla bridge till Bityili 1 junction	46
	Ngoulemakong junction- Mbeka'a - Ebotenkou	36
Total		500

Source: WB (Project PDMA)

During the survey, it was clarified that the route between Balikumbat and Ndop at Ngo-Kentundjia commune was duplicated with the route of NW1 which is the one of the target roads of this project. Thus, the study team has discussed with PIDMA in order to avoid the duplication of the target road, thereby PIDMA has selected the other routes in Ngo-Kentundjia commune which could create the synergy with this project.

3.3.4 Present Condition of Rural Road Sector

(1) Present Condition of Rural Road

According to MINTP road statistics, the total route length in Cameroon is 98,522km. The total route length of Rural Road is 78,802km, and it accounts for about 80% of the total route length. The pavement rate of National Road, Provincial Road, Departmental Road and Rural Road in each region is shown in the table below. Although all roads other than National Road, Provincial Road, and Departmental Road have been categorized into Rural Road through many years, the road master plan "Plan Directeur Routier du Cameroun 2006" showed the idea distinguishing 12,300km of them as preferential road from other Rural Roads. In some road-related documents recently published, these preferential Rural Roads have been classified as "Urban Road". Even though the pavement rate of Rural Road is 0% in the table below, the paving rate of Rural Roads combined with "Urban Road" is about 5.3% in another road-related statistics in 2013.

Table 3.3.4 Pavement Condition in Cameroon

Region	National Road		Provincial Road		Departmental Road		Rural Road		Total	
	Route Length (km)	Pavement Rate (%)	Route Length (km)	Pavement Rate (%)	Route Length (km)	Pavement Rate (%)	Route Length (km)	Pavement Rate (%)	Route Length (km)	Pavement Rate (%)
Far North	558	81	826	13	806	3	10,343	0	12,533	5
North	664	56	392	11	1,077	23	8,343	0	10,476	6
East	799	61	1,188	1	923	0	18,948	0	21,858	2
Central	1,173	51	1,038	28	985	5	14,548	0	17,744	5
West	335	81	596	20	466	4	4,146	0	5,543	7
Littoral	360	92	566	24	292	9	2,816	0	4,034	12
North West	446	29	242	31	326	0	3,814	0	4,828	4
South	1,057	34	376	19	1,109	10	7,661	0	10,203	5
South West	648	38	148	10	296	0	2,571	0	3,663	7
Sub-Total	6,040	**54**	5,372	**16**	6,280	**8**	73,190	**0**	90,882	**5**
Adamaoua	1,028	-	303	-	697	-	5,612	-	7,640	-
Total	7,068		5,675		6,977		**78,802**	-	**98,522**	-

Source: MINTP road map and statistics

(2) Overview of Decentralization for the Operation and Maintenance of Rural Roads

Even though MINTP has been recognized as a competent authority for the whole road administration in Cameroon, MINADER and Communes (Municipalities) have also been implementing operation and maintenance of existing Rural Roads in their own budget. In this context, MINTP and MINADER seek to transfer responsibilities of operation and maintenance of Rural Road to Communes along with the budget. The table below shows the road classification, the implementing body of the work, and the implementing body of operation and maintenance.

Table 3.3.5 Implementing Body of Road Improvement Work and O&M Work

Road Classification	Implementing Body of Road Improvement Work	Implementing Body of O&M Work
National Road	MINTP	MINTP
Provincial Road	MINTP・Region	MINTP・Region
Departmental Road	MINTP・Department	MINTP・Department
Rural Road	MINTP・Commune・MINADER	MINTP・Commune・MINADER

Source: JICA Study Team

MINTP determined that transferring responsibility of construction and O&M of Rural Roads to municipalities along with the related budget from Road Fund, which has been managed by the Director of Rural Road Department, in 2010 (Décret N°2010 / 0240 / PM du 26 février 2010). The President Paul Biya also granted the authority for the use of road fund to the Mayer of Communes in 2012. In this context, MINTP donated civil construction equipments equivalent to 26 billion FCFA to 104 Communes between the year of 2011 and 2013. Some of the Communes of Central Region, South Region, North West Region, Littoral Region and West Region had already implemented road rehabilitation work by the use of decentralized budget. The table below shows the transition of the amount of funds which have been transferred to 360 Communes from MINTP. It can be seen that there is an increasing trend year by year.

Table 3.3.6 Transition of the Amount of Funds Transferred from MINTP to Municipalities

Year	2010	2011	2012	2013	2014
Total (FCFA)	1,091,000,000	1,100,000,000	1,450,000,000	3,700,000,000	5,240,000,000

Source: MINTP Web Site

3.3.5 Challenges of Rural Road Sector

(1) Operation and Maintenance System of Rural Road

Operation and maintenance of rural roads has been gradually transferred to municipalities along with

budget. However, the O&M system of Rural Road based on road engineering knowledge and skills have not been formed among municipalities due to the fact that the most of road related project had been controlled by MINTP officers since a long time ago. As a result, its scope of work tends to be restricted to the selection of target route, budgeting, and the examination of basic plan for road maintenance. There is a situation that most municipalities are not able to do technical studies of rural road construction, O&M, and quality control of construction work.

(2) Technical Capabilities of Road Construction

Road construction contractors in Cameroon are ranked irregularly among those concerned as A (foreign-affiliated company), B (leading local company), and C (local SME). Taking into account the information gathered in the site with "Annuaire des Enterprises Camerounaises" issued in 2012, there are about 9 A class companies that could clearly be confirmed in 2016, and approximately 48 companies (including B +) are classified into B-class (see Annex).

A class company is a foreign-affiliated company (France, Egypt, China etc., etc.) with branch offices in Douala or Yaoundé, and has ordered national or provincial road development mainly from the World Bank and AFDB.

Among B class companies, enterprises with extensive experience of national roads maintenance are particularly distinguished as B + enterprises (14 companies). They have also received part of the work of the World Bank, AFDB and AID agencies.

On the other hand, small scale renovation of rural roads usually paved with laterite is performed mostly by local companies in the C rank around maintenance target route. Many of the renovation works of existing rural roads are often completed by correction of road surface and re-cutting of earth ditches with motor graders. However, the most C class companies do not own large construction machines such as motor graders, and road rollers. These companies are renting such construction machines from MATGENIE with operators. According to the commune staff and local consultants, engineering knowledge on road construction of these local contractors and affiliated technical staff is low. It is contributing to the early deterioration of the refurbished road due to insufficient compaction and roadbed defect.

(3) Technical Standard for Road Construction Work

Although there is no definitive edition of the technical standard for road construction works in Cameroon currently, there are some reference books as follows. AMÉNAGEMENT DES ROUTES PRINCIPALES is one of the common reference documents for road design issued by SETRA (Service d'Etudes Techniques des Routes et Autoroutes). MANUEL D'EXECUTION DE PETITS OUVRAGES ROUTIERS EN AFRIQUE is a construction manual for small-scale road related structure in African countries issued by Ministry of Cooperation as it was known then in France. The detailed road construction planning reports created by foreign consultant have been referred as well. After all, the road design has been carried out on a case-by-case basis with these reference books. MINTP has been aware of the absence of definitive technical standard document for road design, and considering the preparation of such standards recently.

(4) Awareness of Voluntarily Maintenance of Rural Road in Rural Community

The section facing residential area and cultivated area has been maintained by people living along the rural road, awareness of co-management for the section between villages has not been fostering. The sediment deposition to the ditches and the luxuriant growth of the plant causes a significant reduction of the width of a road at the section between villages where traffic volume of the vehicle is less. There is a need to consider such current condition of awareness among people living along rural road when make an O&M plan to the target rural roads.

3.4 Present Condition and Challenges of Agricultural Equipment Sector

3.4.1 Upper Level Plan of Agricultural Equipment Sector

Promotion of agricultural mechanization is regarded as important in Cameroon, and a working group on “agricultural mechanization strategy” was established in MINADER. The final draft of this strategy papar was created in 2014 and it is waiting for approval to be published by the Cameroonian government. According to DOPA, public hearings were held among stakeholders in early March 2016 and it is being modified based on its results. The contents of this strategy paper are followings:

- Promotion of agricultural mechanization on large scale production areas
- Acceleration of agricultural machinery procurement
- Human resource development for agricultural mechanization
- Establishment of support program for introducing agricultural machinery

This loan project can play a major role in implementing this "agricultural mechanization strategy".

- Promotion of agricultural mechanization on large scale production areas: The production filed can be increased and the rental of agricultural machineries such as tractors and combines will be introduced for the development of irrigation facilities in Upper Bamunka area. This component can contribute to promote the agricultural mechanization on large scale production areas as a model.
- Acceleration of agricultural machinery procurement: The various Japanese agricultural machineries are being planned to introduce to UNVDA. This introduction process could be the model case for the procurement of agricultural machinery.
- Human resource development for agricultural mechanization and Establishment of support program for introducing agricultural machinery

The training of operation and maintenance will be provided for each agricultural machinery to be introduced in this project. It will be possible to develop human resources in the agricultural machinery field through this soft component and it will contribute to disseminate this programme as a model case to the related organizations in Cameroon.

3.4.2 Related Administrative Bodies and Their Roles

(1) Direction of Professional Agriculture Organization and Agricultural Exploitation Support (DOPA)

DOPA is in charge of the agricultural machinery in MINADER and there are 10 staffs. The main tasks are (1) promotion and monitoring of agricultural mechanization program, (2) promotion of agricultural machinery and agricultural equipments (3) development of performance evaluation and use standard of agricultural machinery, (4) creation of certification file of agricultural machinery,

(2) National Center for Research and Experimentation of Agricultural Machinery (CENEEMA)

The National Centre for Research and Experimentation of Agricultural Machinery (CENEEMA) was established in 1974 under the supervision of DOPA. The main tasks are (1) providing the tractor rental service, (2) providing the lecture/driving training for tractors and (3) performance review and extension of new tractors. The mechanization department consists of 10 staffs that are responsible for handling the management and maintenance of 15 tractors of SONALIKA and their 10 attachments. There are two types of tractor's lecture / driving training are conducted (3 months for regular courses and 4 months advanced courses which include much technical elements). Each course has a capacity

of 25 people and about 50 people participate every year. The tuition fee is 250,000 CFFA for a regular course. According to CENEEMA, the training costs about 600,000 FCFA per participant hence MINADE bears the difference from the tuition fee and actual cost. Farmers, NGOs staffs, new employment seekers (tractor and operator) and a small number of women participate to the course.

3.4.3 Assistance of Donors

We could not get enough information up to date on the aid granted in the agricultural mechanization sector. According to officials from the UE and the FDA when the agricultural machinery maintenance system is not working, there is no proper management, and it is difficult to obtain spare parts. Therefore when a machine breaks down it is almost certain that it will no longer be used. This is why the UE and FAD provide only material that requires no maintenance (hoe, rake, harrow, wheelbarrow).

3.4.4 Present Condition of Agricultural Equipment Sector

Under the guidance of MINADER, agricultural mechanization in Cameroon is being promoted by government affiliates such as CENNEMA, UNVDA in North West region and private machine service providers. There are almost no cases that a general farmer owns the agricultural machine. The most popular agricultural machinery is tractor for plowing work. Tractors are using for sowing the seed of maize before the rainy season, and for rotary plowing before rice planting work for rice cultivation after harvesting the maize in UNVDA area in north west region. The plowing work by manpower is still mainstream however, there are some cases of government-related organizations and private machine service providers are used as well. For example, UNVDA and private companies conducted the rental service of tractors for 450 ha in five UNVA areas in 2015.

Cameroonian government is implementing its own original policy for promoting the agricultural mechanization. MINEPAT has operated the tractor assembly factory in Ebolowa with India SONALIKA (Head office Mumbai) in south region since 2012 by Indian aide. There are 3 types of horsepower of the tractor assembled in this factory, 60 HP, 75 HP and 90 HP. The methodology of CKD (Complete Knock Down) importing all parts from India is adopted. Since the beginning of factory operation, 715 units were assembled and 415 units were offered to MINEPAT and MINADER (see the table below) and the donated tractors are provided to the affiliated institutions without any charges in both ministries.

Table 3.4.1 Number of Distributed Agricultural Equipments

	2007	2008	2009	2010	2011
Tractor 130 CV (big)	8	－	－	13	14
Tractor from 37 to130 CV (average)	6	－	－	5	15
Farmer	144	93	108	1 611	467
Rotary feeder	1 763	105	176	116	32
Chain tractor	5	4	7	4	19

Source : DOPA and JICA Study Team – rice promotion detailed project study plan in Cameroon

It seems that MINEPAT is considering selling the tractors to the private sector, but there is no achievement so far. MINEPAT expects that the prices for selling to the private sector are assumed to be 7.2 million FCFA for 60 HP, 9 million FCFA for 75 HP and 10.2 million HP for 90 HP. At the field survey on the assembly factory in Ebolowa by JICA mission team, 300 tractors were kept as inventory.

When we visited the EBOLOWA workshop, there was no tractor for sale to provide from the workshop and there were 300 tractors kept within the workshop. According to the workshop head they are there for 3 years, the tires are damaged, rust appeared and the level of damage is serious. Also 10 harvester / threshers, 30 rice transplanters, plows towed and other equipment are kept there.

Table 3.4.2 Allocation of SONALIKA Tractors

	60CV		75CV		90CV		Total
	MINADER	MINEPAT	MINADER	MINEPAT	MINADER	MINEPAT	tractors
2012	26	−	51	6	20	8	111
2013	18	1	34	21	20	46	140
2014	4	17	30	11	1	21	84
2015	−	−	35	44	−	1	80
Total/Minis.	48	18	150	82	41	76	415
Total/Power.	66		232		117		

Source: DOPA and JICA Study Team – rice promotion detailed project study plan in Cameroon

3.4.5 Challenges of Agricultural Equipment Sector

It has been pointed out that among the "agricultural mechanization strategy paper," but the current state of the problems is as follows.

- Development of human resources for agricultural mechanization
- Newly introduced agricultural machinery and evaluation and demonstration research of existing agricultural machinery
- Promotion of domestic agricultural machinery manufacturing industry

Present state, "human resource development for agricultural machinery" is, at CENNEMA, but has implemented a classroom-practical training of tractor intended for the farmers and the general students who wish, the staff of the government-affiliated agricultural machinery agencies training that target have not been performed. Also, the agricultural universities of Cameroon, agricultural machinery and course of agricultural engineering were used as a professional (curriculum) has not been set. In addition, there is a need to conduct more research to improve the content of the order to adapt the equipment to work the soil of a specific situation, such as the nature of the site of the country, including the establishment of a research and development institutions, development of mechanization research and development personnel program is required.

Although related to the development of human resources for agricultural mechanization, in Japan, based on the current situation of agricultural machinery maker different machine is running, the field of use and work the results of the evaluation is essential. Currently, this role is CENNMA, to build a system to carry out this evaluation, feedback is required.

Domestic agricultural machinery manufacturing industry is a small machine such as maize for the mill, a household system and micro-enterprises. In the future, there is a need for support of the expansion and human resource development of the financing system of the country

Chapter 4 Present Condition of the Target Site of the Project

4.1 Validity of the Selection of Survey Area

JICA study team has confirmed the appropriateness of the selection of survey area specified in the terms of reference of this study.

(1) Validity of the Site Selection Regarding the Irrigation development Component and Installation of Agricultural Equipments Component

As stated in chapter 3, although the rice producing area under the jurisdiction of SEMRI in far north region is the highest rice production area in Cameroon, approximately 90 % of rice produced there is exported to Nigeria and its supplement to domestic market such as Duala and Yaoundé is limited. While the production amount in the rice producing area under the jurisdiction of UNVDA covers only 15 % of the total production amount in Cameroon, its potential to become principle rice supplying area for those cities would be higher than that of far north region from the view point of close distance to the domestic mega markets. On the other hand, the irrigation facilities such as drainage canal and internal farm road in most of rice producing area in North West region are not well constructed. Hence, the existed milling plant managed by UNVDA was established 30 years ago meaning that those facilities have already been deteriorated, which results in the lower yielding percentage of milled rice from the husked rice. Therefore, it is assumed that the irrigation development and the installation of proper post-harvest facilities including country elevator would improve the productivity and quality of rice produced there drastically. Moreover, the target area of this project has already been selected as the target area of PRODERIP indicating that the target area would increase the rice productivity based on the technical support of PRODERIP. From the view point mentioned above, it is clarified that the selection of survey area for this project has sufficient validity.

(2) Validity of Target Access Road for Access Road Development Component

According to the terms of reference of this study, MINADER has selected 98 candidate routes covering 1,958 km in total as target road for the rehabilitation. These are selected as the access road connecting the rice producing area to the neighboring market which located in North West, central east and south region. Moreover, the selected candidate routes include the road connecting the pilot rice producing site of PRODERiP and PRODERIP to the market. Therefore, it is clarified that the selection of the target roads for this project has sufficient validity from the view point of the creation of synergy with these technical cooperation projects.

4.2 Irrigation Development Component

4.2.1 Target Area

(1) Selection of Target Area

Regarding selection of target area, following conditions were set up, namely, 1) necessity of flood control measures, and 2) accessibility to Ndop town considering close cooperation with both a) the access road component and b) activities of PRODERIP. As a result of examination based on the conditions above, Upper Bamunka area, which is located on the south of Ndop town, was selected as a target area (The table below). A check dam has already been constructed in the Mufuo River which is water source of the Upper Bamunka area, and thus flood control measure is basically implemented. A model farm of PRODERIP is also located within the area, and therefore it will lead synergetic effects. Moreover, although there is an issue of poor drainage in the Upper Bamunka area, it is a common issue in the UNVDA area, and therefore, it is expected to disseminate the effect or lessons learned of the project to the other areas.

Table 4.2.1 Selection of Target Area

Area investigated	North of Ndop (Babungo area & others)	East of Ndop (Tangoh area, Babess area, Kovalim area & others)	West of Ndop (Bamessin area)	South of Ndop (Upper Bamunka area)
Needs of flood control	Necessary	No need	No need	No need
Accessibility to Ndop town	Middle distance	Long distance	Long distance	Short distance
Result	×	△	△	○

(2) Border of the Target Area

1) Geographical Border

The Upper Bamunka area is located on the south of Ndop town with national road 11 (N11). On the west of the Upper Bamunka area, departmental road 72 (D72), which is branching from N11, runs north and south. Mufuo River, which is the source of water-supply to the Upper Bamunka area, is located along the D72.

On the other hand, Monkie River flows from west to east direction on the south of Upper Bamunka area. And the Monkie River provides water to the Lower Bamunka area.

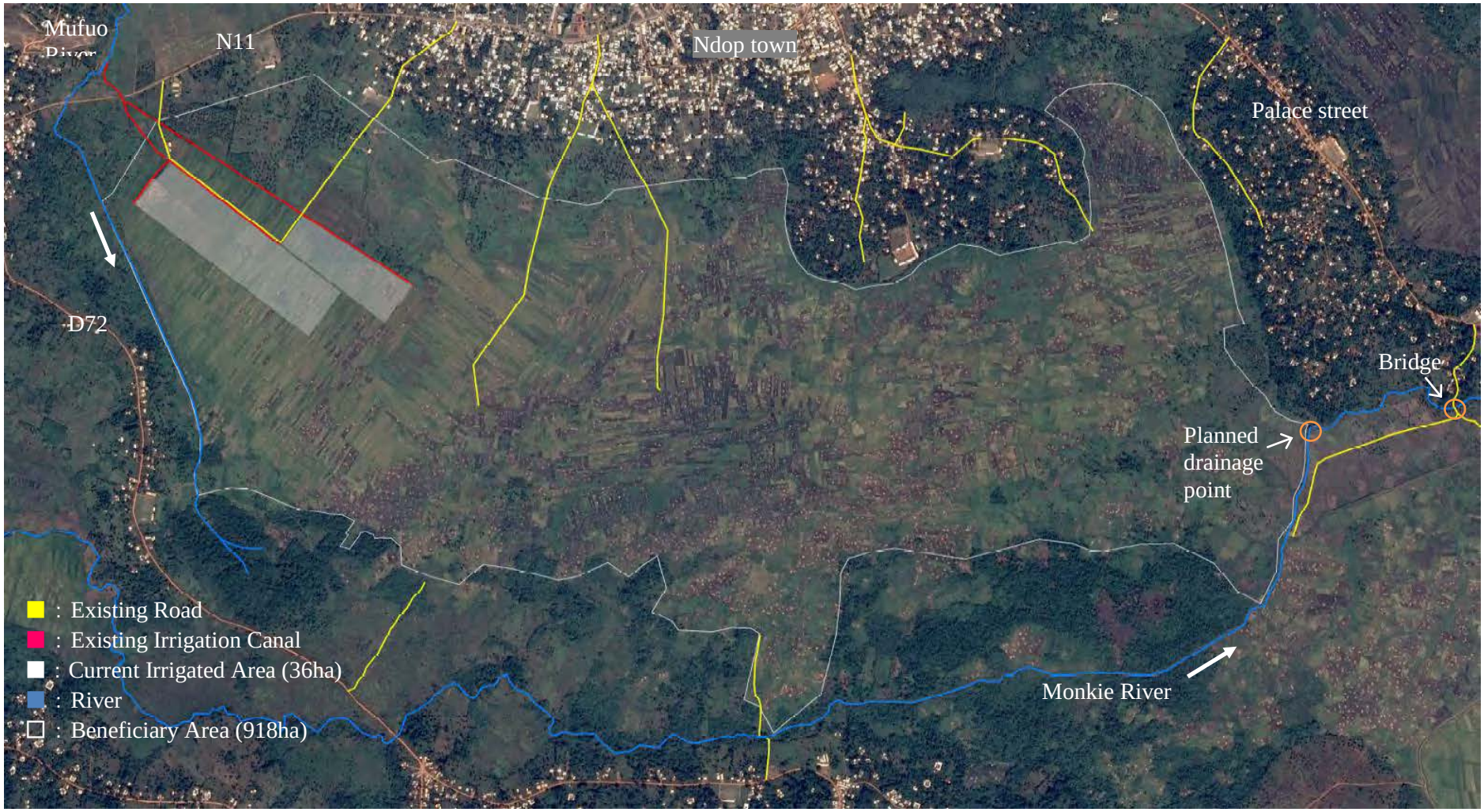


Figure 4.2.1 Outline of the Target Area

(Source: JICA Survey Team)

2) Administrative and Social Border

In Cameroon, administrative area is composed of Region, Department and District. Under the Department, there are Village and Quarter. However, Village and Quarter are not official administrative areas but the areas based on traditional tribe. Border of Village tends to be kept unclear not to encourage dispute among tribes.

Administrative area near Ndop is summarized shown as following figure. The target area extends over the two villages named Bamunka and Bamali.

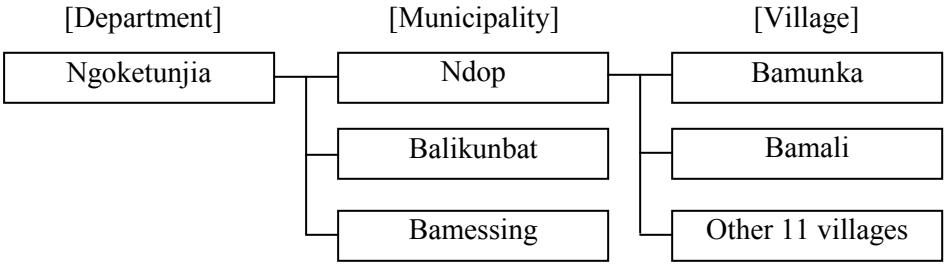


Figure 4.2.2 Administrative Area in Ndop

Source: JICA Study Team Note: There are no districts in this area. Therefore, villages are just under sub-divisions.

3) Selection of Beneficiary Area

Based on the cooperation of UNVDA, following policies were adopted to fix beneficiary area considering geographical, administrative and social borders.

- In the Upper Bamunka area, rice farming with irrigation has been conducted using the Mufuo River water and such a practice for present cultivation is well considered.
- In the Upper Bamunka area, the north and south parts belong to Bamunka and Bamali villages respectively, and two tribes exist together for farming. The practice is well considered.
- On the south of the Monkie River, the area takes water only from the Monkie River, and therefore the area is not included in the Upper Bamunka area.
- Farmers tend to expand their cultivation area by burning forest area. However, UNVDA has a policy not to conduct root cutting from the view point of ecosystem conservation. Therefore, existing forest boarder will be the boarder of beneficiary area.

Based on the policy above, boarder of the beneficiary area was decided and shown in the figure above. Beneficiary area of the project is 918ha.

4.2.2 Topographic, Measurement and Geotechnical Survey

(1) Topographic Survey

Topographic survey was conducted to create a topographic map for basic design of irrigation facilities. From the result of the topographic survey, topographic situation in the target area is as follows.

- Land slope in upstream area: 1/125 (0.8%)
  - *Difference in the altitude: 1173-1160.5=12.5m, Length: 1530m
- Land slope in mid & downstream area: 1/590 (0.17%)
  - *Difference in the altitude: 1160.5-1153.5=7.0m, Length: 4242m
- Land slope in total: 1/294 (0.34%)

In the target area, farmland structure is as follows. In the upstream area, plot (called “room”) size is basically 20m x10m, and the long side is laid out along contour line. Farmers tend to use 4 or 5 plots

along the long-side direction (4 room: 10m x 80m, 5 room: 10m x 100m) for rice. On the other hand, in the mid & downstream area, plot size is not consistent (30m x 30m and others) and plots are not arranged regularly.

(2) Farmlands Structure of Lower Bamunka Area

There is another irrigation project named Lower Bamunka, which is consolidated in 1994 and evaluated as the most ideal irrigation project in the UNVDA area. Beneficiary area of the Lower Bamunka area is about 900ha and irrigated agriculture is conducted in about 600ha. In this area, the Monkie River water is used for irrigation, and water after use is drained to the same river in the downstream area. Characteristic of the area is shown in the following table. To create basic concepts of the irrigation component, characteristics of the Lower Bamunka area are well considered in addition to the topographic situation, original issues, and farming practice in the Upper Bamunka area.

Table 4.2.2 Characteristics of the Lower Bamunka Area

SN	Characteristic
1	Standard plot size is 20m x 100m.
2	Irrigation & drainage canals and farmroads are constructed to all the plots.
3	Farmroads are laid out along not irrigation canals but drainage canals. Excavated soil of drainage canals are used for farmroads.
4	UNVDA plowing service with tractor is disseminated in about 40% of the area. Constraint of further dissemination is number of tractors held by UNVDA.
5	Tractor passages are not constructed, and tractors have entered to farm fields directly passing through drainage canals.
6	Water Users Association named “Farm” has been organized same as in Upper Bamunka area.
7	Gates at main & secondary irrigation canals are managed by UNVDA.
8	This area is not traditional agricultural area. After the development, settlers have started agriculture.

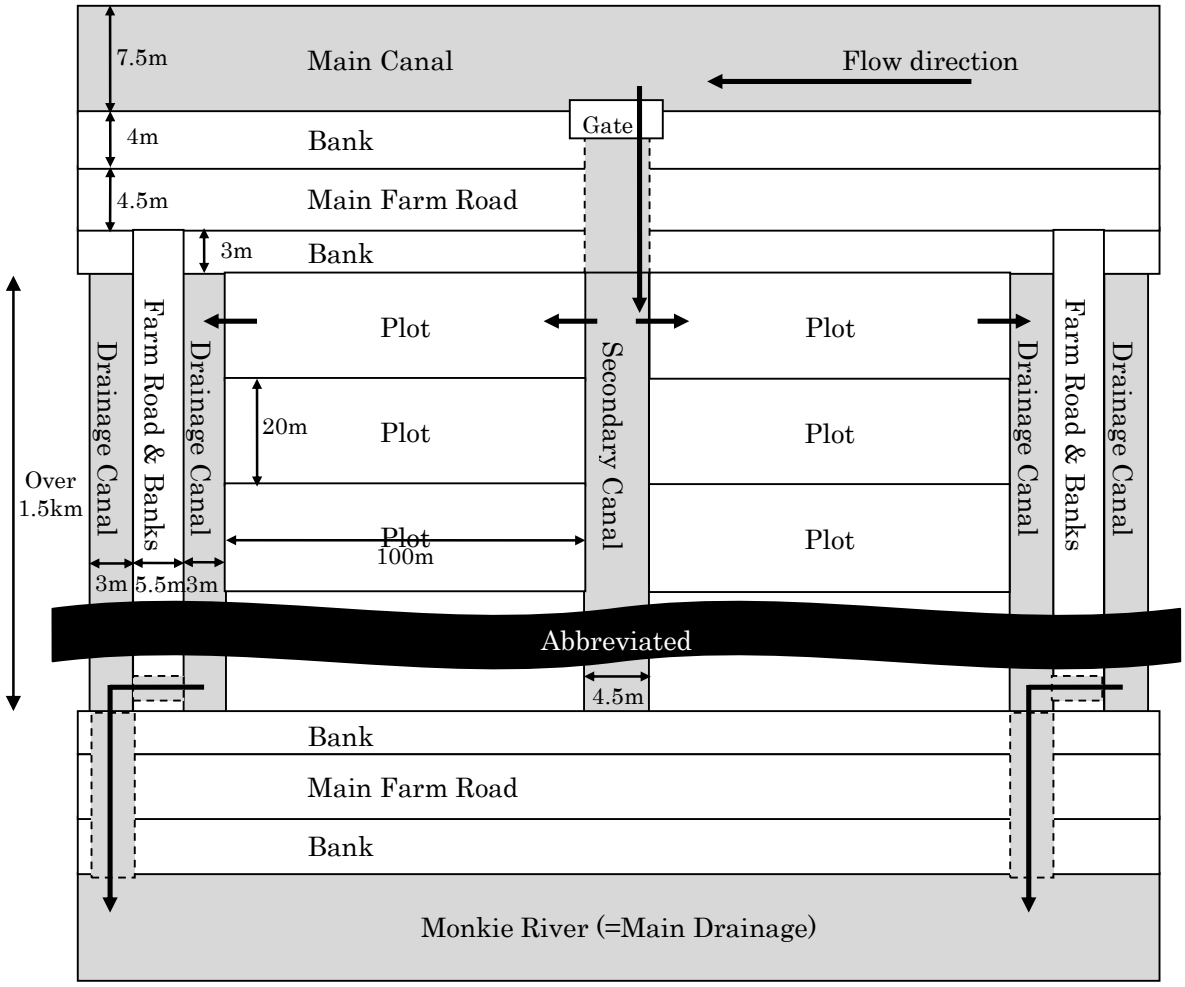


Figure 4.2.3 Structure of Farmlands in the Lower Bamunka Area
(Source: JICA Study Team)

■Related specifications■
Altitude of Main Farm Road is higher than that of Main Canal at 1.5m.
Altitude of Main Farm Road is higher than that of plots at 1.2m.
Altitude of Farm Road is higher than that of plots at 0.8m.
Depth of Secondary canal is 0.8m.
Small land slope in a plot.
Depth of Main canal is 1.2m.
Depth of Drainage canal is 0.45m.

(3) Measurement Survey for Existing Irrigation Facilities

Measurement survey was conducted for the items shown in the following table to know the current status of irrigation facilities and rivers.

Table 4.2.3 Items of Measurement Survey

Item of survey	Detail	Specifications
Measurement of existing irrigation canal	Centerline survey	Every 50m interval
	Longitudinal survey	Every 50m interval
	Cross-sectional survey	Every 50m interval, Width more than 30m
Measurement of river	Centerline survey	500m to up and down stream each side from the intake point at every 100m interval (Total 1000m)
	Longitudinal survey	500m to up and down stream each side from the intake point at every 100m interval (Total 1000m)
	Cross-sectional survey	500m to up and down stream each side from the intake point at every 200m interval (Total 1000m)

Source: JICA Study Team

Drainage possibility in the Upper Bamunka area is examined based on the measurement survey. Following tables are summary of measurement survey, field observation and famers' interview at 2 points, namely, a tail end of the planned main drainage canal (Figure 4.2.1 "Planned drainage point") and a bridge located in 700 m downstream from the tail end (Figure 4.2.1 "Bridge"). As shown in the table for the Bridge, the water level of the Monkie River (1153.40m) was lower than the elevation of walking floor of the bridge (1151.10m) at 2.3 m on August, which is heavy rainy season. Therefore, cross-sectional flow area is secured enough even in the heavy rainy season at the bridge. As shown in the table for the tail end, the elevation of the river bank, which is almost same as elevation of the farm field, was higher than the water level in the river at 0.7 m on June and November, which tractor and combine harvester are assumed to be used respectively. Therefore, drainage effect will be secured on June and November. On the other hands, elevation of the river bank was lower than the water level in the river at 0.4m on August (heavy rainy season). However, constraint to expand rice area is not too much water in the heavy rainy season but in the beginning stage of rice farming (June and July) because rice plants are still short in the beginning stage.

Table 4.2.4 Elevations at the Bridge Locating in 700m Downstream from the Tail End

Observation date	24th of May	18th of June	August	November
Elevation of walking floor of the bridge	1153.40			
Water level in the river	1150.10	1150.36	1151.10 (Interview)	1150.36 (Interview)
Elevation of the riverbed	1149.60			

Table 4.2.5 Elevations at the Tail End of the Main Drainage Canal

Observation date	24th of May	18th of June	August	November
Elevation of the river bank	1154.19			
Water level in the river	1153.09	1153.49	1154.59 (Interview)	1153.49 (Interview)
Elevation of the riverbed	1151.14			

(4) Geotechnical Survey

Much water in the field was observed in the target area. Therefore, a test for bearing power of soil was conducted to check traficability of tractors or combine harvesters.

1) Bearing Power of Soil

Bearing power of soil is divided into two main classes for traficability as follows (MAFF, Design standard "Farmland consolidation").

i) Bearing power of soil for plowing and harvesting

Target value of cone index (N/mm^2) is 0.39 on average, and its minimum requirement is 0.2[5]. Cone index will be measured in plowing layer of soil.

ii) Bearing power of soil for saturation and paddling

Minimum requirement of cone index is 0.2 on average in inundation condition. Cone index will be measured in below the plowing layer of soil (plow sole layer).

[5] 40 hp of tractor is assumed.

2) Result of Simple Dynamic Cone Penetration Testing

Regarding bearing power of soil, simple dynamic cone penetration testing was conducted on 16th of June, and the result is summarized as following table. Nd value is field result, and cone index is estimated from the Nd value. However, bearing power of soil for plowing and harvesting cannot be judged from the result in this time because testing was conducted in inundation condition before saturation and paddling. Therefore, it needs to be tested in coming detailed design stage. Cone index values were beyond the standard value (0.2) in all measurement points. Therefore, it is concluded that tractor can be used for saturation and paddling even in the downstream area of the target area at present situation. Actually, it was observed that 75hp of tractor was used in the farmland same as the measurement point of midstream area. It is thought that combine harvesters will also be available because it is generally said that combine harvesters can be available in the farm field where tractor is available as combine harvesters are right compared with tractors. Measurement points are same as measurement points of the soil survey described later.

Table 4.2.6 Result of Simple Dynamic Cone Penetration Testing

No. of knock	Penetration depth	Penetration depth	Nd value	N value				Corn Index (Estimated)			
				Okada (1992)			Shinnin (1986)	The Japanese Geotechnical Engineering Society		Ogawa (1986)	
n	h	Δh	Nd	Coarse grained soil	Sandy soil	Cohesive soil	Nd=1.5N	qc=0.1N		qc=Nd/15	
(Times)	(cm)	(cm)	(Times/10cm)	N	N	N	N	Qc		qc	
Most upstream point											
3	10	10	3.0	1.5	2.0	2.3	2.0	0.23	Plowing layer	0.20	Plowing layer
4	20	10	4.0	2.0	2.6	3.0	2.7	0.30	0.26 (ave.)	0.27	0.23 (ave.)
4	30	10	4.0	2.0	2.6	3.0	2.7	0.30	Plow sole layer	0.27	Plow sole layer
4	40	10	4.0	2.0	2.6	3.0	2.7	0.30	0.30 (ave.)	0.27	0.27 (ave.)
Upstream point											
3	10	10	3.0	1.5	2.0	2.3	2.0	0.23	Plowing layer	0.20	Plowing layer
2	20	10	2.0	1.0	1.3	1.5	1.3	0.15	0.19	0.13	0.17
3	30	10	3.0	1.5	2.0	2.3	2.0	0.23	Plow sole layer	0.20	Plow sole layer
3	40	10	3.0	1.5	2.0	2.3	2.0	0.23	0.23 (ave.)	0.20	0.20 (ave.)
Midstream point											
2	10	10	2.0	1.0	1.3	1.5	1.3	0.15	Plowing layer	0.13	Plowing layer
3	20	10	3.0	1.5	2.0	2.3	2.0	0.23	0.19 (ave.)	0.20	0.17 (ave.)
3	30	10	3.0	1.5	2.0	2.3	2.0	0.23	Plow sole layer	0.20	Plow sole layer
4	40	10	4.0	2.0	2.6	3.0	2.7	0.30	0.26 (ave.)	0.27	0.23 (ave.)
Downstream point											
2	10	10	2.0	1.0	1.3	1.5	1.3	0.15	Plowing layer	0.13	Plowing layer
2	20	10	2.0	1.0	1.3	1.5	1.3	0.15	0.15 (ave.)	0.13	0.13 (ave.)
4	30	10	4.0	2.0	2.6	3.0	2.7	0.30	Plow sole layer	0.27	Plow sole layer
3	40	10	3.0	1.5	2.0	2.3	2.0	0.23	0.26 (ave.)	0.20	0.23 (ave.)

Simple dynamic cone penetration testing

75 hp of tractor observed in the midstream point

4.2.3 Survey on Hydrology, Meteorology and Water Resources

(1) Rainfall and Meteorology

The climate in North West region is classified as Cameroon type of equatorial climate. It has two seasons: rainy season and dry season. Rainy season begins in mid-March and end in mid-November. 95% of rainfall is seen in rainy season. From April to October, monthly rainfall exceeds 100mm/month and September has the highest monthly rainfall. The figure below shows rainfall pattern in Ngoketunjia where the target area is located. Temperature, humidity, wind velocity, sunshine duration in North West region is shown in the following table.

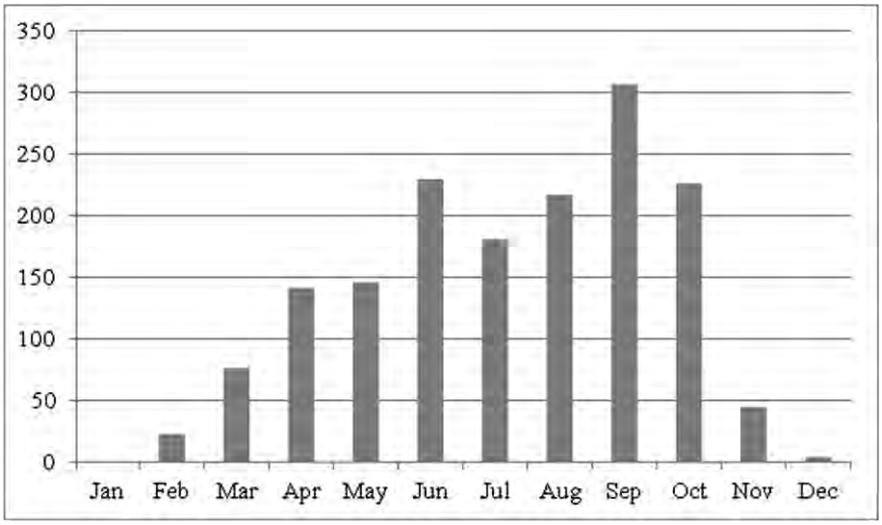


Figure 4.2.4 Rainfall in Ngoketunjia
Source: JICA Study Team made the graph based on rainfall data provided by UNVDA

Table 4.2.7 Temperature, Humidity, Wind Velocity and Sunshine Hour

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Temperature	Degree													
Maximum		29.2	30.5	29.6	28.0	26.7	25.7	24.7	24.8	25.2	25.9	27.2	28.4	27.2
Minimum		14.7	15.9	17.2	17.5	17.0	16.4	16.2	16.7	16.0	16.2	15.3	14.3	16.1
Humidity	%	60.9	59.5	64.4	69.7	71.1	72.6	73.8	74.2	73.6	71.6	68.1	63.4	68.6
Wind velocity	m/second	4.7	5.8	5.8	5.0	4.3	4.0	4.0	3.6	4.0	4.3	4.7	4.3	4.5
Sunshine hour	hours/day	7.8	8.0	6.8	6.5	6.8	5.8	4.5	4.3	4.6	5.8	7.5	8.2	6.4

Source: JICA Study Team made the figure based on data provided by UNVDA
Note: Data from Koundja meteorological station except for humidity which is from Ngoketunjia meteorological station.

(2) River Discharge

Though there is an intake facility in the Mufuo River, no records of water level and water discharge are taken. Bamendjin dam controlled and maintained by UNVDA and other rivers in North West region have also no data related to water discharge. Result of discharge measurement in the Mufuo River showed that discharge of the river in February, which is the end of dry season, was 0.02 to 0.03m^3/sec and 0.04 to 0.06m^3/sec in early March, which is the beginning of rainy season. UNVDA begins to take water from the Mufuo River from late May or beginning of June when water level rises high enough to lead water to canals. With this water, raising seedling is held at the most upper part of the target area of 3ha. The water from the Mufuo River also covers 30 to 40ha for growing rice at upper part of the target area.

4.2.4 Soil Study

(1) Objective and Methodology of Soil Survey

The soil profiles study and chemical analyses of soil were carried out to grasp the soil characteristics of the project site. The soil profiles study was conducted in 4 areas as shown in the figure below and annex.

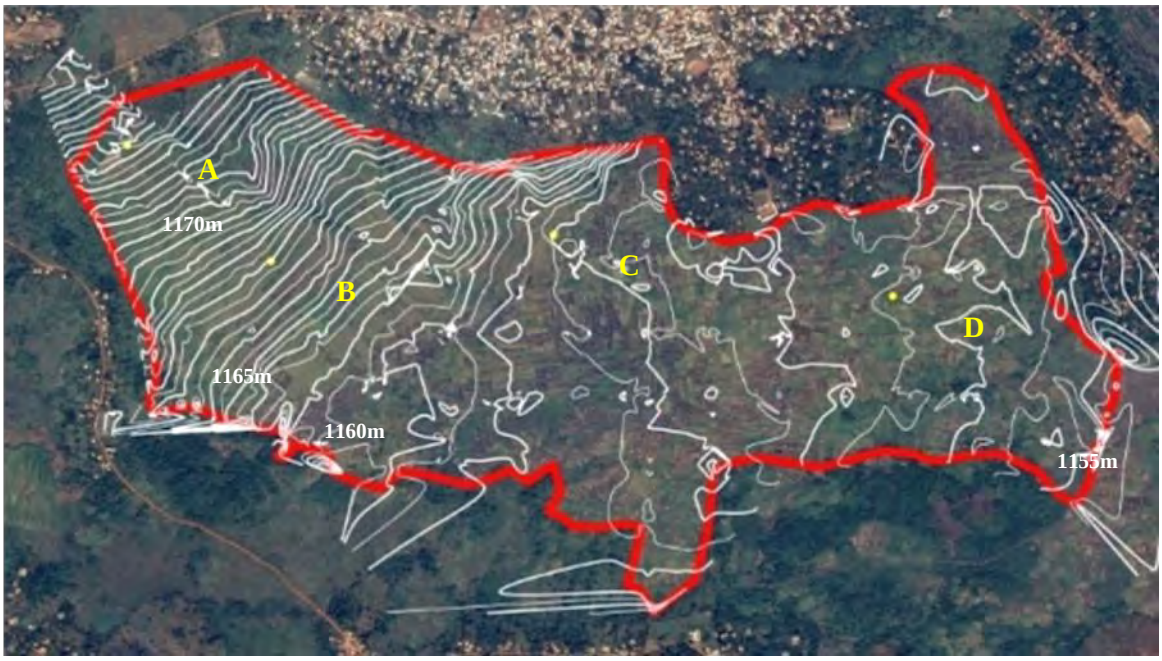


Figure 4.2.5 Survey Area of Soil Survey
Source: JICA Study Team

The soil samples collected from each layer of soil profiles are dried properly. The soil chemical analysis was conducted by the laboratory in Cameroon. The contents of soil chemical analysis are stated in the table below.

Table 4.2.8 Contents of Soil Chemical Analysis

Classification	Element of analysis
Chemical Aspect	pH (H_2O), Electrical conductivity (EC), total Nitrogen (T-N), total phosphorus (T-P), available phosphorus (Av.P), Exchangeable Base (Ex.Ca^{2+}, Ex.Mg^{2+},Ex.K^{+}, Ex.Na^{+}, cation exchange capacity (CEC)、Total Iron (T-Fe), Total Manganese (T-Mn)
Physical Aspect	Particle Diameter

Source: JICA Study Team

(2) Result of Soil Profile Survey

The results are summarized in the table below. On 4 analysed points on the only sector, point A is diagnosed with a packed area (hard ground). The soil surface varies from one point to another and a thickness of about 15-20 cm. On every point the clay content tends to be high, particularly soils of points A and B situated upstream that contain mild clays and soils C and D situated downstream , which contain a majority of heavy clays. All soils were classified from plastic to very plastic ones, notably soil B. Apart from soil C density of the upper soils is relatively low, but tends to rise on the lower side.

Table 4.2.9 Result of Soil Profile Survey

Points	Side	width (cm)	Colour	Texture	Plasticity	Compactness
Point A	Ap	0-14/16	5YR 3/4	Light clay	Plastic	Medium
	Ad	14/16-30	5YR 3/4	Light clay	Plastic	Compact
	B	30-45/50	5YR 2/3	Light clay	Plastic	Very compact
	C1	45/50-68	5YR 3/3	Light clay	Plastic	Very compact
	C2	68-85+	5YR 4/4	Light clay	Plastic	Very compact
Point B	Ap	0-15/18	5YR 3/1	Light clay	Very plastic	Medium
	B	15/18-20/22	5YR 4/4	Light clay	Very plastic	Compact
	Cg1	20/22-50	5YR 5/1	Heavy clay	Very plastic	Very compact
	Cg2	50-80+	5YR 6/1	Heavy clay	Very plastic	Compact
Point C	Ap	0-15/22	5YR 3/1	Heavy clay	Very plastic	Compact
	BC	15/22-42/45	5YR 3/2	Heavy clay	Very plastic	Compact
	Cg1	42/45-68/70	5YR 6/1	Heavy clay	Very plastic	Compact
	Cgir2	68/70-85+	7.5YR 6/6	Heavy clay	Very plastic	Compact
Point D	Ap	0-10/15	5YR 3/1	Heavy clay	Very plastic	Medium
	AB	10-15/20-25	5YR 3/1	Heavy clay	Very plastic	Compact
	B	20-25/45-53	7.5YR 5/1	Heavy clay	Very plastic	Compact
	C1	45-53/70	5YR 5/1	Heavy clay	Very plastic	Compact
	C2	70-85+	7.5YR 4/1	Heavy clay	Very plastic	Compact

Source: JICA Study Team

(3) Result of Soil Chemical Analysis

The results are shown in table below. The pH of soil for irrigation is between 4.23 and 5.85 indicating an acid soil as the whole. Exchanges bases (Ca, Mg, K, Na) are lower than the exchange of cations, which corroborates the low pH. The total phosphorus content is between 149 and 628mg / kg but the active phosphorus content is extremely low (0.16 to 4,82m). Given that phosphorus does not dissolve due to the low pH volume of the soil. When soils are immersed, phosphorus dissolves because their pH increases, but low soil phosphorus content could limit yields in irrigated rice production. The ground surface of points A, B and D have very high iron content. The soil of point B shows a value of 1761.3 mg / kg on the surface. According to the farmers' survey of sector B, the reddish water flows on part of rice farms, suggesting that the water that supplies rice has high iron content. On the strongly acidic soils / deoxidized, iron is easily dissolved causing damaging overloads for crops, manifested by the appearance of brown spots on leaves. Farmers know from experience that the reddish water have bad effect on the growth of rice. Almost all samples had high iron content, indicating that the disease due to excess iron in the soil are a limiting yields factor for irrigated farming sector to grow and develop well.

Table 4.2.10 Result of Soil Chemical Analysis

Point	area	pH(H_2O)	EC	Ca	Mg	K	Na	CEC	T-N	T-P	Av.P	T-Fe	T-Mn	Sand	Silt	Clay
			mS/cm	---------- cmol (+) kg^{-1} ----------					g/kg	mg/kg	mg/kg	mg/kg	mg/kg	--------- % ---------		
Point A	Ap	4,59	0,046	2,57	0,78	0,18	0,11	10,13	1,71	556,5	1,08	883,0	31,29	35,89	27,50	36,62
	Ad	5,85	0,046	5,51	2,44	0,32	0,06	9,86	1,30	628,2	0,77	378,5	37,15	36,82	28,50	34,69
	B	5,62	0,025	4,15	1,89	0,47	0,13	10,20	1,04	561,4	0,47	397,8	64,79	36,82	24,50	38,69
	C1	5,71	0,018	3,84	1,81	0,37	0,10	8,76	0,61	456,5	0,31	853,1	76,30	33,89	25,42	40,69
	C2	5,67	0,021	3,24	1,58	0,37	0,09	7,54	0,52	372,6	0,47	445,1	64,66	35,89	24,42	39,69
Point B	Ap	4,27	0,046	0,72	0,20	0,20	0,08	9,76	1,91	380,2	0,47	1761,3	39,21	35,82	30,50	33,69
	B	4,34	0,029	1,39	0,40	0,24	0,05	8,22	1,12	318,1	0,31	291,6	511,85	37,74	25,57	36,69
	Cg1	4,88	0,015	3,00	1,16	0,32	0,09	10,73	0,79	306,6	0,31	792,3	641,05	28,67	19,28	52,05
	Cg2	5,30	0,011	3,24	1,73	0,47	0,14	11,99	0,54	252,0	0,16	513,8	125,75	20,67	19,64	59,69
Point C	Ap	4,29	0,058	2,96	1,36	0,21	0,21	18,87	3,18	506,8	4,82	513,8	31,22	20,46	16,78	62,76
	BC	4,80	0,027	4,87	2,72	0,39	0,19	14,04	1,03	226,9	2,90	473,1	189,54	19,60	13,93	66,47
	Cg1	4,79	0,024	2,77	1,59	0,20	0,10	7,21	0,48	149,0	2,14	479,9	21,34	26,60	28,86	44,54
	Cgir2	4,83	0,023	3,36	1,99	0,24	0,13	9,23	0,43	264,7	0,31	1523,8	133,86	25,60	12,78	61,62
Point D	Ap	4,24	0,058	2,53	1,10	0,37	0,16	18,97	3,81	606,3	0,47	1099,7	151,82	22,53	24,78	52,69
	AB	4,23	0,067	3,76	2,03	0,37	0,14	18,23	3,02	502,8	4,68	810,4	132,16	18,60	27,71	53,69
	B	4,49	0,044	5,23	3,24	0,33	0,13	15,74	1,66	386,2	3,49	529,4	184,81	18,67	21,57	59,76
	C1	4,54	0,039	4,99	3,19	0,36	0,13	14,99	1,41	323,5	2,29	511,7	105,69	16,67	24,28	59,05
	C2	4,59	0,041	5,67	3,57	0,48	0,15	19,02	2,07	508,8	2,59	765,9	120,34	14,67	16,28	69,05

Source: JICA Study Team

(4) Recommendation Based on the Soil Survey

The following points were raised in view of the soil survey outcomes:

- ✓ The project irrigation soil areas generally presents a high clay content, and are very plastic and very compact. It is a difficult soil even as its physical properties and its nutrient retention capacity are high because when dry, it becomes strong and when immersed it becomes plastics and weakens the foundations. When the supply of tractors and combine harvesters will be studied, suitable equipment will be provided to adapt them to these conditions, drainage and water management systems.
- ✓ Soils irrigation project sector have low pH which facilitates phosphorus deficiencies; therefore contributions in appropriate fertilizers should be provided to increase yields. Moreover surface soil has high iron content and therefore the excess iron may occur. Surface iron accumulation is probably due to the water coming from the web which is very ferruginous. Consequently, provide proper drainage systems will be installed to reduce groundwater eruptions and limit diseases due to excess iron.

4.2.5 Survey for Internal Farmroad

(1) Result of the Soil Survey

As shown in the result of the soil survey, it was found that the soil texture was high in clay contents. And the viscosity, plasticity and compactness were also high. Therefore, bearing power of soil is enough high when the soil is dried. However, plasticity of the soil will become obvious when the soil contains water.

(2) Sandbag Construction Method

Sandbag construction method is positively adopted in JICA projects, and the characteristics are as follows.

- Target of the sandbag construction method is community roads where no. of passing vehicles is smaller than 50 cars.
- The sandbag construction method can be conducted by residents themselves.
- Roads by the method are strong for the pressure from the above, and it is hard to form wheel tracks with rain.
- Regular maintenance is necessary to keep surface coating of sandbags.
- The method is applied not to construction of new roads but to repair of existing roads.
- Plastic bags for cereals or fertilizers tend to be used in developing countries because the price is not high.

(3) Condition of Existing Internal Farmroads

Regarding existing farm roads, height of roads were 1.2 meter from the field, and roads were compacted by compactor. As the result, roads haven't subsided although wheel tracks are observed in the rainy season.

(4) Possibility of Sandbag Construction Method

Plastic bags for serials or fertilizers were easy to obtain in the market of the target area. Management committee of water users association named "Farm" responded that member farmers would join any construction works based on necessity.

However, farmers haven't experienced participation to any construction works in UNVDA area. And, farmers tend to hire labors when hard works are required in the field, for example, excavation of

drainage canals. Moreover, existing drainage canals are not laid out as a network, and thus, it is difficult to say that cooperation between farmers are well functioned.

Considering above facts, it is concluded that introduction of participatory construction works for farm roads is not easy. However, it is thought that farmers' participation can be introduced in repair of internal farm roads using soft component from the view point of promoting farmers participation.

4.2.6 Survey on Water Management, Operation and Maintenance (O&M) of Irrigation Facilities

(1) Present Status of Water Distribution and Operation of Irrigation Facilities

Present status of water distribution and operation of irrigation facilities in the target area is as follows. Taking water from the Mufuo River is managed by UNVDA Seed Farm Monitor. They start taking water on the end of May to the beginning of June and finish taking water on the mid of October to the end of October. They open the gate at 6 to 7 am and close the gate at afternoon to evening generally. However, these opening and closing hours are changed based on the farmers' request although a basic time table has been prepared by UNVDA. For example, the gate are kept open about 1 week for transplanting. Water distribution and operation of secondary and more lower canals is managed by farmers

(2) Present Status of Maintenance of Irrigation Facilities

Present status of maintenance of irrigation facilities in the target area is as follows. Regarding maintenance of related rivers (Mufuo River and Monkie River), UNVDA conducts cleaning of these rivers based on the request of farmers within UNVDA budget. During 2010 to 2016, cleaning of these rivers was conducted one time for the Monkie River in 2015. And the cleaning was conducted by using UNVDA backhoe and operator. Actual cost was only fuel cost of the backhoe because the operator was also UNVDA staff. Regarding maintenance of canals, farmers can get their maintenance cost from UNVDA based on farmers' request and conduct maintenance activities by themselves. However, such kinds of maintenance activities have not been conducted since 2010. On the other hand, maintenance activities which don't cost money, for example, cleaning of canals, have been conducted by water users association named "Farm" based on the necessity.

(3) Water Users Association Named "Farm"

1) Outline of Farm

In the targeted area, 6 Water Users Associations (WUAs) named "Farm" have been established by the instruction of UNVDA (The table below). "Farm" has been uniquely developed by UNVDA, and it is not common in Cameroon. Therefore, "Farm" is not regulated by the law in Cameroon.

Table 4.2.11 "Farm" in the Upper Bamunka Area and Their Cropping Plans for Rice in 2015

SN	Name of Farm	No. of farmers			Planned cropping area [ha]		
		Male	Female	Total	Developed	Traditional	Total
1	Upper Main Farm	969	1,224	2,193	11	194	205
2	Upper Middle Farm	150	97	247	-	74	74
3	Tumba	138	95	233	-	46.2	46.2
4	Lower Middle Farm	123	42	165	-	64.6	64.6
5	Muakwe	106	78	184	-	40.48	40.48
6	Mbueh	98	94	192	-	48.5	48.5
Total		1,584	1,630	3,214	11	467.78	478.78

Source: JICA Study Team Note: Planting area is based on self-declaration of farmers.

2) Structure of Farm

"Farm" has a managing body named "Farm Committee". And "Farm Committee" is composed of 5 board members, namely, president, vice president, treasurer, secretary and adviser. Some Farms have divided their areas in some blocks and appointed block leaders separately from boards members.

Each Farm has 2 kinds of meeting bodies. One is Farm Committee meeting and another is General Body meeting. Farm Committee meeting is held every 1 week to 1 month. On the other hand, General Body meeting is held on May every year. In the General Body meeting, financial status is shared, and election of Farm Committee members is conducted. Term of Farm Committee members is one year generally. Extra General Body meeting is held depending on the necessity. Regarding records, a secretary of "Farm" is managing Farm Registration Booklet, and a treasurer is managing Financial Record.

3) Participation and Cost Sharing

Participation to the "Farm" is basically compulsory, and all the farmers in the area have joined "Farm" actually. "Farm" members must pay a registration fee for participation to the "Farm" (One time only), and amount of the fee depends on "Farm" (From 3,000FCFA to 10,000FCFA). Moreover, "Farm" members need to pay a fee for "Farm" activities every year, and the fee is 30 kg of rice production. And "Farm" members also need to pay same amount of products to their chief of tribe every year as a loyalty.

4) Activities and Financial Status

Activities of "Farm" are 1) reallocation of farm lands needed for irrigation projects, 2) O&M of irrigation canals and drainage canals and 3) conflict management within farmers. Regarding maintenance of canals or internal farm road, Farm hires labors depending on the necessity. Each "Farm" is keeping 40,000 to 80,000 FCFA saving.

5) Expulsion from Farm

"Farm" fines a member for payment rejection of a fee for "Farm" activities. If a member reject the payment for 2 years in a row, "Farm" and UNVDA confiscate his/her farm land and expel him/her from the "Farm".

6) Issues of "Farm" for Farming Activities

"Farm" committee members pointed out their issues for farming activities in the Upper Bamunka area as follows, namely, 1) too much water in the field, 2) lack of internal farm roads, 3) non-leveled lands and 4) lack of irrigation canals.

"Farm" committee members also agreed to conduct integration of existing small-farm lots to let their farming activities easy by using farming machineries (tractors or combine harvesters) considering their ideal area of Lower Bamunka area (Standard plot size is 100 x 20m in Lower Bamunka area).

7) Actual Status of Farm Members

The literacy rate of "Farm" members is 75 to 80 %, and there are various members such as a person graduated from elementary school or a person who has doctor degree.

Regarding role of female in "Farm", female farmers can join the committee members of the "Farm". And it is said that female members also participated in the meeting actively. However, only three members are female (secretary x 2, adviser x 1) among 30 committee members. Therefore, it is

thought to be male-dominated traditionally.

4.2.7 Study on the Present Agricultural Condition of the Target Area

(1) Introduction

Agriculture within the jurisdiction of UNVDA focuses mainly on rice production because UNVDA has developed irrigated agriculture in the Ndop plain, where large quantities of fluvisoils and histosoils are deposits from the river after flood and particularly very rich. The fluvisoils are considered as perfect soil for agriculture and rice cultivation, while histosoils are soils that do not drain well.

In the jurisdiction, rice production is lower than other cereals and tubers, but rice has become a main cash crop in the area. Apart from rice, farmers grow maize and cowpea, plantain, yams, cocoyam and vegetables in their upland. Rice is for own consumption but it is also an important cash crop. Maize is the basic food crop as well as cowpea, and both are grown mainly to satisfy self consumption but can be destined for sale. These two crops are essential for farmers.

The income source of farmers comes mostly from the sale of agricultural products, livestock, small businesses, handicraft, working as farm help. Small scale goats, sheep and poultry are raised for self consumption.

The study area is a part of the Upper Bamunka sector which is one of 5 UNVDA irrigated areas. In this section, we shall talk about agriculture within the UNVDA management areas in general and then agriculture on the study area

(2) Areas and Producers of Irrigation Sectors

The areas and the number of producers in five irrigation sectors tend to increase because many farmers expressed the wish to participate in rice production. As described in the table below, the figures of the developed and traditional areas with the percentage of each sector and the number of producers for 2015. The lower Bamunka with almost 1,063 ha is the largest sector in term of area and Upper Bamunka the one with the highest number of producers. Across all sectors, the average area of a producer is 0.25 ha. In 2015, the development rate was 44% for all the five sectors, the Upper Bamunka was the least developed sector with a rate of only 21%.

Table 4.2.12 Areas and Number of Producers on the Irrigation Sector (2015)

Sector	Area (ha)			Ratio	Producers		
	Developed	Traditional	Total	(%)	Male	Female	Total
MONOUN	195	34	229	85	503	693	1,196
BANGOLAN	339	189	528	64	654	778	1,432
BABUNGO	199	444	643	31	1,105	893	1,998
LOWER BAMUNKA	547	516	1,063	51	1,807	2,540	4,347
UPPER BAMUNKA	191	700	891	21	2,516	2,459	4,975
TOTAL	1,471	1,883	3,354	44	6,585	7,363	13,948

Source: JICA Mission from UNVDA data

(3) Rice Production

1) Evolution of Rice Production and Cultivation Areas

Between 2000 and 2008, rice production increased from 6,000 to 8,000 tons on the 5 sectors above mentioned, and between 2008 and 2010 it exploded. In 2004 it was 5,575 tons and reached 17,000 tons in 2014. In 2000 the operated areas were 1,740 ha. In 2014 they had almost doubled to 3,303 ha. This is explained by the fact that the rice sector has been heavily promoted by the government of

Cameroon following the global crisis in cereal grain prices between 2007 and 2008.

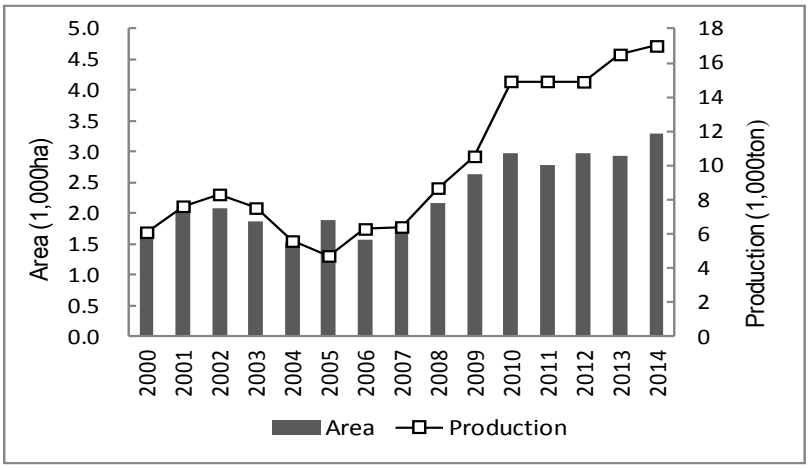


Figure 4.2.6 Evolution of Area and Production of Rice (2000-2014)
Source: JICA from UNVDA data

2) Rice Varieties

As described in the table below, six varieties are currently cultivated in the irrigation sectors. Among these varieties, Tainan 5 is short grain and longer growth period than other varieties. Otherwise many traditional varieties are cultivated.

Table 4.2.13 Major Rice Varieties

Variety	Growth Period (days)	Yield（t/ha）	Grain form
1 Tox 3145	150－155	5 – 6	long
2 NERICA L36	145－150	6－7	long
3 NERICA L 42	145－150	6－7	long
4 NERICA 8	115－120	2－3	long
5 NERICA 3	115－120	2－3	long
6 Tainan 5	160－165	3 – 5	short

Source: JICA Mission from UNVDA data

3) Cultivation Calendar of Rice

In the irrigation sectors of UNVDA, rice cultivation is possible only during the rainy season. According to UNVDA the most cultivated varieties are Tox 3145, NERICA L36 and NERICA L42 and UNVDA recommends the cultivation of three other varieties

Farmers, except rice cultivation, used to grow maize, cowpea and potatoes and jamajama (one of vegetables) throughout the year if water is available. Many farmers possess in addition to rice fields have upland fields where they grow maize , cowpeas , groundnuts , cassava , banana , coco yam, palm oil , tomatoes, etc.

Work Items	J	F	M	A	M	J	J	A	S	O	N	D
Canal Cleaning												
Land preparation												
Repairing of levees												
Nursering												
Planting												
Herbicide Application												
Weeding												
1st Fertilization												
2nd Fertilization												
Harvesting												
Storage/Selling												

Figure 4.2.7 Cultivation Calendar of Rice
Source: JICA Mission from UNVDA data

4) Agriculture and Gender

i) Crops and Burden Share on Gender

The table below shows the gender division in agricultural products. For rice, maize and cowpea, work is not divided; it involves both women and men. Women are primarily growing co yam and cassava and men plantain among others. This division is also related to the fact that traditionally women are responsible for cooking. The new crops such as tomato and potato are often shared between men and women, but this is not systematic.

Table 4.2.14 Burden Share on Gender by Crops

	Rice	Maize	Cowpea	Cassava*	C	Cassava	Potato	Tomato
Men	○	○	○	△	○	―	△	○
Women	○	○	○	○	△	○	○	△

Source: JICA Mission on investigation/hearing of agricultural groups and farmers
Note : ○ Principal △ Auxiliary

ii) Burden Share on Gender in Rice Production

In the sectors of the management area of UNVDA, there are as many registered female farmers as male, and each individual has a defined task. In the men's rice filed, women often assist them, but in the women's rice filed, men do not assist them much except for plowing. The sharing of tasks in rice production is shown in the table below.

In the target area, men and women manage their own plots, parboiling is mostly done by men, hired labours and children are often called to participate in production tasks. In the year 90s parboiling was often done by the farmer, but now have rice millers are charged to do it and very little farmers continue to practice it. The rice milling is often entrusted to professionals, although some farmer groups have milling machines.

Table 4.2.15 Burden Share on Gender in Rice Production

	Plowing	Nursery	Transplanting	Fertilization	Weeding	Harvest	Threshing	Drying	Parboil	Milling
Men	○			○	○	△	△	○	○	○
Women	△	○	○	○	○	○	○	○		
Children			○			○	○			

Source: JICA Mission from investigation/hearing Note : ○Principal △ Auxiliary

iii) Processing of Agricultural Products

The processing potential of agricultural products in the area seems to be high given the many cultivated crops. Regarding rice parboiling and milling, it is conducted by professionals today. Parboiling by farmers is small amount that prepare jollof rice for parties. The main processed products are listed below; at the level of the farmers, the most important processed products are rice, maize, cassava.

Table 4.2.16 Major Processed Crops

Crops	Processing	Market
Rice	processing, white rice, flower, cake, alcohol	grain: urban market cake and alcohol: local, self consumption
Maize	flower, combine	grain: urban market(duala etc) flower: local, self consumption
Cassava	gari, water fufu, boboro, amidon, local whisky	urban market local self consumption
Plantain	chips, cakes	local, self consumption
Soya beans	oil, bran	local, self consumption

Source: JICA Mission from investigation/hearing

(4) Agricultural Condition in the Targeted Area

i) Outline of the Target Area

As mentioned above in paragraph 4.2.1 3) "Decision of Beneficiary Area ", Upper Bamunka sector is supplied water from Mufuo and Monkie rivers; the target area will only take water from Mufuo. The target area is consist of six farms (Water Association) of which the number of producers is shown in the table below (as of 2015). It is noticeable that the Upper Bamunka sector employs alone 65% of the total number of producers.

Table 4.2.1 Number of Producers in the Target Area (2015)

Farm	Number of producers		
	Men	Women	Total
Upper main farm	969	1,224	2,193
Upper middle farm	150	97	247
Tumba	138	95	233
Lower middle farm	123	42	165
Muakwe	106	78	184
Mbueh	98	94	192
Total	1,584	1,630	3,214
Total in the sector's percentage	63%	66%	65%
Upper Bamunka sector	2,515	2,459	4,974

Source: JICA Mission from UNVDA data

ii) Cultivated Crops

The target's area is set as 918 ha. Farmers produce single rice cropping and the main crops are maize and rice. Corn, beans, potatoes are grown in the 600 hectares before rice planting. Rice cultivation begins in June and lasts until December. The target area is hardly developed[6] and the land is poorly drained, so that the rice is cultivated only half due to the immersion during the rainy season. The cropping calendar is shown below.

[6] UNVDA developed 11 ha of land for seeds production

Table 4.2.2 Cultivated Crops in the Target Area

Crop	Cultivated Area（ha）	Cropping intensity (%)
Rice	459	50
Maize	597	65
Beans, potato	92	10
Djyamadjyama	46	5
Total	1,102	130

Source ：JICA Mission from UNVDA data

Note ： Area of 918 ha. The occupancy rate/sector's area. Maize, beans, potatoes are often mixed and it is difficult to separate areas from these two crops

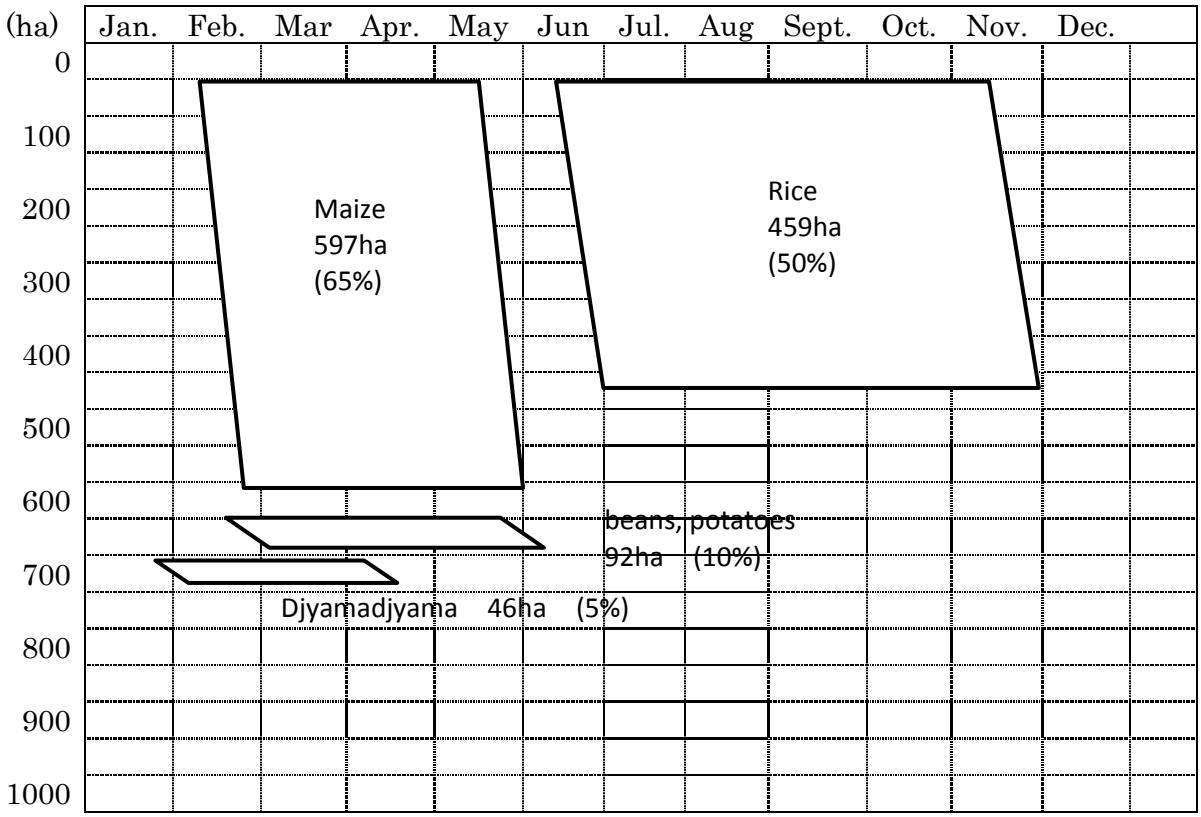


Figure 4.2.8 Present Cropping Calendar of the Target Area

Source: JICA Study Team

iii) Production and Yield of Crops

The figures of production in the target area are given in table below. Rice production is estimated at 1,423 tons, maize to 1,075 tons, potatoes to 138 tonnes and 74 tonnes of beans.

Table 4.2.3 Production and Yield of Crops

Crop	Area(ha)	Yield (t/ha)	Production(ton)
Rice	459	3,1	1,423
Maize	597	1,8	1,075
Beans	92	0,6	74
Potatoes	92	1,5	138

Source: JICA Mission from UNVDA data Note: estimated yields from farmers hearing

iv) Farmer's Economy

To assess the farm economy, we have investigated 10 to 12 families in each of the 10 villages of Upper Bamunka with the help of UNVDA extension officials, including 116 households.

Households were randomly selected in order to avoid biasing the survey.

v) Characteristics of Respondents

In the sectors where UNVDA distributes the land use rights to farmers, the survey focused on half of the men and half of the women, but as it was working season for farmers, men have responded in majority (67% against 33%). The situation of men and women in the sector, the number of farming experience, age, family status, are given in the table below

Table 4.2.4 Family Status

Number of men			Number of women					Total
Married	Singles	total	Married	Singles	widow	Divorced	Total	
74	4	78	28	1	8	1	38	116

Source: JICA mission

Table 4.2.5 Age and Farming Experience of Respondent

Men		Women	
Age	number of farming experience	Age	number of farming experience
47	23	45	21

Source: JICA Mission

vi) Household's structure and professional activity

Regarding household composition, men answers differ from those of women; so we made an average. It seems that an average household has between 9 and 10 people. (See table below)

Table 4.2.6 Household's Composition

Less than 14 years old	Between 15 and 35 years	Between 36 and 60 years	61 and more	Total
4.1	3.6	1.6	0.3	9.7

Source: JICA Mission

In a household, 5.9 people on average have a professional occupation as independent farmers (3.6 persons) farm helps or those who manage a small business.

Table 4.2.7 Household's Professional Activity

Own account farmer	Employee	Small business	Craftsman	Farm help	Total
3.6	0.2	0.7	0.6	0.8	5.9

Source: JICA Mission

vii) Farm income

The average farmer's income of the target area is 1,300,000 FCFA of which 34 % from rice farming and 24% of income from other activity.

Table 4.2.8 Income of the Farmers

Unit: thousand of FCFA

	Income from Crops					Income from non-Crops							Total
	Paddy	Maize	Beans	Vegetable	sub-total	Livestock	Small trading	Hadicraft	Formal employ-ment	Laour sellin	Remit-tance	sub-total	
Male	493	426	48	96	1,063	127	65	43	103	26	13	377	1,440
Female	399	381	60	93	933	77	102	5	44	24	12	264	1,197
Av.	446	404	54	95	998	102	84	24	74	25	13	321	1,319

Source: JICA Mission Note: The personal consumption is included in agricultural revenue

viii) Floods

As mentioned above, even during the harvesting season in December, the rice filed is still submerged, making the work less efficient and negative impacts for the drying rice. Some rice

mill parts are flooded to the point that rice cultivation is impossible. The percentage of land submerged is often at the knees level at harvesting period as shown in the table below. The 60 % of respondents replied that the water reaches their knees.

Table 4.2.9 Percentage of Flooded Plots at Harvesting Period

	Farmers' number	%
Immerged part	70	60
Non immerged part	46	40
Total	116	100

Source: JICA Mission

ix) Needs of Technical Training for Producers

The technical training needs for both men and women mainly concern fertilizers and transplanting. Many producers said they did not know the proper spacing for transplanting. Women have special request about fertilization techniques but no request for plant protection treatments, especially herbicide usage because it is the men's concern. All the technical needs are shown in the table below.

In the Ndop plain, women hold land, produce, sell their products and manage the money willingly.

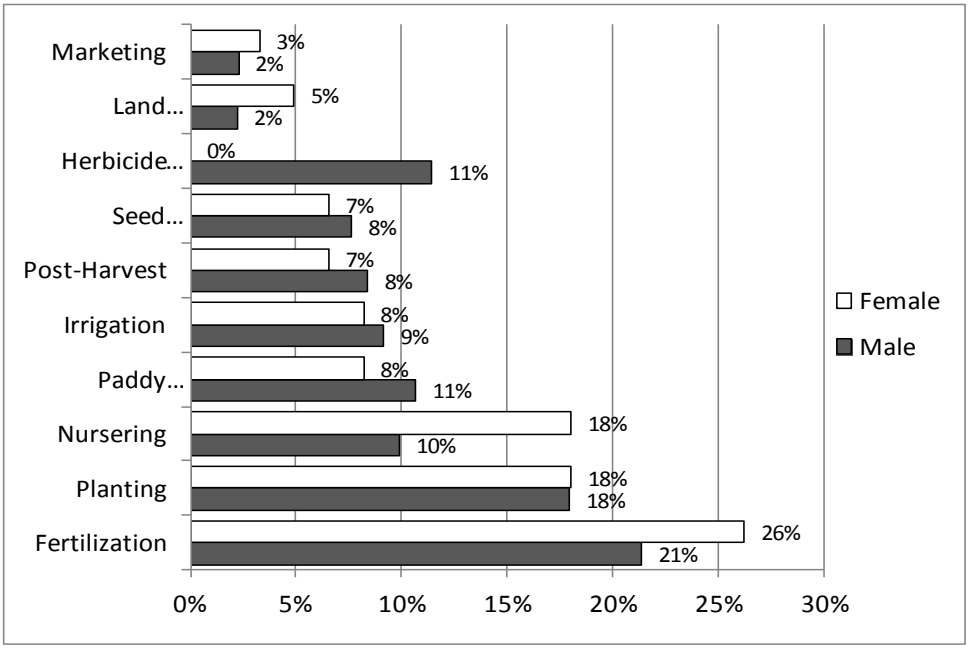


Figure 4.2.9 Agricultural Training Needs

Source: JICA Mission Note: Cumulated answers

(5) Data Collection for the Economic Effect Calculation

The cultivated land percentage on 918 ha of project area (today) by type of crops is 80% for the first maize growing cycle, beans and potatoes (March to May - 735 ha) and 50% for the second cycle occupied by rice farming from June, about 459 ha. Rice farming occupies only 50% of the cultivated area mainly because 50% of unused land is submerged because they are located in flood zones (altitude below the flood line).

The cropping system of the project area shows an occupancy rate of 65% of the land by maize between March and late May (percentage calculated in relation with 918 ha), 10% of beans and potatoes.

Rice yields are 2.5 t / ha on average, with significant disparities between upstream irrigated rice (30 to 40 hectares) on which yields are 5t / ha, non-irrigated areas have efficiencies of 3 t / ha and areas immersed in water of the lower downstream portion have yields of 2 t / ha. Farmers sell their products mainly to UNVDA at the price of 110-120 FCFA / kg. Maize yields 2 t / ha and is sold 150 CFAF / kg. Every year in November or December, UNVDA and farmer groups (farmer committee) meet to set the price of rice. The development of nurseries begins in early June and transplanting is done between early July and late July. Rice harvesting is done between mid-November and late December.

In general, most of the farmers practice maize / rice combination. At the end of the farm are the forests of palm and bamboo that are slowly burnt by farmers and increases rice farming areas.

4.3 Access Road Development Component

4.3.1 Confirmation of proposed target routes for rehabilitation from MINADER

(1) Confirmation of proposed target routes for rehabilitation from MINADER

The proposed target routes for rehabilitation from MINADER, the implementing agency of this project, are as follows.

Table 4.3.1 Summary of Proposed Target Routes for Rehabilitation from MINADER

Region	List Planner	Target Routes	Total Number	Total Km
North West	UNVDA	7 Routes / 215 km	98 Routes	1,958 km
Central	MINADER	91 Routes / 1,743 km		
South	MINADER			
East	MINADER			

The total length of proposed target routes for rehabilitation from MINADER is 1,958 km. The list of target route for the North West region was made by UNVDA. The list for the Central region, South region and East region was made by MINADER with assistance from regional branch staff of MINADER. It was ascertained that the lists includes Departmental Road, Provincial Road, and National Road through the confirmation work.

(2) Summary of Proposed Target Routes for Rehabilitation from MINADER

It was carried out a field investigation of 1,000km of proposed target routes for rehabilitation from MINADER in this study. The investigation shows that the width of existing rural road is between 4m and 6m. The road is generally paved with laterite and have earth ditch on both sides. Since the most of rural road are paved with soil like laterite, soil erosion of the road surface due to rain was recognized at a slope of each route. There was a reduction of the width of a road at the section between villages due to the sediment deposition to the ditches and the luxuriant growth of the roadside plant in almost all roads.

Development of a wheel track, and the luxuriant growth of the roadside plant which causes a reduction of the road width

Soil Erosion of the Road Surface

Deteriorated Wooden Slab

Malfunctioned Pipe Culvert due to the Soil Sediment

The length of most bridges investigated is less than 10m. Although all bridges are functioning somehow, some bridges would require replacement of whole structure or partial repairs. In particular, wooden bridges temporarily installed by timber company need to be replaced with reinforced concrete bridges. Even though it was confirmed that small-scale drainage structures such as pipe culvert had already installed in the minimum required points where rain water is concentrated, additional installation and partial repair of drainage structure is required as the situation demand.

4.3.2 Selection of Target Route for Rehabilitation

With due regard to the list of target routes for rehabilitation from MINADER, the study team selected the target routes which contribute to "the expansion of market distribution amount of agricultural products with a focus on rice".

(1) Procedure of Target Route Selection

The total number and total length of proposed target routes for rehabilitation from MINADER is 98 routes and 1,958 km respectively. The target routes for rehabilitation in this project were selected by the following procedure.

Step 1: Selection of Target Arrondissement
Step 2: Selection of Routes Investigated
Step 3: Evaluation of Routes Investigated
Step 4: Consideration of Balance between Project Volume and Regional Rice Production

i) Step 1: Selection of Target Arrondissement (see Annex)

The target arrondissements were selected with the viewpoint of: 1) contribution to the expansion

of market distribution amount of rice; 2) beneficially population; 3) priority route in the MINADER's development plan. In this context, the study team selected arrondissements satisfying one of the following conditions.

No.	Conditions
1	Top arrondissement of the total amount of rice seed provision from PRODERiP in the Region
2	Arrondissements where PRODERiP activities, such as provision of rice seed and training, are recognized, among arrondissement ranked within the top3 of the population number in the Region
3	Arrondissements which include priority routes of MINADER, PRODERiP and UNVDA

The target arrondissement selected is as follows:

Table 4.3.2 Target Arrondissements

Region	Arrondissement
North West	Ndop, Balikumbat,
Central	Obala, Akonolinga
South	Ngoulemakong, Sangmelima, Biwong Bulu
East	Batouri

Source: JICA Project Team

ii) Step 2: Selection of Routes Investigated (see also Annex)

The routes investigated were selected from the route list of target arrondissement, with the following viewpoint.

① Routes which contribute to the improvement of rice productivity: Route where people living along the route received rice seed provision from PRODERiP
② Routes which secure road network: Routes which are directly connected with National Road, Provincial Road and Departmental Road

iii) Step 3: Evaluation of Routes Investigated (see also Annex)

The routes investigated are evaluated with following three viewpoints. The routes were divided into three group (A, B, and C) based on the overall score which is maximum 15 points.

① Accessibility to the well prepared principal road such as National Road, Provincial Road and Departmental Road.
② Direct benefit population (total population around the route)
③ Zone level number of rice farmer who received rice seed from PRODERiP in 2015

iv) Step 4: Consideration of Balance between Project Volume and Regional Rice Production (see also Annex)

The balance between the volume of road rehabilitation work in 4 regions and current regional rice production and the amount of regional seed provision from PRODERiP is examined as follows.

Table 4.3.3 Rice Production of 4 Regions in 2010

	North West	Central	South	East	Total
Production (ton)	27,108	9,588	1,728	373	38,797
%	70%	25%	4%	1 %	100 %

Source: 『AGRI-STAT 17』 MINADER 2012

Table 4.3.4 Amount of Regional Rice Seed Provision in 3 Target Regions of PRODERiP (2012 -2015)

	Central	South	East	Total
Rice Seed Provision (Sacs)	5,300	2,128	1,510	8,938
%	59 %	24 %	17 %	100 %

Source: PRODERiP

It should be noted that rice production of North West region accounts for 70% of the entire four regions, whereas that of East region is extremely low and accounts for only 1%. On the other hand, the performance of rice seed provision from PRODERiP in these four years is as follows: Central Region (59%) > South Region (24%) > East Region (17%).

Taking into consideration the factors mentioned above, the study team proposes a project volume between regions as follows. Moreover, Eastern region has been excluded from the target regions in consideration of the performance of rice production and PRODERiP activities.

Table 4.3.5 Tentative Estimation of Project Volume between Three Regions

	North West	Central	South
Project Volume	70%	30%	
		20%	10%

Source: JICA Project Team

(2) Result of Target Route Selection

In accordance with the selection procedure described above, the target routes have been selected as the list below. The list has already been confirmed by relevant organizations in July 2016.

Table 4.3.6 Result of Target Route Selection

Region	Arrondissement	No.	Route	km	Evaluation (Study Team)	Priority (MINADER)	Overall Evaluation
North West	NDOP, BALIKUMBAT	**NW1**	Bamali (N11) - Bamali 3 Corners – Balikumbat	15.5	A	Priority	◎
		NW2	Bamali 3 Corners (D72) - Bambalang	14.5	A	Priority	◎
		NW3	a) Bamessing (N11) – Mbelue – Nsemi Junction (N11) b) Bamessing Irrigation Field – D72	15.6	A	(Priority)	○
Central	OBALA	**C1**	a) Mboua I (N4) - Mbele II J.C.1 – Mbele II J.C.2 – Mengama - Mban b) Mbele II J.C.1 – Edokasi c) Nkoledouma (N4) – Mbele II J.C.2 d) Mengama - Ntsaekang (P13)	24.9	A	Priority	◎
	AKONO LINGA	**C2**	Menguemesi (P23) – Até – Koundou (N10)	36.5	B	Priority	○
South	NGOULE MAKONG	**S1**	Ngoulémakong (N2) - Enamngal - Biwong Bane (D42)	39.2	A	-	○
	BIWONG BULU	**S2**	Nkolbitye (D39) - Nkoetye	8.8	B	Priority	◎

Source: JICA Project Team

(3) Summary of Target Routes

1) NW1 (North West Region)

The route is a part of D72 which is categorized into Departmental Road. The target section is from Bamali, where the intersection of D72 and the National Road N11, to Balikumbat. The distance from Bamali to Balikumbat is 15.5km. The route is a main road among local communities and also utilized as an access road to the irrigated rice fields managed by UNVDA, such as Bamessing Irrigation Field (498ha) and Upper Bamunka Irrigation Field (917ha). There is flat lowland area utilized for irrigated rice fields and the residential areas at the roadside of the 9km stretch from Bamali, where small local commercial buildings are clustered. The traffic of heavy vehicle in rainy season causes a deterioration of the road surface due to poor drainage. Such flat lowland area is followed by 1km slope and a gently undulating area where there are some villages. The road is a

laterite paved, whose width is generally between 6m and 9m, and with earth ditches on both sides. Although the ditches at the slope section has been tried to be protected from soil erosion with the application of stone pitching, its construction quality is not consistent.

	
Deterioration of the Road Surface due to Poor Drainage (Lowland Area)	Partial Application of Stone Pitching to Ditches (Undulating Area)

2) NW2 (North West Region)

The Route is categorized into Rural Road. The target section is from Bamali 3 Corners, where the intersection of the route and NW1 (D72), to Bambalang. The distance from Bamali 3 Corners to Bambalang is 14.5km. The route is a community road and also utilized as an access road to the Upper Bamunka Irrigation Field (917ha). All of the section is located in flat lowland area where mainly utilized for irrigated rice fields and the residential areas. A few local rice milling factories are operating along the roadside. The road is a laterite paved, whose width is generally between 4m and 6m, and with earth ditches on both sides.

	
Intersection of the Route and NW1 (D72)	Roadside Utilized for Residential Area and Cultivated Area

3) C1 (Central Region)

The Route is categorized into Rural Road. The target section is from the villages in Obala to Mbouda I, where the intersection of the route and National Road N1, Nkoledouma where the intersection of the route and National Road N4, and Ntsaekang where the intersection of the route and Provincial Road P13. Its overall length is 24.9km. The route is a community road and also utilized as an access road to the cultivated areas. Although all of the section is located in a slightly undulating area, the population density is rather high especially in the area close to the city center. These areas have been mainly utilized for the residential areas and cultivated area for cacao, banana,

maize and so on. There is a cocoa related facility along the roadside. The road is a laterite paved, whose width is generally between 4m and 6m, and with earth ditches on both sides.

Entrance of C1. The gate is installed for preventing the entry of heavy vehicle

Cocoa Related Facility along the Roadside

4) S2 (South Region)

The Route is categorized into Rural Road. The target section is from Nkolbitye where the intersection of the route and Departmental Road D39 to Nkoetye. Incidentally, the section between Nkoetye and Ebolowa, which is the capital city of south region, has already paved with DBST. Its overall length is 24.9km. The route is a community road and also utilized as an access road to the cultivated areas. Although the section includes undulating areas, there are some villages at the flat areas the population density is rather high especially in the area close to the city center. The road is a laterite paved, whose width is generally between 4m and 6m, and with earth ditches on both sides.

Decline of Road Width Cased by Luxuriant Growth of the Vegetation in the Section between Villages

DBST Paved Road to Ebolowa

4.3.3 Geological and Geotechnical Feature of Target Route

(1) Summary of Geological and Geotechnical Investigation

Along with field investigation, fundamental geotechnical test and CBR (California Bearing Ratio) test for seven routes were conducted to grasp the current condition of subgrade, subbase and borrow pit from the civil engineering point of view. In addition, cement mixing test was conducted for a borrow pit near NW1. Summary of the investigation are shown in the table below.

Table 4.3.7 Summary of Geological and Geotechnical Investigation

Investigated Routes	North West：NW1, NW2, NW3　Central：C1, C2　South：S1, S2 (Total: 7 Routes)
Period	Feb 2016 – July 2016
Contents	1. Field Investigation ・Examination of geological map (scale: 1/1,000,000 & 1/500,000) ・To grasp the topographical and geological control point of the route 2. Laboratory Testing of Soil ・Moisture Content Test / Density Test of Soil Particle / Grain Size Analysis of Soil / Atterberg Limit Test / Proctor Compaction Test / CBR Test / Cement Mixing Test
Sampling Method	For each target roads: ・Collecting 1 sample soil of sub-grade at intervals of 3 km ・Collecting 5 sample soils from 1 borrow pit around the target route
Laboratory Soil Test	The test was conducted with reference to following guide and standard: ・GUIDE PRATIQUE DE DIMENSIONNEMENT DES CHAUSSEES POUR LES PAYS TROPICAUX ・AASHTO manuals and related document

Source: JICA Project Team

(2) Result of Laboratory Testing of Soil

The following is an overview of laboratory testing of soil sampled from four target route (NW1, NW2, C1, and S2). The table below shows the soil classification based on the Unified Soil Classification System (USCS) and CBR value of the soil samples. A result of all laboratory tests for seven routes is attached at the end of the report as a reference. The USCS is a soil classification system used in engineering and geology to describe the consistency and grain size of a soil. The CBR test is a penetration test for evaluation of the mechanical strength of natural ground, subgrades and base courses beneath new carriageway construction.

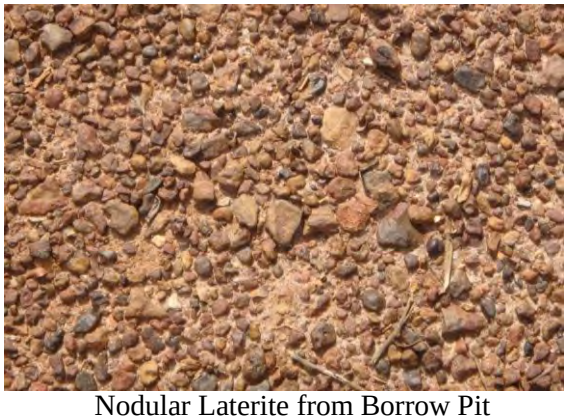
Table 4.3.8 Summary of Laboratory Testing of Soil

Items		North West		Central	South
		NW1 (15.5km)	NW2 (14.5km)	C1 (24.9km)	S2 (8.8km)
Subgrade	Number of Samples	5: 1sample×5points on the route	5: 1sample×5points on the route	10: 1sample×10points on the route	5: 1sample×5points on the route
	USCS Classification	CL: 3 samples SC: 1 sample MH: 1 sample	MH：5 points	SC: 4 samples GC: 3 samples CL: 1 sample MH: 1 sample Immeasurable: 1 sample	SC: 3 samples GC: 1 sample CL: 1 sample
	CBR Value	6 – 26 (avg:13)	7 – 15（avg:10）	13 – 44（acg:24）	15 - 44（avg:30）
Borrow Pit	Number of Samples	5: 5sample×1points	5: 5sample×1points	6: 3sample×2points	5: 5sample×1points
	USCS Classification	SC: 2 samples GC: 3 samples	GC: 5 samples	GC: 4 samples SC: 1 sample CL: 1 sample	GC: 5 samples
	CBR Value	18 – 39（avg:26）	16 – 41（avg:30）	25 – 39（avg:32）	19 – 35（avg:27）
(Note) CL: clay of low plasticity / SC: clayey sand / MH: silt of high plasticity, elastic silt / GC: clayey gravel					

With respect to the sub-grade soil of NW1 and NW2, it should be noted that the soils contains high percentages of fine grain soils. There is a section constructed on an embankment over the alluvial soil in NW1. Although it is possible to pass without problems in dry season, the damages from unreasonable passage of large vehicles makes the part of NW1 impassible temporarily in the rainy season. On the other hands, the CBR values of the sub-grade soil of C1 and S2 indicate the similar value of soil from Borrow Pits, whereas the sub-grade soil of C1 and S2 still contains rather high percentages of fine grain soils.

From the above, it is important to conduct additional detailed investigation including CBR test with consideration of control points revealed by this study and with economical point of view such as utilization of existing soil as sub-grade and sub-base.

In addition, although the study team confirmed that there is enough amount of nodular laterite which is utilized as a sub-base course material around the target routes, it is still necessary to conduct additional investigation to find more high-quality sub-grade and sub-base materials.


Nodular Laterite from Borrow Pit

As already mentioned, the base course for asphalt pavement and DBST pavement would be formed with the application of cement stabilization treatment on nodular laterite. In this preparatory survey, trial cement mixing test for the sample soil from NW1 was conducted in order to know the rough guideline of blending ratio of cement and to assess the test implementing capacity of the local soil test institution. The ratio of cement mixing for the trial test is 2%, 3%, 4% and 5%. The table below shows the result of cement mixing test of sampled soil.

Table 4.3.9 Result of Cement Mixing Test

Cement Mixing Ratio (%)	**0%**	**2%**	**3%**	**4%**	**5%**
Unconfined Compression Test（MPa）	-	-	1.6	1.9	2.5
CBR Test	31	56	168	214	336
(Notes) The cement used for the test is Portland Composite Cement CPJ35. Curing period is 7days. In Japan, quality specification of unconfined compression strength for cement stabilization for base is 2.9 MPa. Curing period is 7days including 1day water immersion curing * Dismissed the maximum value 44 by rejection test. Values are the average of 9 samples					

With consideration of the reduction in strength due to 1 day water immersion, the adding amount of cement to the sample soil can be 5% or more if in accordance with Japanese quality standards. In this survey, in order to improve laterite and to make it as a base course, general portland cement was used as an additive, and the addition amount was tested. On the other hand, Japanese guidelines for the selection of solidifying materials are shown as follows (from the "Soil Improvement Manual" by Japan Cement Association). For the stabilization of cohesive soil, lime-based solidified material and quicklime are shown to be effective compared with general portland cement as additive. Therefore, additive materials other than general portland cement are also subjected to the mixing test, and optimum (strength and price) additives must be selected for each target route at the stage of detail design work.

Notes for The Additive Material Selection (extracted from Soil Improvement Manual)

Sandy Soil

Suitable: Cement-based agent, General portland cement, Portland blast-furnace cement
Slightly Suitable: Lime-based solidification material, Quicklime

Cohesive Soil

Optimum: Cement-based agent, Lime-based solidification material, quicklime
Suitable: General portland cement, Portland blast-furnace cement

In addition, the development of strength depends not only on the type and the amount of additives, but also on the construction environment such as underground water level, the degree of compaction, curing period and so on. Therefore, in the mixing test at the time of the detail design, the following construction environment must be taken into consideration.

Groundwater Level

When the influence of the groundwater is assumed at the construction stage, it is necessary to consider the influence of the groundwater at the time of mixing test in laboratory, such as not setting a non-moisture curing period.

Degree of Compaction

The thickness per layer shall not be 20 cm or more so that a sufficient compaction degree (90% or more) can be secured at the time of construction.

Period of Temporary Placement

Since it is supposed to be mixed at the road construction site, the duration of temporary placement is not considered.

4.3.4 Investigation on Target Routes

(1) Preparation of Current Topographical Map, Longitudinal Section View, and Route Map

Current topographic map, longitudinal section view and route map of seven routes has been prepared for the study. Instead of conducting topographic survey under the condition of limited work schedule, the topographic map was created by utilizing satellite images, GPS data recorded during the traveling survey on the route, and DEM data. Longitudinal section view and route map of the target routes has been created based on the created topographic map and the GPS data recorded in the traveling survey. In addition, a route survey was conducted on the 4 routes which were selected finally as target routes.

(2) Confirmation of Road Related Structures

The major road related associated structures that have been identified in the survey are as follows. The list of structures of each route is attached at the end of the report (see also Annex).

Bridges: Stone Bridge, Concrete Bridge, Wooden Bridge
Culverts: Pipe Culverts, Box Culverts
Road Side Ditch: Earth Ditches, Stone Pitched Ditches
An overview of the current condition of these structures in the target routes is as follows.

1) Bridges

i) Stone Bridges

In the area around Ndop, there exist many arch-shaped stone brides which had been built in the German colonial era. Although the length of most bridges is around 10m, there exist a few bridges of the length 20m with 2 spans. The most bridges maintain a relatively good condition, even though about 100 years from the construction have passed.

ii) Concrete Bridges

The major type of concrete bridge recognized in the target area is short span a steel bridge which was composed of concrete abutment, steel I-beam as a bridge girder, and wooden slab / concrete slab. The total length of most bridges is less than 10m.

Arch-Shaped Stone Bridge

Concrete Bridge

iii) Wooden Bridge

Most wooden bridges were temporarily constructed by timber loggers at the section closing river less than 10m. The structure was composed of wooden slab and the grid-like structure of log whose diameter is around 1m.

2) Culvert

i) Pipe Culvert

Although there are four standard types of diameter (φ600mm, φ800mm, φ1000mm, and φ1200mm), the dominant type is a corrugated pipe of φ800mm. There were many cases of deformed pipe culvert caused by the weight of vehicles passing above the culvert.

ii) Box Culvert

The dimension of major types of box culvert is as follows: 2.0m×1.5m、2.0m×2.0m、3.0m×2.0m、4.0m×3.0m. There are also two barreled and triple barreled type. And installation example compared to the pipe culverts, but is small, in recent years of road repair, installation example is increasing. Although the total number of box culvert is quite smaller than corrugated pipe culverts, the installation example of box culvert in road rehabilitation project is increasing in recent years.

Pipe Culvert (φ800mm)

Box Culvert with Streambed Protection

iii) Road Ditches

Most of the road ditch on the target routes is an earth ditch which has been re-shaped when the road surface is re-shaped with motor grader. Although there is a construction example of stone pitched concrete ditch at the slope of the NW1, its construction quality is not consistent.

Earth Ditch

Stone Pitched Concrete Ditch (NW1)

4.3.5 Traffic Survey

Traffic volume survey was conducted for the routes categorized into A and B in the evaluation results by the study team, and for MINADER's high priority routes. The results of the survey are as shown in the table below.

Table 4.3.10 Result of Traffic Survey

Routes	Grand Camion	Petit Camion	Bus	Van	4WD	Pickup	Sedan	Moto	Total
NW1	68	69	0	53	16	44	46	1,191	1,486
NW2	27	55	7	22	8	119	77	339	653
NW3	1	14	0	1	16	20	86	424	561
C1	0	0	0	3	2	28	46	1,234	1,312
C2	10	3	0	27	1	5	4	63	112
S1	0	5	0	0	11	17	51	866	949
S2	0	16	0	19	20	29	39	159	282

Source: JICA Project Team

4.3.6 Survey on O&M in Rural Road

With consideration for recent O&M decentralization process of rural road, the survey on the O&M of rural road was conducted at MINTP Departmental Office, Obala municipality and UNVDA.

(1) MINTP Lekié Office

In principle, the MINTP departmental office is responsible for the O&M of the project target routes. The organization form of each prefectural office and the contents of the operation and maintenance work of the roads that are routinely done are almost the same. Therefore, here we outline the MINTP Lekié office that has jurisdiction over C1, which is one of maintenance service route.

The target route C1 of this project is under the jurisdiction of the MINTP Lekié departmental office. There is one technician on nine communes in the prefecture. In addition to these technicians, a total of 11 officers including chief engineers and administrators who manage the entire office are located in the departmental office. In addition to implementing the O&M of roads, nine engineers carry out technical support such as construction supervision to engineers in communes.

The budget of the office is as shown below. The budget is divided into office operation cost and project cost. The project cost is devoted to the renovation of the road under the jurisdiction of the office. The office does not own any construction machinery, and all the road improvement carried out by the office is re-entrusted to the contractor.

Table 4.3.11 Budget of MINTP Lekié Office

Year	Office Operation Cost (FCFA)	Project Cost (FCFA)	Items
2014	12,000,000	225,000,000	Rehabilitation of Rural Road (L=39.0km)
2015	9,000,000	85,000,000	Rehabilitation of Rural Road (L=16.0km)
2016	8,000,000	*35,000,000	Rehabilitation of Rural Road (L=4.5km)

Source: JICA Study Team
*The project cost in 2016 shows the actual cost up to October and does not indicate the total project cost for the same year.

(2) Obala Municipality (Commune)

Municipality of Obala has 64 officials including Mayer. Technical department of planning and urban development including 6 technical staff and 2 operators is responsible for the O&M of rural roads. Target route for regular maintenance of the year is determined by hearing conducted by Mayer. In this hearing, the way of using the budget is discussed with t the representatives of the communities in Obala.

The main contents of the road repairs are re-shaping of the road surface by motor graders. Compaction, re-shaping of the soil ditches, repairing and reconstruction of bridges and culvert are generally not included in the contents. The target distance of repair work is generally a few km for each road. Although the municipality of Obala owns 1 motor grader, the municipality rents the grader from MATGENIE in the case of a malfunction. They order local small-scale contractors near Yaoundé to work sometimes.

The time trend of O&M budget for roads in Obala is as follows. Financial resources include a decentralization-related budget.

Table 4.3.12 Time Trend of O&M Budget for Roads in Obala

Year	O&M budget for roads（FCFA）	Item
2012	60,000,000	Bridge Construction
2014	88,800,000	Maintenance of Rural Road (21 routes)
2015	57,778,000	Maintenance of Rural Road (10 routes)

Source: Document provided by Obala Commune

It should be noted that 27,778,000FCFA of 57,778,000FCFA of O&M budget for road in 2015 is a decentralization-related budget transferred from the central government to the Municipality.

(3) UNVDA

UNVDA has 132 officials as of January 2016. Department of Rural Engineering including 59 staff is responsible for the O&M of rural roads along with other rural engineering work. Maintenance target routes of the year are determined by UNVDA with consideration of the current road conditions. Although main contents of the road repair work conducted by UNVDA is re-shaping and compaction of road surface and re-shaping of earth ditch with motor grader and road roller, reconstruction of earth roads, bridges, and culvert have been also carried out by themselves.

The table below shows the time trend of O&M budget for roads in UNVDA. Its funding is basically based on the annual budget request to the MINADER headquarters.

Table 4.3.13 Time Trend of O&M Budget for Roads in UNVDA

Year	O&M budget for Road (FCFA)	Item
2013	89,000,000	Maintenance of Rural Road and Culvert
2014	114,000,000	Maintenance of Rural Road
2015	125,000,000	Newly Construction of 50km Rural Road
2016	76,000,000	Maintenance of Rural Road

Source: UNVDA

As the table above shows, the annual O&M budget for rural road has been secured up to the present

time in the UNVDA. It could be said that there is a necessary administration system and professional personal for sustainable O&M of NW1 and NW2 in UNVDA. On the other hand, it is necessary to consider the O&M system and budget of D72 which is improved to asphalt pavement and categorized into Departmental Road. Technical and financial assistance from MINTP headquarters, MINTP regional bureau, and Ngo both - ketunjia Prefectural Government would be required for the O&M system of NW1.

Table 4.3.14 Construction Machines* in UNVDA

Type of Machines	Motor Grader	Road Roller	Wheel Loader	Bulldozer	Power Shovel
Numbers	3	3	1	3	3

*excluding Dump Trucks

4.3.7 Survey on O&M of Construction Machineries in MATGENIE

The project aims to contribute to the improvement of paving rate in Cameroon by the introduction of road stabilizer. MATGENIE has been tasked with doing O&M of construction machinery, and lending such equipment to small and medium-sized local contractors that do not have such machineries. It is expected to increase in demand on rental construction machineries from local contractors and Communes under the decentralization process of rural road management.

(1) Number of Construction Machineries Owned by MATGENIE

The table below shows the list of construction equipment owned by MATGENIE. The number of construction machinery owned by MATGENIE is 160 units as of March 2016. Motor graders, vibratory rollers, fuel tankers, and dump trucks are the dominant equipments among them. With respect to holding numbers of machineries by regional branch, Yaoundé branch holds 31 units and the most holdings. On the other hand, the number of machineries owned by Ebolowa branch (South), Bertoua branch (East), and Bamenda (North) branch is respectively 5 units, 11 units, and 16 units.

Table 4.3.15 Number of Construction Machineries Owned by MATGENIE

	TN	NA	PC	CV	TP	CC	CE	TT	ST	PPH	CG	CB	Total
Yaoundé	5	7	1	2	0	5	0	2	2	0	1	8	33
Ebolowa	0	3	1	1	0	0	0	0	0	0	0	0	5
Douala	1	5	2	2	0	1	1	1	1	0	0	0	14
Kumba	2	4	0	2	0	1	1	2	2	1	0	2	17
Bertoua	1	3	1	2	1	1	0	1	1	0	0	0	11
Bamenda	1	6	1	3	0	2	1	1	1	0	0	0	16
Bafoussan	1	6	1	3	1	2	0	2	2	0	0	0	18
Ngaoundere	1	5	1	3	1	3	0	1	1	0	1	4	21
Garoua	1	5	1	2	1	2	0	1	1	1	0	3	18
Maroua	1	2	0	1	1	0	0	1	1	0	0	0	7
TOTAL	14	46	9	21	5	17	3	12	12	2	2	17	160

Source: MATGENIE

TN: Tracteur Niveleur (Tractor Leveler), NA: Niveleuse automotrice (Motor Grader), PC: Pelle Chargeuse (Excavator Loader), CV: Compacteur Vibrant (Vibratory Roller), TP: Tractopelle (Backhoe), CC: Camion Citerne à Carburant (Fuel Truck), CE: Camion Citerne à Eau (Water Truck), TT: Tracteur Routier (Road Tractor), ST: Remorque porte engins (Trailer machine carrier), PPH: Pele hydraulique (Hydraulic Pele), CG: Camion de Graissage (Truck lubrication), CB: Camion Benne (Dump Truck)

(2) O&M of Construction Machineries in MATGENIE

1) O&M of Construction Machineries in Regional Branch of MATGENIE

Currently, the technical staff working in the garage of the regional branches has been tasked with implementing routine O&M work of construction equipments. The staff has been maintaining equipments with reference to original maintenance manuals of equipment, and all maintenance work

is recorded in a predetermined logbook. O&M of the newly installed load stabilizer in MATGENIE would be also carried out in the same manner. It is estimated that the existing staff has enough potential to implement O&M of load stabilizer if appropriate technical training is provided to such technical staff.

On the other hand, abandoned construction machineries were found in the garage. The majority of such problem is the lack of critical spare parts in Cameroon.

2) Current Condition of Spare Parts Acquisition

Currently, the spare parts acquisition of all construction machineries owned by MATGENIE is all managed together by the Direction of Technique (DT) in central office. Instead of direct ordering of spare parts to the supplier with original budget, regional branch is required to submit the spare parts list which they needed to DT. There is an idea of cost minimization by bulk purchase of spare parts in DT. However, this causes the following problems in O&M of construction machineries in regional branch.

・The MATGENIE tends to refrain from ordering spare parts until the request amount of spare parts from branch become certain amount. It causes the delay of delivering parts to the branches, and the spare parts that regional branches requested to DT do not reach at appropriate timing.

・It has been becoming difficult to acquire spare parts for old Japanese construction machine and new Chinese machine.

Even though there is a problem above, spare parts of main construction machineries in MATGENIE can be provided from local machine dealers in Yaoundé and Douala.

4.4 Installation of Agricultural Equipment Component

4.4.1 Verification of candidates sites for the establishment of post - harvest treatment and selection of operation site

Based on the field survey, UNVDA is selected as the target organization for the development of agricultural equipments. The reason for selecting is as follows.

- ✓ It is reported that UNVDA has jurisdiction over 3,354 ha of rice fields. There is not private enterprise that has sufficient capital and technical strength for conducting the services of plowing or post-harvest works targeting for the entire rice fields. In contrast, UNVDA has already managed the large size milling plant and several agricultural equipments which indicates that the capital and technical strength of UNVDA reaches certain level.
- ✓ The goal of NRDS and objective of this project is to increase the rice sufficiency ratio in Cameroon. However, most of the private millers produce per-boiled rice and sell their products to Nigeria. Selecting UNVDA as target organization for the development of agricultural equipments would lead the domestic rice promotion followed by national policy.
- ✓ The other public enterprises also have jurisdiction over the irrigated rice fields in Far-North region and West region. By selecting UNVDA as target organization, this project would become the model to promote rice cultivation in Cameroon.

Besides, for the installation of post-harvest facilities, two candidate sites were studied; the site located at the UNVDA headquarters in Ndop and Babungo which is also the UNVDA property (30 minutes by car from the Ndop headquarter). The site located on UNVDA site in Ndop was eliminated because it could cause nuisance in the surroundings with noise in the sites especially when heated dryers are running, or in the rice farms where hulling or polishing machines are functioning. The site owned by UNVDA at Babungo has a surface area of 44ha, but leveling works are necessary because the field is rugged and not supplied with electricity. But as UNVDA has no other land, it strongly recommends setting up the collection site and rice mill there.

4.4.2 Investigations on Agricultural Equipment Needs and Selection of Equipments

(1) Needs (for men and women separately)

An interview was conducted with two farmers of the Upper Bamunka farm (irrigated area) and 4 farmers' groups (GIS) which are a group of women and 3 groups of men. 2 representatives from each group in total of 16 people (8 men and 8 women) were interviewed the demands of agricultural mechanization.

As a result of the survey the following points were clarified. No farmer owns agricultural machines and some of them use the plowing service of tractor from UNVDA and private sector. Men require 1) power tiller, 2) tractor, 3) harvester on the other hand women require 1) cars / tractors carrying paddies from the field (after the threshing process) 2) excavation machine for river channel 3) rice planting machine. It is estimated that there is much demand for plowing service of tractors.

(2) Result from the Interview of Dealers for Agricultural Equipment in Cameroon

There are no dealers for agricultural equipments in Yaoundé but there are two dealers in Douala.

CFAO EQUIPEMENT: It imports and sells Massey Ferguson tractors. This company has sold 20 tractors in 2014 and 22 in 2015 with the output power of 85~135 HP, and 95% of them are 4WD type. 80% of the customers are related organizations / companies in Cameroon. In addition, it also imports and sells construction machines made by JCB, the company of U.K.

EMEI DIESEL: It imports and sells the tractors from Indian company Sonalika (Solis type). This company has sold 15 tractors in 2014 and 25 tractors in 2015, 90% of them are 90 HP and 10% of them are 75HP.

In Douala there is also the company "Agro Mac" that we have not been able to interview. This company was created in 1998 to import and sell the different agricultural equipments made in China (husking, polishing cone, cultivators, mower, harvester, etc.). The payment terms, contracts and after-sales service of these three companies are detailed in the table below. None of these three companies sell equipments made in Japan.

Table 4.4.1 Contracts, Payment and After-Sales Service of Agricultural Machines Dealers

	Contract and payment requirements	After-sales service
CFAO EQUIPEMENT	Cash, 30 to 50% for the deposit. The rest should be paid by cash in a lump	Specialized section exists for after-sales service based on customer's demand (fee-based service). There is enough stock of spare parts
EMEI DIESEL	Cash, 30 % for the deposit. The rest should be paid by cash in a lump	After-sales service based on customer's demand (fee-based service).
Agro Mac	Cash, 50% at the payment. The rest should be paid by cash in a lump. Payment by credit is not acceptable.	Free Technical supervision for three months after delivery under guarantee. After the guarantee period, service is not free of charge. The price is 20,000FCFA / day (including accommodation costs) or 25 000 FCFA / day if it is far from the site

Source: JICA Study Team: Report of study for the project establishment of the rice promotion project in Cameroon including Hearing survey on the field of JICA

Plowing service with tractors is not carried out by agricultural machinery dealers. In Cameroon, it is considered desirable that public cooperation such as UNVDA or private company continue to provide the plowing service with tractors.

(3) Results from Interview of Makers for Agricultural Equipment in Japan

An interview was conducted with Japanese agricultural equipment makers. JICA study team requested three major companies (one leading medium-sized company and three medium-sized companies) to get opportunity for having an interview by email or phone call. Finally two major companies (one leading medium-sized company and one medium-sized company) accepted this request. The reasons why the others did not accept to have the interview are 1) They have no plan to expand the business in Africa including Cameroon; 2) Specific plan is not developed for the business in Africa, etc. As ODA or yen loan project, it is difficult for these companies to develop the business on a commercial basis in terms of after-sales service and spare parts supply after providing the machinery.

1) Sales towards African Countries

Major and leading medium-sized agricultural machinery makers have sales results to Africa through the assistance of various donors on a private commercial basis or private company (Egypt, Kenya, Ghana, Nigeria, Senegal, and Ethiopia, among others). Their main sales destinations are Egypt, Kenya, Ghana, Nigeria, Senegal, Ethiopia and etc. The major maker companies have the sales results in other African 15 countries although they have not sold their machineries to Cameroon. The medium-sized agricultural machinery makers did not have sales result to African country, however, if will be requests to sell their products to Africa, they answered that they would consider selling products.

2) Major Sales and Product Sales Channels (including spare parts supply)

There are two types of sales, "sales through aid projects by various donors" and "sales to the private market". The channels of product sales are two types “sales to user through the local agent” or “sales to local agent through the trading company”. Also, the channels of spare parts supply is the same as the product sales channel.

3) Major Impediments for the Business

Major impediments listed are; (1) high price in terms of competition with other makers, (2) difficulty in approving loans at the time of purchase, (3) low purchasing power of users, (4) difficulty in overseas remittances from African countries to foreign countries.

To cope with these impediments, the following policy can be considered; (1) appeal the comparative superiority of machine’s quality and performance rather than price, (2) demand the improvements while drawing on the financial circumstances of the target country, (3) elaborate a sales strategy not only for individual farmers, but also for government corporation, (4) promote the improvement of business environment to the target country and etc.

4) Development of Agricultural Equipments for the African Market

Based on the present circumstances where price competition with other makers is severe, one maker responded that it has a desire to develop although they don’t assume their plan.

5) Cameroon’s Position in the Commercial Strategy on African Markets

Given the scale of farming and rice cultivation in Cameroon, its priority is at medium among all 54 African countries.

6) Supply System of Maintenance and Spare Parts After Selling Agricultural Equipment to Cameroon

They have the will to develop new local dealers through local offices of local trading companies or local agencies and to establish a structure based.

7) Challenges and Conditions for Considering the Business in Cameroon

Challenges and conditions are followings; (1) trends of competitors, (2) capacity of local dealerships, (3) expansion of public support to promote agricultural mechanization (expansion of support measures from Cameroon, Japan and other donors) (4) promotion and expansion of irrigated areas, (5) improvement and expansion of infrastructure such as port facilities, roads, electricity, water supply, communication, etc.

Incidentally Japanese agricultural machine makers, Yammar Co., Ltd. and Satake Co., Ltd and the trading company, Toyota Tsusho Corporation are interested in this project.

4.4.3 Survey for Maintenance and Management System of Agricultural Equipment

UNVDA owns a rice milling plant (marketing department (DC) post-harvest processing section) and agricultural equipment center (rural engineering department (DGR) garage section), each of which manages operation and maintenance.

(1) Rice Milling Plant

The operation time and the annual milled rice volume of rice milling plants are as shown in the table below.

Table 4.4.2 Operating Time and Amount of Annual Polished Rice Produced

Year	Operating time (hour/year)	(tons/year)
2013	970	3,337
2014	886	2,954
2015	964	2,804

Source; JICA Study Team

Stock of rice rice in the inventory as of end of February 2016 is 2,753 tons and system of rice milling is made-to-order. There are 4 staffs for operator / maintenance, 9 staffs for workers. Regarding spare parts, a small amount of expendable parts are stocked in inventory. To order other parts, it should be ordered directly to the German maker (pre-payment to the maker is premised) and general parts can be also purchased in the agricultural machinery dealer in Duala.

(2) Center of Agricultural Equipment

Agricultural machinery which this center owns is shown in the table below.

Table 4.4.3 Agricultural Equipments in the Center

Agricultural machines	Unit	State	Remarks
Tractor_MF 70HP	1	machine in operation	MF: Massey Ferguson
Tractor_MF 90HP	5	4 machine in operation 1 machine in broken down	MF: Massey Ferguson
Tractor_MF 120HP	1	machine in operation	MF: Massey Ferguson
Tractor_MF 150HP	1	machine in operation	MF: Massey Ferguson
Tractor_MC 150HP	1	machine in operation	MC: McCORMICK
Tractor_SONALIKA 60HP	2	machine in operation	
Tractor_SONALIKA 75HP	5	5 machine in broken down	
Tractor_SONALIKA 90HP	3	1 machine in operation 2 machine in broken down	
Combine harvester (improved version)	1	available	SONALIKA
Reaper	2	available	Italian-made
Rice transplanter	4	4 machine in broken down	Chinese-made
Tractor_ Implement (rotary tiller)	15	available	Turkey-made

Source; JICA Study Team

Major troubles of the tractor are (1) breakage of transmission, (2) breakage of PTO shaft on the tractor

side, and (3) breakage of universal joint on the implementation side. The cause of the failure is that an excessive load is applied to the tractor in case there is something hard object such as a stone on the cultivation field or in the case of use of too large or small implement which is not complied with the horsepower of the tractor. There are also failures that occur because the user of tractors use in the wrong way. To solve these problems, the soft component will be implemented as a technology transfer.

Regarding the repair work, they use the repair slips and take the record.

There are 51 staffs including 14 tractor operators, 10 construction machinery operators, 8 mechanics, 3 welding workers, and other trucks and drivers in the center.

Regarding spare parts, they stock a small amount of wear-out parts in the inventory. The tractor that they own, MF made machinery is available to get the spare parts at dealer in Douala, however SONALIKA made machinery is not available in Cameroon. Hence it's very hard to repair appropriately. They have no choice but to remove the necessary parts from the broken tractors to repair other tractors.

In addition, UNVDA is implementing the plowing service with tractors provided at 18,000 CFFA per hour. Likewise, the fee of other services is also reviewed every year, and if necessary it will be revised. Regarding the financial condition of this service, the balance has some profit although there is a certain amount of expenditures such as spare parts fee.

(3) Distribution of UNVDA's Rice

Rice grown in the management area of UNVDA is largely shipped to private millers (see diagram below). Rice millers are located either in the urban area of Ndop along the national road or in the villages. There are more than 60 processing millers some of which are newly set up in the target area. According to UNVDA and the rice millers survey[7], the production of 17,000 tones of rice in 2014 was directed to 21% towards UNVDA (3,700 tones), 42% to urban millers (7,000 tons) 18% to the villages rice millers (3,000 tones) and 19% (3,300 tons) were used for own consumption, seeds, or sold by farmers.

1) Farmers －UNVDA

Rice that farmers sell to UNVDA is first hulled, bagged and transported to one of its 18 collection centers (18 warehouses) by farmers. The rice selling price is fixed after negotiations between the UNVDA and farmer representatives. Since 2012 it remains 12,000 FCFA / 100 kg. After buying the rice from farmers, the UNVDA keeps in its stores for a period which depends on the operating conditions of its rice mills and the availability of the central store. The factory processes rice on command for wholesalers at a price of 16,500 FCFA / 50 kg (2015) of white rice.

2) Farmers – Urban Rice Millers

Rice mills nearby Ndop are those who currently buy bigger quantities of rice. Each rice mill treats between 20 and 400 tons of rice per year. Most of them do both milling and parboiling; about half of the rice purchased by these millers is parboiled. Large millers that process 400 tons per year make 90% for parboiling.

The private purchase price of rice are influenced by the UNVDA prices and often sold at 12,000 FCFA / 100 kg. Parboiled rice is sold at border markets in Cameroon-Nigeria or Nigerian traders in the Ndop market at the price of 10,000 to 13,000 FCFA / 50 kg. White rice is sold to wholesalers of Bamenda, Bafoussam and Ndop at the price from 10 000 to 14,000 FCFA / 50 kg.

[7] Result from the survey upon 40 processing rice companies throughout Ndop (town and villages in March 2016

3) Farmer's Rice Millers in the Villages

Rice millers are also set up in the villages with the most units that treat 20 to 30 tons per year.

These units are not dealing with parboiling and almost devote all the rice milling. There are rice mills which purchase rice from farmers or intermediaries and those who do not deal with processing. In the first case the mill itself sells white rice to wholesalers, in the second case, farmers or intermediaries sell processed rice. Prices are influenced by the prices determined by UNVDA, but the rice is usually sold at 12,000 FCFA / 100 kg .White rice at10,000 or 11,000 FCFA / 50 kg in the village markets.

In some cases the intermediaries adds the transport fees from the plot in the purchase price of rice rice, which lowers the farmer's margins. Farmers often store the rice until the following season to sell it when market prices are high.

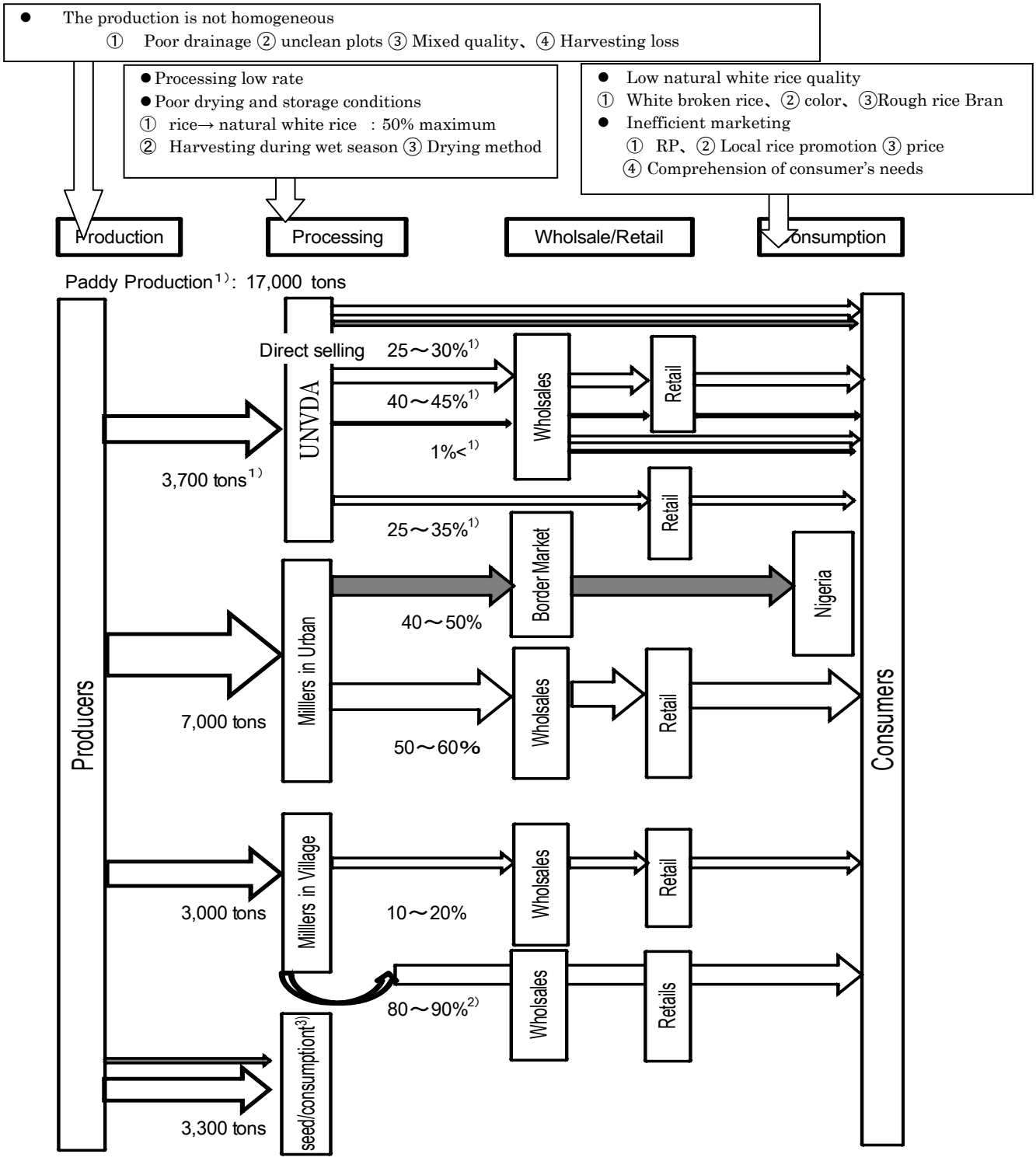


Figure 4.2.8 Rice Transaction Chain and Challenges

Source: Marketing study from UNVDA data

Note1) Based on the UNVDA's document, 2014.
2) After milling, producers bring and sell.
3) Included the gift and selling by producers.
4) ⇨ White Rice ⇨ Parboiled Rice

4) Commercialization of Rice and Sub-Products Conducted by UNVDA

UNVDA buys rice from farmers and sells white rice, parboiled rice, brown rice , broken rice (for fufu) , dirty broken (for livestock) , rice bran (for livestock) . The table below shows sales of rice and sub-products between 2012 and 2015. It is noticeable that the white rice share tends to decrease and the proportion of broken rice and bran rice tends to increase. The market situation in 2015 reflected a continuation of this situation with 1,113 tons of white rice sold (55%), 363 tons of dirty broken rice (18%) and 334 tons of clean broken rice (17%)

UNVDA states to deal with wholesalers and retailers in 17 cities nationwide, but 40 to 45% of its transactions are conducted with the 6 major wholesalers who take large quantities. Furthermore UNVDA has two direct sale points in Ndop and Douala, which sell between 25 and 30 % of its production.

Table 4.4.1 Evolution of Rice and By-Products Sold by UNVDA in Volumes（2011-2015）

Unit: ton、%

	2011		2012		2013		2014		2015	
	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)
Unpolished Rice	241.5	27.2	11.4	0.9	14.8	0.7	12.1	0.8	24.1	1.2
White Rice	24.7	2.8	882.0	67.5	1,400.1	63.2	893.4	57.3	1,113.3	54.9
Parboiled Rice	69.2	7.8	11.7	0.9	16.1	0.7	9.6	0.6	10.6	0.5
Clean Broken Rice	54.4	6.1	124.1	9.5	260.7	11.8	241.1	15.5	362.5	17.9
Dirty Broken Rice	46.1	5.2	174.4	13.3	291.0	13.1	158.1	10.1	333.8	16.5
Bran	451.1	50.9	103.2	7.9	233.9	10.6	244.7	15.7	183.1	9.0
Total	887.0	100.0	1,306.8	100.0	2,216.6	100.0	1,559.0	100.0	2,027.4	100.0

Source: UNVDA data Nota：UNVDA sells rice and sub products. The English word used in this table and their meaning in French are the following: Riz complet：Unpolished rice、riz blanchi：Natural White rice、riz étuvé：Parboiled rice、riz cassé：Clean broken rice、brisures：Dirty broken rice、son：Fine rice bran et Rough rice Bran.

The table below shows sales of rice and sub -products in amounts of FCFA. We see that the white rice share is reduced, and the broken rice and clean broken rice tends to increase.

Table 4.4.2 Evolution of Rice and By-Products Sold by UNVDA in FCFA (2011-2015)

Unit: 1,000CFA、%

	2011		2012		2013		2014		2015	
	1,000 CFA	(%)	1,000 CFA	(%)	1,000 CFA	(%)	1,000 CFA	(%)	1,000 CFA	(%)
Unpolished Rice	96,600	50.7	4,560	1.3	5,920	1.0	4,840	1.2	9,640	1.9
White Rice	8,151	4.3	291,060	81.4	462,033	78.9	294,822	74.7	367,389	71.2
Parboiled Rice	34,600	18.1	5,850	1.6	8,050	1.4	4,800	1.2	5,300	1.0
Clean Broken Rice	11,968	6.3	27,302	7.6	57,354	9.8	53,042	13.4	79,750	15.5
Dirty Broken Rice	5,532	2.9	20,928	5.9	34,920	6.0	18,972	4.8	40,056	7.8
Bran	33,833	17.7	7,740	2.2	17,543	3.0	18,353	4.6	13,733	2.7
Total	190,684	100.0	357,440	100.0	585,820	100.0	394,829	100.0	515,868	100.0

Source: UNVDA data

5) Constraints of Distribution for UNVDA's Rice

Most reports and documents indicate that local rice is not competitive with imported rice for the Cameroonian consumer. Difficulties of UNVDA's rice distribution require urgent solution in three stages in the value chain of rice.

Table 4.4.4 Constraints and Countermeasures of Distribution for UNVDA's Rice

Constraints	Countermeasures
Production stages	
• Drainage is not good and the plots is not well levelled • The cultivated varieties are not homogeneous and fertilizers are not efficiently used. • The actual production figures and average yield seem lower than official figures, and a serious study has to be conducted on the yields. • The variety mixture has a negative impact on yields, harvesting period, drying, storage and processing, that is to say it is one of the causes of the quality decrease. • These production difficulties are deeply related to the rice production and quality and must quickly be solved.	● Drainage canal ● Seed purification and improvement of cultivation technology ● Yield survey ● Cultivation of the same varieties for sale ● Production plan for sale
Processing stage	
• The processing conditions are directly related to drying and storage of rice as it is produced in the stage above. • The machines used by UNVDA and private rice mills are out of use and produce a small percentage of natural white rice. • On some plots, harvesting is done on submerged rice farm, and post-harvest drying carried out by farmers is not enough. • The variety of water content differs is different(the period of optimum harvest differs) so that some varieties are stored as they contain a lot of water • Poor dried rice, loaded with excess water is bagged and kept in the store; the risk of rice yellowing is great. • Rice degradation risk at the plot level. • Processing conducted under these conditions reduces the percentage and quality of white rice; it is necessary to renew the processing equipment and improve production techniques.	● Improvement of drying and storage method: introduction of milling unit ·and country elevator ● Renewal of rice milling machine: Introduction of high-performance milling unit ● Drainage canal ● Unification of production variety ● Improvement of drying and storage method: improvement of cultivation technology and introduction of milling unit ·and country elevator ● Proper harvest on tome, improvement of cultivation technology
Consumer's stage	
• At the retail, compared to imported rice, rice from UNVDA has a high broken rice rate, and yellow rice, sometimes weevils. • The owners of retail shops of Yaoundé and Bamenda have the impression that rice from UNVDA is poor quality and relatively more expensive than imported rice. • The consumers in urban image that local rice is cheaper than imported rice. • The owner of retail shops that sells the UNVDA rice in bags of 2kg to 5kg look forward to enlarge business with the UNVDA.	● Quality control ● Analysis of consumer needs and quality control ● Advertisement of domestic rice ● Analysis of consumer needs and improvement of retail packages ● Creation of "Delicious rice = Oishi rice" ● Rice marketing reflected consumer needs

• Many retail shops like the taste of UNVDA rice and hope that local rice will be developed but nowadays most consumers in urban ignore its existence. • To increase UNVDA rice consumption must do public relation on local rice through the media and quality must also be improved to support competitiveness and meet the consumer's demand.	

Chapter 5 Environmental and Social Considerations

5.1 Issues to Consider Regarding Environmental and Social Considerations

5.1.1 Summary of the Work Components with a Social and Environmental Impact

The priority works of the Project are the rehabilitation of the irrigation perimeters (900 ha), the development of rural roads and the construction of polishing and rice milling plant. These are summarized in the table below.

Table 5.1.1 Summary of the Irrigation Development Component

Region	Arrondissement	Description of the facilities	Specifications
North West	Ndop	Arable road	Overall length 28,22 km, Width 5 m (roadway 4 m, shoulder 0,5 m × 2), Foundation embankment 1.2 m,(0,3m in upstream area) Layer of about 10 cm of asphalt composed of gravel (hardened and crushed laterite)
		Flow channels	Overall length: 46,34 km
		Irrigation canal (upstream)	Secondary irrigation canal (0,75 km), tertiary irrigation canal (total length 6,68 km) - Upstream: width 0.5 m, depth 0.5 m - Downstream: width 0.4 m, depth 0.4 m
		Parceling	Development area of 164.3 ha in uniform plots of 100 m x 30 m - Standardization: Removal of existing slopes, development of new slopes (100 m × 10 m)

Source: JICA Study Mission

Table 5.1.2 Summary of the Access Road Component

Region	Arrondissement	Road	Length (km)	Road type	Improvement type	Specification
North west	Ndop, Balikumbat	Bamali (N11) - Bamali 3 Corners – Balikumbat	15.5	Dpt.	Asphalt Coating	Road 7.0 m, shoulder 1.0 m, concreted trench 1.2 m (on both sides)
		Bambalang - Bamali 3 Corners (D72)	14.5	Rur.	Laterite coating	Road 5.0 m, Roadside 0.5 m *, ditch of earth 1.2 m * For the part that requires attention to pedestrians, consider extending to a maximum of 1.0 m.
Central	Obala	1) Mboua I (N4) – Mbele II – Edokassi 2) Mbele II – Bilon – Nkoledouma (N4) 3) Mbele II – Nkolndongo – Mengama – Nyeannam J.C. (P13) 4) Mengama – Ntsaekang (P13)	24.9	Rur.		
South	Biwong Bulu	Nkoetye – Nkolbitye (D39)	8.8	Rur.		

Source: JICA Study Mission

Table 5.1.3 Summary of Installation of Agricultural Equipment Component

Classification of equipment	Place of deployment (proposition)	Quantity	Specifications
Country elevator Milling plant	Land of UNVDA (Babungo)	1	Foundation work, construction of building structures, electrical works, fixing of equipment - Annual collection volume of rice: 1 000 tones - Receiving capacity: 15 tones / hour x 2 channels - Combustion dryer for rice bales: 30 tons x 6 - Silos: 500 tons x 12 - Decorticator: 3.6 tons / hour x 2 - Polisher: 3 tons / hour x 2 chains - Color sorter: 2 - Scale: 4 - Quality Analyzer
Tractors	Agricultural Equipment Center at the UNVDA headquarters in Ndop	10	- 30 or 40 CV - Tractor equipment: rotary cultivator, harrow
Combine harvester	Materials Center at UNVDA headquarters in Ndop	10	- Normal type (general purpose) - Treatment capacity: 0.2 to 0.6 ha / hour

Source: JICA Study Mission

5.1.2 Initial State of the Environment and the Society

(1) Biophysical environment

1) Climate

i) North West Region

The project study area has tropical climate of Sudan-Guinean type known as "Cameroonian" because there is a nuance around Mt Cameroon which stretches to the mouth of the Sanaga encompassing the passage, the High Western Lands. It is characterized by an overabundance of rain that falls in one season and last nearly nine months. Such rainfall intensity is due to the presence of mountains that play a regulatory and corrective role on climate.

From one year to another, there is a variation of rainfall within the area with annual average of 1600 mm, with maxima observed in August and minima in May.

Temperatures range between 18 and 43 ° C, and are experiencing strong diurnal variation. The annual average is about 25 ° C. however it should be noted that the height differences affect the temperature within the area. Indeed, within pen plain zone (300 m), the average annual temperature is 32 ° C; while in the heights (1600 m) thereof is not more than 21 ° C. Furthermore, there is an inversion night temperatures at the bottom of important reliefs. This is a phenomenon caused by the cold drafts coming down the tops where the nights are cool. So much that in the Plain of Ndop, some areas (like Babungo) may experience minimum of 13 ° C.

As regards the relative humidity of the air, it varies between 60% and 90%. In the Ndop Plain, it constantly blows a cold wind, the speed increases in the dry season and the beginning of the rainy season.

ii) Centre region

The equatorial climate in the region is characterized by high and constant temperatures (25 ° C on average), with peaks above 30 ° C in the dry season and minima of 20 ° C. Total annual rainfall is between 1600 and 2000 mm. This is a climate with four seasons of unequal lengths:

- A short dry season from July to August,
- A long dry season from December to March,
- A short rainy season from March to June and
- A long rainy season from September to November.

iii) South region

The project area belongs to the classical Guinean equatorial climate present in the whole southern part of Cameroon. Temperatures are constant between 24 and 25 ° C, and amplitudes are approximately 2.4 ° C. Rainfall is abundant over the year, with an annual total estimated at 1700 mm. Four seasons characterize this climate:

- The long dry season (or "Essep" in the local language Bulu) covers the months of December, January and February. These are the driest months where it is registered less than 15 - 50mm of water and temperatures of 25 °C, with peaks up to 31 ° C.
- Early rainy season stretches from May to June, with maximum rainfall recorded in May (200 mm)
- The short dry season lasts from mid-June to August. The secondary minimum rainfall of the year is achieved in July (65 mm). This is often a period marked by the rainy season (called "Oyon '' in Bulu).
- The main rainy season (September ~ November) (called "Sou'ou" in Bulu), has a rainfall peak in October (with 300 mm)

2) Topography and soils

i) Northwest region

All along the Cameroon Dorsal on which the project site straddles, the geological activity of Higher Eocene defined a mountainous dominance, with the following mountains: Mount Cameroon (4095 m), Mt. Manengouba (2411 m), Mount Okou (3010 m), the Mandara Mountains (1142 m), Mount Ngo-Ketunjia (1500 m), the Bamboutos Mountains (2740 m), Mount Kogham (2 263 m), Mount Mbappit (1990 m) (Bobiondo, 2006). Downstream of these mountains range valleys dominated by the plains of Tikar, Mbam, Noun, Ndop, Mboa and Ako.

The topography of the project area consists of vast asymmetrical plateaux completed by vigorous tectonic escarpments. The western and southern borders are raised and overlook the Noun Plain (1100 m) through a fault scarp of 200 to 300 m of command; while to the north, the plateau comes in contact with the region of grassfields (1800 ~ 3011 m) from Bamenda which is dominating the collapse Ndop basin (1200 m) on a fault scarp of 500 m to 700 or 1000 m of elevation which separate the Tikar plain from the Grassfields (Tchindjang, 1996 and 2006).

On the soil map, Ndop which is the epicentre of the project and located in a rift basin (1200 m) behind the Ngo-Ketunjia and Bamboutos mountains has a relief of plains and three main soil types (Andosols ferralitic and waterlogged soils), which have the advantage of being rich in organic matter and are very fertile, although they are subject to erosion.

ii) Centre region

The region presents a less contrasting relief, including a vast gently undulating pen plain of average altitude of 650 m (SEGALEN, 1967). This is a series of hills that frame the valleys. The soils are sandy lateritic clay, generally shallow and rejuvenated by erosion; the support some perennial crops, including cocoa, palm oil and fruit trees. In swampy valleys - mainly the Nyong Valley and the approaches of many other rivers are encountered hydromorphe soils suitable for market gardening during the dry season.

iii) South

The relief of the area is made up of plateaux with an average altitude of 600 to 700 m. It is a relief of rolling hills marked by a succession of half oranges covered with forests with a granite substrate at the base. These hills surround the valleys drained by rivers and swamps. On the soil map, soil is lateritic (ferralsols) red, from the decomposition of shale. These are poor acid soils with very low fertility. In the valleys of rivers, the presence of hydromorph soils with a sandy

consistency fosters sand extraction activities.

3) Hydrograph

i) Northwest region

The drainage system of the area is organized around the Noun watershed, a tributary of Mbam which is itself a tributary of the Sanaga River. In this area the main rivers are: the Noun, the Muke, the Massemoa, the Wegma, the Tembou, the Kitan, the Monoun, etc. They all spring from the surrounding mountain ranges and run from west to south-east or north to south. Due to the extreme roughness of the relief, cliffs abound, and the rivers are dotted with numerous falls. Moreover, the area is rich in groundwater that is regularly supplied by heavy rains to ensure the sustainability of rivers and springs, as well as the height of the water table.

Regarding the Ndop plain, it is essentially drained by the tributaries of the Noun River. But most of the rivers within the area are temporary, as they dry up during the dry season (mid-January - end of March), making irrigation difficult during this period. Fortunately, as noted above, the water table is superficial, enabling the production of various off-season crops (maize, beans, cocoyam and vegetables).

ii) Centre region

The area is drained by numerous rivers, notably the Nyong, which waters the neighboring towns of the capital city. In northern Cameroon southeast plateau, Lom and Djerem rivers, from the Eastern Region, hurtle the Adamawa Plateau and cross the entire region, and they are found in low altitudes to form the Sanaga which is the longest river in the country, 750 km of length.

In the study area, the Afamba in east Obala flows to the north and receives Ntsas River that skirts the town in the west to flow into the Afamba in the north. The villages of the project's area are watered by an extensive network of rivers and streams that flow into the tributaries collectors of the Sanaga. These include: the Edouma which crosses the road north of the village Mbele, and Noah crosses the road south of the village Mban. Koumou in the villages of the Akonolinga subdivision has many tributaries, including Abassa which crosses the project road.

iii) South region

The river network of the region is very vast. Raffia Streams and swamps swell the rivers that feed the many perennial rivers. In the project villages' areas, rivers of great importance are: Seng which rises north of Nko'étyé and joined Mvila southwest Ebolowa after being swollen by the Mvi'i and Mfiande. While Memou'ou whose source lies west of Nkolbityé, took the north-east to join the Okpweng, before flowing into the Fale who joined the So'o wider north

Regarding the Biwong-Bané area and Ngoulémakong, the river network is dominated by certain rivers flowing northwards to join the Nyong. It may well include the Kama flowing east of Biwong-Bané and Soumou flowing west from the town of Ngoulémakong.

4) Flora and Fauna

i) North West region

The primitive vegetation of the area has undergone profound changes due to anthropogenic actions. It is noted the disappearance of primitive populations and their replacement by savanna (*Lophira sp., Bauhinia sp., Daniell sp., Anona sp., etc.),* the herbaceous layer characteristic of *"grassfields" (Hyparrhenia sp. Pennisetum sp., Imperata cylindrica),* crops and fallow.

The wildlife is scarce due to overexploitation. But we still encounter some forest and savannah buffalos, warthogs, duikers, cane rats, and pangolins etc. The lakes and rivers are rich in fish species (tilapia, catfish, etc.). Birdlife is also well stocked and diverse, with specific species such

as wild ducks and guinea fowl, francolin, etc.

ii) Centre region

The vegetation of the area is made up of dense forest already heavily degraded as a result of human activities, secondary forests, and gallery forests along streams, many fallow and orchards.

Regarding the fauna, it is difficult nowadays to meet large mammals and primates (gorillas, chimpanzees, baboons). The destruction of the forest under the combined effects of population pressure and poaching has inevitably resulted in the loss of wildlife due to the decrease in plant cover, which was their natural refuge. However, we still find in the region a few species such as small mammals (deer, porcupine, blue duiker, Gambian rats and cane rats) as well as reptiles and birds (partridges, parrots, geese, guinea fowl, etc. . .). And in the many rivers, people fish various species of fish and crustaceans using traditional methods (net, line, dam).

iii) South region

The project site canopy is made up of a dense evergreen forest. This is a forest with a rich flora consisting of high commercial value timber species. The operated spaces around villages include fruit trees, cocoa farms and especially fallow.

Regarding the fauna, it is just as varied and abundant. But it should be noted that large mammals and protected species (elephant, chimpanzee, gorilla, wild pigs, duikers, etc.) have moved away because of noise gear loggers and poaching. However, we meet in fallow lands, many rodents (rat-palm, hedgehog, porcupine, etc.). There are also many species of birds and rivers, people fish various species of fish and crustaceans using traditional methods (net, line, dam).

(2) Human milieu

1) Population

i) Northwest region

In human terms, the last population survey of 2005, the Ngo-Ketunjia division had a population of 187,348 inhabitants (data of BUCREP). It is a cosmopolitan population, which incorporates indigenous (Tikar, Nso Wimbum and Widikume), the national ethnical groups from elsewhere, as well as nationals of other countries (including neighboring Nigeria).

Historically, the Tikar people are from the southwest of Adamawa (in the Tibati region, Bangajo, Ndobo and Kimi). Their migration to the study area dates back to between the 17th and 18th century. They are now scattered in many chiefdoms (or "fondoms") Ndop, Mbem-Nsungli, Bum, Kom, and Fundong Nsaw.

ii) Centre region

Indigenous peoples in the region belong to the Bantu group. The Ewondo, Eton and Bassa are some native ethnic groups of this region that brings together people of diverse backgrounds. At the last 2005 population survey, the population was estimated at 3,098,044 inhabitants (of which 2,226,537 urbans and 871,507 rurals).

iii) South region

On the human scale, the indigenous peoples of the Region are pygmies and Bantus. The former are found in the depths of forests (around Bipindi, Kribi Campo, Djoum, etc.). While the latter belong to various groups, including the following:

- The Fangs (or Pahouins), composed of Bulu, Fang, zaman Ntoumou and nvae. As far as demographic and space occupation are concerned, this subgroup is unquestionably the dominant entity, with Bulu constituting the majority ethnical group.

- The Betis, culturally and linguistically related to the Fangs, they occupy the northern part of the region. They include Fongs and Ewondos (subdivisions of Biwong Bané and Ngoulémakong), the Yanda the Omvang, and Evuzok.

At the last 2005 population's survey, the region had 634 655 inhabitants. The population of the Mvila division where the project sites are located was, meanwhile, estimated at 179 429 (71 542 urbans, against 107,887 rurals).

2) Organization and traditional and social administration

i) North West region

The people of the seven constituent villages of the project area have a very hierarchical organization where social life is influenced by religion, customs and traditions. They are administered by the "fons" (or leaders), which in addition to their role as auxiliaries of the administration, still have considerable authority to make the traditional justice (notably land issues and civil cases, especially the successions).

The advantage of Fon on their counterparts prevailing in various other Cameroonian towns is that they draw their power from a very long pre-colonial ritual tradition and retain therefore a strong moral and spiritual influence on their citizens.

Table 5.1.4 Traditional Administration of the Population of the Survey Area

Division	Subdivision	Village	Ethnical group	Chiefdom
Ngoketunjia	Ndop	Bamunka	Tikar	1st
		Bamali	Tikar	2nd
		Bambalang	Tikar, Bamoun	2nd
		Bamessing	Tikar	2nd
		Babanki	Tikar, Borroro	2nd
	Balikumbat	Balikumbat	Balikumbat (Tchamba)	2nd
	Babessi	Babungo	Tikar (Vengo)	2nd

ii) Centre and south region

Over time, the above mentioned indigenous populations have constituted in patriarchal societies structured around linage where all member groups from a common ancestor are grouped around a family head. Each village is headed by a leader chosen within a family; he is assisted by several notables in administering the village. Within each family, the exogamy, virolocality and patrilinearity are considered as leitmotivs.

3) Land rights

i) North West region

Within the project area and in the Western Upper Plateaux as the whole, access to land is very difficult since all village lands belong to the Fon, the traditional leader, vast families and notables. Elsewhere, the demographic pressure has rendered the land very inaccessible so that most conflicts are the result of land dispute for fertile land.

Here as elsewhere in the country, properties are traditionally inherited from father to son. Male children are taken as natural successors. At the death of their father, they inherit all lands and related objects under the chairmanship of a successor designated and under control of the first born. Female children are excluded from the sharing but they have the right of ownership till they get married.

ii) Centre and south regions

The populations of these areas have a community conception that the land is a leg of the ancestors who belong to the same family group and its operation is free for all family members.

The crops belong to all family members who cultivate them. It is very frequent to have on the same plot many owners of crops that have been planted. In general; the cash crops belong to the family head (the patriarch or his representative) is taken as the first occupant.

Traditionally, the properties are inherited from father to son. Male children are taken as natural successors. At the death of their father, they inherit all land and related objects under the chairmanship of a successor designated and under control of the first born. Female children are excluded from the sharing but they have the right of ownership till they get married.

4) Religion

i) North West region

The inhabitants of the study area are mostly Christians (Catholics, Protestants) and Muslims. Between them there is a climate of harmonious coexistence that finds its perfect expression in the Bambalang village where a large Muslim community lives and comes from the Noun division (Western Region). It is necessary to note that regardless of their religious affiliation, the people of the area engaged into animistic practices (ancestor worship, magico medical - rites, etc.).

ii) Centre and south region

People actively practice the Christian religion, with major denominations: Catholicism, Protestantism, Adventism, and full gospel churches. While the Muslim community which is strongly represented, practice Islam. But it is clear that regardless of the religion practiced, many people are still attached to the ancient animist traditions

(3) Socioeconomic Profile

i) North West region

The main economic activity of the population is agriculture. Thanks to the exceptionally favorable climatic and soil conditions, the area is favorable to the production of much speculation, either: (i) industrial crops (tea, cocoa, coffee, palm oil); (ii) food crops (maize, cassava, cocoyam, potato, peanut, potato, cucumber, yam, beans), or (iii) vegetables (onions, garlic, cabbage, carrots, lettuce, leek, radish, pepper). Thanks to the action of the state Company UNDVA, rice production is widely developed in the Ndop plain, which is the second rice-growing area of the upper western lands. Regarding the "gender" aspect, according to the Mayor of Ndop, Daniel B. Ntoh, "Over 81% of agricultural production is under the responsibility of women, which, paradoxically, have less than 1% of the land ". (See "Stopover in Ndop for CERAC" Cameroon Tribune May 27, 2013.)

The predominance of grasslands within the study area led to the development of cattle breeding which is mainly practiced by Bororo (or Fulani) from the north of the country.

Among the various other income-generating activities, it should be necessary to mentioned: (i) the fisheries activities whose products are used for household consumption and for sale; (ii) handicrafts is very developed in all chiefdoms within the study area, some of which have become true attractions like the Royal Museums of Bambalang and Babungo; (iii) small business, par retailers; (Iv) a number of small businesses of the informal sector, etc.

ii) Centre region

Thanks to the dynamism of the people, along with the high soil fertility, the villages of the project became nourishing breasts for the whole region. The main crops grown are:

- All food speculation of the country (cereals, tubers, vegetables, etc.).
- Perennial crops (cocoa, oil, coffee palm, rubber, sugar cane, etc.), which are produced traditionally as well as industrially.

The presence of seed fields and support of agricultural stations - created by MINADER (Client) or animated by itself, promote high agricultural productivity within the villages of the project.

Other gainful activities present in the study area are:

- The exploitation of non-timber forest products (Djansang, Okok, etc.) is also an important source of income for the population.
- The practice of fishing in the many rivers that water the region, which allows local residents to stock up with animal protein and to replenish their savings when surpluses are sold in markets

- Traditional breeding, but also cattle
- Handicrafts, especially woodworking and raffia.
- The extraction of sand on the banks of major rivers
- Some industrialization has even emerged in the region, with the presence of the UFA, the existence of many wood or coffee processing plants (Mengang), oil mills and soap factories.
- Commercial activity clearly dominated by food trade and small retailers.

iii) South region

Economically, the region is characterized by the hypertrophy of the primary sector. Agriculture is the most important branch, has two sub-branches:

- An export branch largely driven by cocoa but also rubber and palm oil that appear increasingly as speculation of cocoa substitute
- A food branch that largely aims to ensure consumption of the peasant population and enable them to generate a surplus for daily supply of the populations of urban areas. Among food crops, it should be mentioned in order of importance: cassava which is the basis of local population's diet; but also cucumbers, cassava, plantain, cocoyam, maize, and groundnut. Many subdivisions have also specialized in the production of some speculation: Ngoulémakong for cassava, Mengong for maize, Biwong Bané for cucumber, Mvangan for plantain. For many crops, there is a net increase in cultivated area and one can observe a positive correlation between the evolution of surfaces and the one of production

Apart from agriculture, breeding of traditional small cattle is carried out: sheep, goats, pigs and poultry that are often left straying.

Since the late 80s, the region's economy is also based on intensive exploitation of forestry resources. We note the presence of a great number of wood processing units with the most of the production being exported as logs. Aquaculture is also practiced. But the fisheries potential of the area is still under-exploited, both for maritime for inland fishing.

(4) Main infrastructures

1) Housing and education

i) North West region

On the educational level, the study area has good infrastructure. Almost all villages have public and private schools (especially religious: Catholic, Presbyterian or Muslim) to cover the entire primary cycle. The public secondary offering is especially present in large cities and sub divisional chief towns. School facilities are mostly built with blocks; and some of them owe their existence from the bilateral assistance of JICA.

ii) Centre region

On the educational level, the region is among the best of the country. Young people may attend the various existing educational institutions in villages or county the capitals or district capitals,

where the Consultant's experts were able to count twenty kindergartens, thirty primary schools, ten colleges of technical education, general and technical education high schools and vocational training centers.

iii) South region

There is a good supply for kindergarten, primary, general and technical secondary education within the study area. Almost all of the host project target villages have at least one school cycle; and other cycles are usually in the nearest urban centers.

2) Health

i) North West region

As far as health is concerned, the sub divisional chief towns in the study area have public health facilities (hospitals, health centers) relatively well equipped. And many villages of the project have integrated health centers (IHC). But many others do not, as a result of this many people have to resort to self-medication or traditional medicine. But for severe cases, patients are referred to hospitals in Kumbo and Bamenda.

ii) Centre region

In terms of health, the area is equipped with several health facilities, especially in urban centers. Everywhere else, apart from few equipped health centers in some villages, throughout the study area the main features are shortage of health personnel, lack of basic amenities and especially drugs. The populations therefore resort to traditional medicine for common illnesses (fever, malaria, headaches, teeth or stomach, etc.) So that only serious illnesses are referred to major cities.

iii) South region

As regards health, there are several good quality public and private health facilities in the study area. Quantitatively, the deficiencies are remarkable, given the statistics of 01 doctor for 8754 people, 01 health unit for 2180 people and 01 bed for 4.78 persons. In addition, the low equipment and lack of drugs are equally garish. This often leads patients to travel to major cities (including Sangmélima and Ebolowa) for serious illnesses. But travel difficulties in this landlocked area force people to resort to traditional medicine, even for the most common diseases (fever, malaria, headaches, teeth or stomach, etc.).

3) Water supply

i) North West region

Access to potable water is facilitated throughout the study area (excluding the Bambalang village) thanks to water catchments in the hills of Sabga which supplies most of the villages where standpipes meet everywhere along the roads serving the settlements.

ii) Centre region

Although the study area is connected to the CAMWATER network, only the urban centers benefit from it. While rural populations have difficulty to get drinking water, and are forced to get water from boreholes, wells and surrounding waterways.

iii) South region

The entire region is experiencing drinking water supply problems because of dilapidated facilities. Of course, water is made available in major urban centers thanks to water resource catchment in the surrounding rivers and its subsequent purification treatment by the technical services of the public water company. But untimely water service interruptions often cause lengthy water shortage, compelling people to supply water from bored wells, springs or the many lakes in the

zone

4) Electricity

i) North West region

The study area is connected to the ENEO network, although some villages are not fully covered (like Bamunka and Babanki). But as elsewhere in the country, the villagers of the study area complain too frequently about power shortage and especially the frequent power cuts

ii) Centre region

The study area is partially connected to the ENEO network. But as for water, it is mainly the urban centers that benefit from it. Even if because of frequent power cuts, wealthier people have to use generators or solar systems whereas the other ones use for the wealthiest citizens; and the hurricane lamp, for others

iii) South region

Most major cities are connected to ENEO network within the area. As for the rural population, many of them are forced to resort to the generator or photovoltaic system for the wealthiest, while the majority use hurricane lamp or lighting with fire wood.

5) Road network

i) North West region

In the study area, same as in the rest of the country, the road network is not very developed. Road degradation, in this hinterland is materialized among others, through scraping of laterite layers, and the floods that dig gullies and cracks, potholes, ruts on roads that are flooded, because of runoff water flowing from ditches waters and road shoulders on roads in the rainy season. Moreover, the invasion of the floor by the brush results in the reduced visibility and the risk of accidents relating thereto. All this damage often result in cuts of roads and the traffic stop, forcing local people to be in their every move, the system "D" that represent the motorcycle , better known nationally under "bend -Skins ".

ii) Centre region

The region is one of the best equipped in terms of roads. However, there is a shortage of good roads in hinterland of the study area which therefore suffers from severe isolation.

iii) South region

The region is seriously handicapped in terms of road infrastructure. Certainly, there are substantial road networks that spans over 891 km and includes highways, regional, divisional and rural roads. But it is clear that only large cities (Ebolowa and Sangmélima in particular) are connected by paved roads to the chief town. Crosslinks between divisional chief towns are not paved, unfortunately they do not receive regular maintenance. It follows a weak bond between the localities within the area, of which the northern part focuses most accessible tracks, while the southern part is conspicuous by a virtual absence of roads, and poor maintenance of existing tracks

5.1.3 Procedures and Implementing Body for the Implementation of the Environmental and Social Considerations

(1) Procedures

1) The Environmental Framework Law

Law No. 96/12 of August 05, 1996 relating to the environmental management is the reference

legislation in terms of environmental impact in Cameroon. This law establishes the principles of environmental action planning, environmental management planning, evaluation of environmental impacts, protection of environment (air, inland waters, sea waters, soil, environmental life), protection against pollution of protected areas (waste, harmful chemicals, noise and smells), management of natural resources, conservation of biological diversity as well as the principles and measures concerning criminal offenses, sanctions or people's participation.

2) Type of studies on social and environmental considerations

The Ministry of the Environment, Protection of Nature and Sustainable Development (MINEPDED)[8] is responsible for the procedures in relation with environmental and social considerations, according to Decree 171 of 2013 laying down the environmental impact studies implementation methods. This decree distinguishes several types of environmental impact studies for different types of projects and their scope are listed as follows: the Environmental and Social Impact Studies (ESIS), Strategic Environmental Assessments (SEA), and Environmental Impact Notices (IEN), for which, investigation costs and environmental monitoring procedures differ from one to another. The ESIS and EINs are subject to obtaining a Certificate of Environmental Conformity (CEC) while the IEN should receive an Attestation of Environmental Conformity (AEC). There are two types of ESIS studies: summary and detailed studies differ in content but with the same process apart from the numerous requests carried out during the public consultation. The validity of the CEC is 3 years from the issue date.

Other special considerations and standards to respect:

- The ESIS/SEA/IEN terms of reference studies must be approved by the Department of Environment. The ESIS/SEA/IEN terms of reference content is set by Order No. 0001 of February 3, 2007 of the Ministry of Environment and Nature Protection. The Order No. 0014/MINEP of July 03, 2007 set the consultants agreement conditions to carry out impact studies for achieving environmental audits. The IEN terms of reference contents is set by MINEP Order No. 2 of 2016. The SEA terms of reference content are subject of any order or decree.
- Only those organizations accredited by the Department of Environment (Consultation firms, non-governmental bodies) are authorized to perform the ESIS. In November 2015, there were 95 organizations accredited under Order No. 0004/MINEP of July 03, 2007 laying down the consultant's agreement conditions to carry out environmental impact studies and audits. The validity period is 5 years.
- The certifications for the IEN are issued at the council level under the technical supervision of the Department of Environmental Management
- The costs for establishing the terms of reference and investigation of the ESIS/SEA/IEN study report are charged by the sponsor (see Table 6.1.1). IEN study fees are set by each municipality but not exceeding a certain amount.

Compared with the JICA guidelines, EISs are at the SEA level, detailed ESIA at the EIA and SEA summary at the ESIS levels. The IEN to address small impact work but important on the environment must be considered as SEA without requiring further study. For studies that do not fall within this category, the level of IEN is not enough.

The content of the studies, the resulted costs and the licenses needed are listed in the following table by type of study.

[8] The sub department of Environmental assessment (division of promotion and sustainable development) and the sub department of environmental Planning of MINEPDED are responsible for monitoring environmental considerations and manage the ESIS implementation

Table 5.1.5 Study Relating to Social and Environmental Considerations in Cameroon

	SEA	Detailed SEIS	Summary SEIS	IEN
Summary (English/French)	○	○	○	○
Project presentation	○	○	○	○
Revision of institutional framework	○	○	○	○
Current situation	○	○	○	○
Changing	○	○	○	—
Impact assessment	○	○	○	○
Attenuation measures	Counseling, proposal of appropriated measures	Prevention, reduction and elimination measures	Attenuation measures	prevention, reduction, elimination and compensation
Meeting with the people involved	Main person interested	People involved, syndicates, NGO, opinion leader, other groups	People interested including sector's population	sector's population
Elaboration of management program	Environmental management plan	Environmental, social management plan , compensation plan if necessary	Environmental, social management plan	Specific environmental and social papers
Public survey	(according to the needs)	○	(according to the needs)	—
Investigation costs for terms of reference	2 000 000 FCFA		1 500 000 FCFA	Not more than 50 000 FCFA
Investigation costs for report	5 000 000 FCFA		3 000 000 FCFA	Not more than 100 000 FCFA
Obtaining agreement	Certificate of Environmental Conformity(CEC)			Attestation of Environmental Conformity (AEC)
Level according to JICA guidelines	SEA	EIA	IEE	(IEE)

3) Environmental and Social Considerations Study Categories

The various transactions categories concerning ESIS and SEA are determined by MINEPDED Decree No. 0001 of 2016[9], those concerning IEN by Order No. 0002 of 2016[10] from the same ministry. Multi-component projects or projects that span on several geographic areas for which the ESIS must be carried out separately will be subject to SEA at the level of measures and main program. Fees and working methods required by the Strategic Environmental Assessment are the same as those from detailed ESIA. After obtaining the Certificate of environmental conformity, as ESIS does not exist by component and by region / division, it will be necessary to establish an environmental impact notice.

The works categories matching with an ESIS or an IEN are listed below; the type of study to be performed depends on the work scope.

- Social infrastructure (water and sanitation supply, health and medical equipment, cultural and educational facilities, housing and shops, etc.)
- Economic Infrastructure (communications, energy)
- Sport and community facilities
- Production sector (farming, irrigation, fisheries, fish farming, livestock, forestry, mining, industry, tourism, telecommunications[11])

Each department sets its ESIS / IEN procedures as part of geographical sector. In the case of road projects for example which focus on several departments, studies differ depending on the type / volume of work for each road section (small section road with a relatively diversified work) for each region. The standards related to investments in this project are shown in Table 6.1.2 below.

[9] Order N°0001/MINEPDED of February 9, 2016 laying down the different operations categories of which achievement is submitted to a strategic environmental assessment or an environmental impact study

[10] Order N°0002/MINEPDED of February 9, 2016 defining the terms of type and environmental impact notice content

[11] Telecommunications are subject to a summary ESIS

Table 5.1.6 Work Classification by Category in the Environmental and Social Considerations in Cameroon (abstract)

	Detailed SEIS	Summary SEIS	IEN
II. Economic infrastructures			
A. Communications	▸ Rehabilitation and modification of tarred roads ▸ Construction/rehabilitation of divisional roads ▸ Construction of tarred roads and highways ▸ Construction/rehabilitation of rural/ urban roads ▸ Construction of structures of more than 100 m high Etc.	▸ Rehabilitation of tarred roads without any modification ▸ Rehabilitation of tarred roads without any modification ▸ Repairs of unpaved agricultural roads ▸ Periodic unpaved road maintenance ▸ Construction of structures of 60 ~ 100 m high Etc.	▸ Open up of local roads/periodic maintenance ▸ Construction/maintenance of communication infrastructures of less than 200 million FCFA
IV. production sector			
A. Agricultural Production	▸ Agricultural improvement on an area of about 1000 ha ▸ integrated production and agricultural operation Etc.	▸ Improvement of a mechanized agriculture 500 to 1000 ha Etc.	
B. Irrigation	▸ Irrigation on surface of a volume more than 100 m³/day ▸ Ground irrigation of more than 20 m³/day Etc.	▸ Irrigation on surface of a volume between 50 and 100 m³/day ▸ Ground irrigation of a volume between 2 and 20 m³/day Etc.	

4) Procedures for achieving environmental impact studies and environmental impact assessments

ESIS and EINs implementation procedures based on Decree 171 of 2013 is reported in Table 6.1.3 as well as the necessary completion time. This table shows that the consulting firm is selected after terms of reference approval; it can also be selected and begin work from the preparation of terms of reference.

The works screening is done at the moment of terms of reference approval, so that administrative decisions regarding the work classification are not known at the terms of reference preparation stages; it is not excluded that works change category after the terms of reference review.

Public consultations take place once the Department of Environment has reviewed the ESIS / IEN report project, but the decree does not specify a deadline. Public consultations are held during the whole week and aimed at raising the participants' opinions on the report content; it is estimated that at least 30 days between notification and publication of the report. The Department of Environment gives administrative decisions based on the Environmental Inter-ministerial Committee's opinion on the ESIS report.

The framework law on Environmental Management sets administrative decision deadlines of the Ministry to a maximum of 4 months from receipt of the environmental study notification. It takes about 60 days to complete an ESIS / SEA study, bringing to about 7 months the time required between demand and issuance of CEC.

Table 5.1.7 Procedure for Achieving Environmental and Social Impact Studies

Procedure	Procedure deadline	deadline
Preparation/agreement of terms of reference	▸ Preparation of terms of reference (promoter) ▸ The promoter presents his request to the responsible administration for the ESIS achievement. 3 elements must be presented: the application form, the terms of reference and attestation of payment proof of supervision costs	
	▸ The responsible government agency sends feedback to the Department of environment within 10 days	10 days
	▸ The Department of environment notify the promoter comment on the terms of reference based on the work category within 20 days after the request	10 days
	▸ If the promoter does not receive the comments within 30 days , it means that it is accepted	10 days
Selection of consultation firm	▸ Once the request for achieving a study is approved, the promoter starts the tender procedures towards legal consultation firms towards the department of environment ▸ The bids are examined, contractor selected and contracts signed	about 20 days
Achievement of study	▸ The consultation firm conducts ESIS on the basis of terms of reference and prepares the report. ▸ The people taking part to the study and its results are submitted to their approval ▸ The public consultations must be notified to the populations within 30 days preceding the work. The minutes of the consultations should be included in the report of study	Environ 60 days
Presentation of report	▸ The promoter presents the report of study with the proof of supervision payment fees to the responsible administrative department (2 copies) and to the department of environment(20 copies)	
Examining of the responsible department	▸ The department of Environment is a mission of study made up of the administrations involved and addresses an evaluation report to the environmental inter-ministerial evaluation committee within 20 days (15 days for summary studies) ▸ The responsible administrative department makes notes to the department of Environment within 20 days (15 days for summary studies) after the report reception. ▸ The department of Environment notifies the ESIS promoter's agreement (15 days for summary studies) after the presentation - Any refusal shall be commented - If no answer, the report is considered to be accepted	20 days (15 days)
public Consultations	▸ After notification of accepting the environmental and social impact studies, the department of environment appoints a special commission and opens public consultations. The public consultation report is presented to the Ministry of Environment and the inter-ministerial committee on the environment. The Promoter is charged to pay the fees	about 30 days
Supervision of the environmental inter-ministerial committee	▸ The department of Environment notifies the ESIS acceptance to the inter-ministerial committee on the environment in the same time to the three following elements within 20 days. - ESIS report accepted, evaluation report of the impact study and public consultations	20 days
Supervision of the Department of Environment	▸ The minister of Environment notifies the final result to the consultation firm within 20 days after the certificate of environmental conformity (CEC)is sent , - He signs and publishes it - If CEC is sent with conditions , it indicates the measures to be undertaken to obtain it - The achievements of works stops if the study is not authorized	20 days

5) Procedures for environmental impact notice (IEN)

The procedures concerning the IEN are established by decree 171 of 2013 and Decree No. 2 of 2016 of MINEPDED. The achievement of procedures based on these decrees is reported in Table 6.1.4 as well as the necessary completion time. The procedures are easier than for ESIS / ESIA for the fact that the IEN are designed as small-scale projects at the council's level. Between the presentation of terms of reference and the certificate of environmental conformity issuance, it takes a period of 3 to 4 months

Table 5.1.8 IEN Procedures

Procedure	Procedure detail	Deadline
Preparation and presentation of terms of reference	▸ Preparation of terms of reference (promoter) - Promoter's request towards local council involved by IEN(4 copies) 3 papers to present: ➢ Achievement request, reference terms, attestation of supervision request. ▸ The local council sends 2 copies at the divisional department	
Examination of terms of reference	▸ The Department of Environment submits its comments on terms of reference to the municipality within 15 days after receiving papers	15 days
Agreement of terms of reference	▸ The local council sent comments on terms of reference to the promoter within 30 days after his request ▸ If no comment is received within 30 days, the terms of reference have been accepted.	15 days
Selection of consultation firm	▸ Once the study request is approved, the promoter begins the tender process towards legal consultation firms ▸ The bids are examined, the consultation firm is selected and contracts are signed	About 15 days
Achievement of result	▸ The consultation firm achieves the IEN study on the basis of terms of reference and prepares the report	About 30 days
Presentation of report	▸ The promoter shall send the report to the municipality together with the IEN report payment examination fees certificate (6 copies) ▸ The local council sends 2 copies to the divisional department and 1 copy to another divisional administrative department	
Supervision of the divisional technical department	▸ Within 5 days after receipt of the report, the concerned divisional administrative department expressed its opinion to the environmental department of the division ▸ Then, after10 days, the divisional environmental department gives its technical opinion to the municipality ▸ If no reply is received within 15 days, it is considered as accepted.	15 days
Supervision of the local council	▸ The local council should send the results to the promoter within 30 days after acceptance of the report - Issuance of a certificate of Environmental conformity (CEC) - If CEC is sent along with conditions, it indicates the measures to be undertaken to obtain it. - The work achievement is stopped if the study is not authorized ▸ If no response within that deadline, the IEN is considered accepted and the issues the CEC	15 ays

(2) Government body responsible for social and environmental considerations in Cameroon

The Ministry of Environment, Nature Protection and Sustainable Development (MINEPDED) was designated as government body in charge of establishing and implementing national policies in terms of nature and environmental protection by integrating sustainable development by Decree 431 of 2012. The main procedures organ relating to national social and environmental considerations is the division of the promotion of sustainable development (DPSD) with a sub-division of environmental assessments (SDEA) and a sub-division of environmental management programs (SDEMP) responsible for their implementation. (Fig. 5.1.1). Monitoring of ESIS environmental management programs and environmental monitoring are the responsibility of the SDEMP but at the achievement stage; both sub-divisions ensure the monitoring of ESIS.

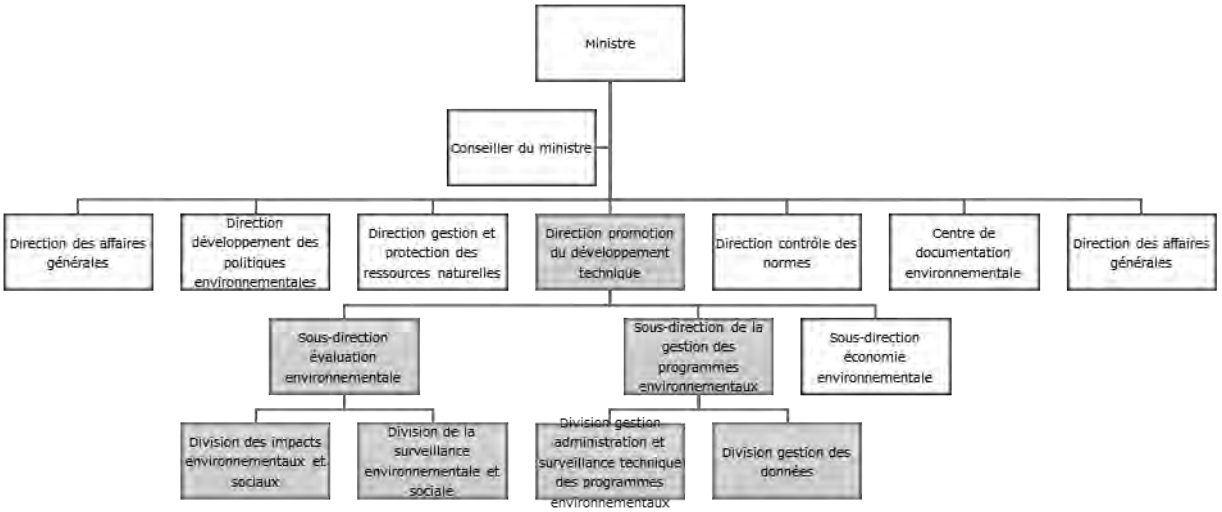


Figure 5.1.1 Organization of MINEPDED (Division in charge of social and environmental considerations)

5.1.4 Comparison of the JICA Guidelines and Legal Framework in Cameroon

The differences between the policies of JICA and Cameroon's legal framework for environmental and social considerations are summarized in the table below. The reflection was given on the conditions to be met in the "Annex 2: Environmental Impact Assessment Reports required for Category A" of the JICA Guidelines on Environmental and Social Conditions.

Table 5.1.9 Comparison of the JICA Guidelines and Legal Framework in Cameroon

No.	JICA Guidelines	Legal Framework in Cameroon	Differences	Principles under the Project
1.	If there is a framework of environmental impact assessment procedures and is applicable to the project, these procedures must be formally completed and approved by the government of the partner country.	In accordance with Decree N 2013/0171 / PM, an ESIA, an SEA or a NIE is required, depending on the type or scope of the project, and the Environmental Certificate of Compliance (ECE) Environmental Compliance Statement (ACE).	There is no difference, but the study of environmental and social considerations must, in principle, be carried out for each department.	Aim for obtaining 3 CECs: Detailed EIES in the Northwest Region, and single EIES in the Central and Southern Region.
2.	The environmental impact assessment report must be drawn up in the official language or a language widely used in the country of implementation of the project. In addition, the explanations must be written in a form and in a language understood by the people of the region.	Stipulated by Decree N 2013/0171 / PM. Reports should be written in English or French and begin with a summary in the language that is not the one used in the body of the text. During the public consultations, a report must be drafted and signed by the contractor and the representatives of the inhabitants.	No difference	Implement the project in accordance with the policies and stipulations of JICA and Cameroon.
3.	Environmental impact assessment reports shall be made available to the public, including local residents, in the country of implementation of the project; Local residents and other stakeholders must be able to consult them at all times and be able to obtain copies.	N/A	No provision under Cameroonian legislation. The ministry responsible for the environment does not make the reports public. They can be consulted on site, but cannot be taken away. The public disclosure of each of the projects is not prevented.	Targeting public accessibility, in particular on the MINADER website.
4.	When preparing environmental impact assessment reports, sufficient information should be made public in advance, discussions should be held with local residents and other stakeholders, and minutes should be drawn up.	Stipulated by Decree N 2013/0171 / PM. The consultation of the inhabitants must be announced to the representatives of inhabitants at least 30 days in advance. The minutes must be attached to the study reports.	No difference	As the ESIA will continue during the study, reduce its notice period.
5.	Discussions with local residents and other stakeholders should be held, as necessary, throughout the preparatory period and the implementation period, and it is particularly desirable for discussions to be held when Environmental impact assessment and in the development of the draft report.	Stipulated by Decree N 2013/0171 / PM, which requires public consultations during the period of execution of the study. Public hearings are held as required after the submission of reports, and stakeholder views are reflected in the final review by the Ministry of the Environment.	Discussions with stakeholders are necessary during the study but not recognized in the selection of evaluation criteria.	In accordance with Cameroonian legislation, hold discussions with stakeholders at the beginning of the study. If necessary, hold discussions during the drafting of the report.

No.	JICA Guidelines	Legal Framework in Cameroon	Differences	Principles under the Project
6.	The scope and level of detail of environmental impact assessment reports should be based on the potential impact of the project. Reports must contain the following elements. - Summary - Project description - Basic information (particularities of the study area) - Environmental impact - Analysis of alternatives - Environmental Management Plan (EMP) - Discussions	Decree No. 2013/0171 / PM stipulates the types of study and the content of the reports; Decrees N 01 and N 02 of the MINEPDED of 9 February 2016 stipulate the categories of study for each type of project.	No difference	Implement the project in accordance with the policies and stipulations of JICA and Cameroon.

Source: JICA Study Mission

5.1.5 Analysis of Alternatives

(1) Irrigation development component

Sites are selected according to the following criteria: 1) Measures do not require flood protection measures (flood control); 2) The sites are linked to the roads to be developed and are taken into account by the technical cooperation. For this, the Upper Bamunka site south of Ndop was selected. On this site, the irrigation water will be fed by the river Mufuo where the water level is regulated by the existence of a dam. In Upper Bamunka FARMs, the problems reported by farmers are (1) excessive flooding due to drainage problems, (2) lack of trap paths, (3) irregular land grading (over-submerged areas and High drying areas), 4) irrigation canal development.

In the Upper Bamunka area: for irrigated rice production, water supply will be provided to the catchment structure built on the Mufuo by UNVDA in 2006, and the village farmers Bamali and Bamunka are practicing rice farming. The beneficial area of 918 ha has been defined taking into account geographical, administrative and social limits. UNVDA's commitment to protecting the ecosystem from deforestation is respected. The options considered during the development of the irrigation plan are shown in the table below.

Table 5.1.10 Options for Irrigation Development Component

Option 1	Option 2	Option 3	Option 4
Routes principales & secondaires	Routes principales & secondaires	Routes principales & secondaires	Routes principales & secondaires
Drainage principaux & secondaire	Drainage principaux & secondaire	Drainage principaux & secondaire	Drainage principaux & secondaire
-	Canaux d'irrigation	Canaux d'irrigation	Canaux d'irrigation
-	Routes troisième	Routes troisième	Routes troisième
-	Drainage troisèem	Drainage troisèem	Drainage troisèem
-	-	Parcellisation (aggrandissement des parcelles)	Parcellisation (aggrandissement des parcelles)
-	-	-	Nivellement, agrandissement de la dimesntion des parcelles

Source: Mission JICA

(2) Access road development component

For this study, we selected roads that are able to contribute effectively to the project's objectives of "increasing distribution volumes in agricultural commodity markets, especially rice" in the list of roads to be developed that we proposed by MINADER. The choice relates to roads which fulfill the following conditions as the sector concerned contributes to increasing rice production; Targets a large

beneficiary population; MINADER (including UNVDA) considers that the development program is very urgent.

The roads to be rehabilitated were selected in accordance with the process outlined above. The overall assessment focuses on the outcome of the mission's assessment and Cameroon's priorities: "◎" indicates that both sides have prioritized the road, and that the mission classified it as A, "○" indicates that, only one of the two parties classified the route as a priority or as A. At the time of the works, one will choose among the priority roads "◎". The list was presented to the Cameroonian authorities in July and has been verified.

When selecting the development plan because it is paved laterite is often observed a degradation due to erosion, in addition it was decided to adopt a method to ensure the best resistance of paving to laterite, Erosion resulting from precipitation is the main factor that hinders the function of the road, consideration, such as the use of concrete coating on the development of drainage facilities, including a ditch has been studied.

When planning the access road component, line 4 of the overall assessment "◎" Option 1, Option 2, which covers almost all 7 roads, including "○" has been proposed.

Table 5.1.11 Outcome of Road Selection

Region	Arrondi.	N°	Road	Length	Evaluation (Study Team)	Priority (MINADER)	Overall Evaluation
North West	Ndop, Balikumbat	**NW1**	Bamali (N11) - Bamali 3 Corners – Balikumbat	15.5 km	A	Priority	◎
		NW2	Bamali 3 Corners (D72) - Bambalang	14.5 km	A	Priority	◎
		NW3	a) Bamessing (N11) – Mbelue – Nsemi Junction (N11) b) Bamessing Irrigation Field – D72	15.6 km	A	Priority	○
Centre	Obala	**C1**	a) Mboua I (N4) - Mbele II J.C.1 – Mbele II J.C.2 – Mengama - Mban b) Mbele II J.C.1 – Edokasi c) Nkoledouma (N4) – Mbele II J.C.2 d) Mengama - Ntsaekang (P13)	24.9 km	A	Priority	◎
	Akonolinga	**C2**	Menguemesi (P23) – Até – Koundou (N10)	36.5 km	B	Priority	○
South	Ngoulemakong	**S1**	Ngoulémakong (N2) - Enamngal - Biwong Bane (D42)	39.2 km	A	-	○
	Biwong Bulu	**S2**	Nkolbitye (D39) - Nkoetye	8.8km	B	Priority	◎

Source: Mission JICA

(3) Installation of Agricultural Equipment Component

Two (2) candidate sites were proposed: namely, the UNVDA headquarters in Ndop and the Babungo site (15 km from UNVDA headquarters); this site were planned for the installation of the various equipment. The option on the first site was abandoned because of the possible nuisances for neighborhood, to possibly result noise from the country elevator and rice milling equipment. On the other hand, the other option on the Babungo site stretching over about 44 ha was selected, since selecting this site would not lead to relocating the existing populations in order to save them from possible nuisances.

The options proposed in this component are presented in the table below.

Table 5.1.11 Options for the Installation of Agricultural Equipment Component

Item	Option. 1	Option. 2	Option. 3
Silo de collecte et unité de décorticage	○	○	○
10トTracteurs	-	-	○
10 accessoires de tracteur (rotary)	-	-	○
10 accessoires de tracteur (herse)	-	-	○
5 combines	-	○	○
Travaux de base	○	○	○
Travaux consutrucutoin	○	○	○

Source : Mission JICA

(4) Overall Concept

In this project, priority according to cooperation with the achievements of PRODERIP use and successor projects PRODERiP, irrigation facilities which can be the basis for the production and supply of high national competitive rice as imported rice, road of Farming, rice machining and processing facilities and maintaining the policy. On the basis of the above policies and field survey, the overall concept plan was made as follows.

- Irrigation development components: Option 4
- Access road development component : Option 1
- Installation of agricultural equipments component: Option 3

(5) Zero option

The zero option (this project is not implemented) is conceivable as follows.

- The negative impact on the environment and society due to the construction and service of the proposed project is eliminated
- Improvement of circulation of agricultural products such as rice and other grains, root vegetables, vegetables and so on in the target area to urban consuming areas will be difficult to realize due to budget constraints of the Ministry of Agriculture
- Progress of road degradation due to the lack of maintenance, les impacts such as increase of accident risk, decrease of traffic access, increase of transportation cost are assumed

Some of the effects assumed by the project implementation are affected by the current situation (without project), and some improvements are expected if mitigation measures are taken through the project. Considering the budgetary constraints of the Ministry of Agriculture, it is undesirable to choose this zero option because such improvement cannot be expected after selecting it.

5.1.6 Scoping and Terms of Reference (TOR) for the Environmental and Social Impact Study

(1) Scoping

Scoping was conducted with the counterpart to identify the scope of field assessments. For the choice of impacts, we have consulted the column "7. Routes" and the column "16. Agriculture, irrigation, livestock" in the environmental checklist annexed to the Guidelines on Environmental and Social Considerations of JICA; The environmental and social impact is studied before / during the works and following the use of the equipment. The results are shown in the table below.

Table 5.1.12 Scoping Results

Evaluation items	Evaluation*		Reason
	PC/C	O	
Pollution			
1. Air	B−	B−	C: Release of dust and emission of exhaust gases from vehicles and gear O: Possible impact due to the likely increase in traffic
2. Water	B−	D	C: Non-negligible degradation of water quality O: No impact expected
3. Waste	B−	D	C: Possible production of waste materials and land from construction O: Possible production of waste having an impact on the neighboring environment
4. Soil	B−	C	C: Possibility of pollution by leaks of construction oils O: Possible impact due to the use of chemical inputs
5. Noise and vibration	B−	B−	C: Expected vibration and noise from the use of vehicles and construction machinery O: Assumed impact due to increased traffic and increased traffic speeds
6. Ground subsidence	D	D	No activity will significantly influence this component of the environment
7. Offensive odors	D	D	Work should not lead to this kind of pollution
Natural environment			
8. Protected area	D	D	No protected area presence in the project area to date
9. Ecosystems	C	D	C: Most roads are to be rehabilitated, loss of forest cover would be minimal Removal of wildlife species O: No impact expected
10. Hydrology	D	B+	C: Work should not have an impact on stream flow O: Coating erosion-reducing wheels mud deposits in streams should decrease
11. Geographical features	D	D	No activity will significantly influence this component of the environment
Social environment			
12. Land acquisition, Involuntary resettlement	B−	D	PC : In the case of existing road repairs no administrative formalities are required; Land acquisitions may be required. No planned resettlement of populations.
13. Pour	B−	B+	C : Vulnerable populations may live on vulnerable populations O : Road surfacing will have a positive impact in facilitating access to school, care and other social services and the market
14. Indigenous or ethnic people	D	D	No expected impact on minorities and indigenous peoples
15. Local economies, such as employment, livelihood	D	A+	C : No impact expected O : Dynamization of the local economy, that is to say that the competition on the production of rice but also of the other crops will be accentuated. The marketing of production sites will increase and the costs of transport in particular of products grown by women will decrease. The time spent repairing the tracks will be assigned to field work.
16. Land use and utilization of local resources	B−	C	PC : Continuation of land acquisition processes due to road repairs C : Temporary occupation of part of the land for auxiliary roads O : Pay attention to the reallocation of arable land to users
17. Water usage	B−	C	C : Risk of impact on muddy waters in the event of the use of watercourses in the vicinity of hazardous works O : Watercourse management by users at irrigated sites
18. Existing social infrastructures and services	B−	A+	C : Risk of deterioration of access to infrastructure and social services caused by the work O : Stabilization of the distribution of agglomerations in rural areas which should contribute to their social development
19. Social institutions such as social infrastructure and local decision-making institutions	D	B+	C : No impact expected O : Stabilization of the distribution of agglomerations in rural areas which should contribute to their social development.
20. Misdistribution of benefits and damages	D	B−	C : No impact expected O : People from elsewhere benefit from the project to the detriment of the natives.
21. Local conflicts of interest	D	B−	C : No impact expected O : Probability of the occurrence of social conflicts arises due to the redistribution of arable land to users

Evaluation items	Evaluation*		Reason
	PC/C	O	
22. Cultural heritage	C	D	C : No cultural heritage site is present on the internal and external perimeter of the works. Monuments and / or archaeological and cultural sites could be destroyed O : No impact expected
23. Landscape	B−	D	C : The landscapes will be temporarily affected by the work C : With existing roads repaired, no impact is expected.
24. Gender	D	B+	C : No impact expected O : Transactions in local markets will be improved, which should benefit women in particular
25. Children's rights	D	B+	C : No impact expected O : Improved access to hygiene and education and increased parental incomes (officials) guaranteeing children's right to care and education.
26. Infectious diseases such as HIV/AIDS	B−	D	C : Brewing of populations, presence of unmarried workers O : No impact expected
27. Working condition	B−	B+	C : Disruption of local activities O : Connecting rural areas to urban centers
Other			
28. Accidents	B−	B−	C : Attention must be paid to the risks of accidents during work O : Increase in road accidents due to increased traffic
29. Transboundary issues / climate change	C	B+	C : The impact of climate change and border crossing is unknown O : The establishment of infrastructures will facilitate the interconnection between the different localities

Source: JICA Study Mission

PC/C: Pre Construction stage/ Construction stage
O: Operation stage

A+/−: Significant impact (positive / negative)
B+/−: Average impact (positive / negative)
C: Unknown impact (need to check during study)
D: Nearly zero impact

(2) TORs for the environmental and social impact study

Since the access road development component covers multiple regions by this project, three ESIA were carried out in North-West, Central and Southern Regions respectively (detailed ESIA for North-West Region and 2 simplified ESIAs for Central and Southern Regions). As the TOR of the ESIA is to be approved by the Cameroonian environmental authorities, they were drawn up in accordance with the Environmental Protection Decree No. 0001 / MINEPDED 2007, which stipulates the contents of the TOR of the ESIA. These TORs are summarized in the table below. The TORs are identical for the detailed ESIAs and the summary ESIAs but the public hearings are not required after the completion of the summary ESIAs. Stakeholder consultations shall be organized independently of the public hearing, which is defined in the Cameroonian system.

Table 5.1.13 Summary of TORs for Environmental and Social Impact Assessments

Elements of study	Description	Methods
Analysis of the initial environmental situation at the project site	- Determination of the study area - Description of the environmental components: physical environment, biotic environment, socio-economic environment, human environment	- Field study, review of existing documentation
Project description	- Preparation of the project summary	- Review of existing documentation
Analysis of alternatives	- Examination of alternatives from technical, environmental and economic points of view	- Review of existing documentation, comparative review
Legal and Institutional Framework	- Audit of the judicial system	- Review of existing documentation
Public Consultation	- Consultation of interested parties (local inhabitants, regional branches of relevant agencies and ministries, land administration authorities and traditional authorities)	- Conducting group interviews and individual interviews during the study period
Identification and assessment of impacts	- Impact identification: nature of impact, scope, scope, duration, accuracy, reversibility - Impact assessment	- Field review, review of existing documentation - Development of an Environmental Checklist
Determination of Mitigation Measures and Cost of Measures	- Measures that are acceptable for preventing, avoiding or mitigating negative impacts - Compensation to victims of impacts that cannot	- Field review, review of existing documentation

Elements of study	Description	Methods
	be mitigated - Compensation for remaining impacts after the adoption of mitigation measures - Measures to optimize positive impacts - Measures to protect the traditional rights of ethnic minorities and aboriginals in the target region of the project	
Development of Environmental and Social Management Plan	- Proposed measures - Purpose of the measures - Means deployed to achieve the goal - Application of those means: considerations and processes - Cost of measurements - Objectively verifiable indicators (OVI) - Implementing agency - Organization of supervision or follow-up	- This includes the mechanisms for supervision or monitoring of the project.
Development of resettlement plan	- Development of a resettlement plan in the event of involuntary resettlement or land expropriation	- Field study (socio-economic study, study of the value of expropriation, etc.)
Public hearing	- Assistance with Public Hearing	- Implementation by environmental authorities after submission of ESIA reports

5.1.7 Stakeholder Consultations

Public consultations were organized in accordance with the principles and rules governing public participation in Cameroon. Prior to the field descent, newsletters were used to disseminate information to most of the stakeholders residing in the project's host sites. The targeted stakeholders were:

- The administrative and sectoral authorities at the level of the Ndop and Balikumbat Boroughs;
- Traditional authorities in the villages of Bamali, Balikumbat, Babungo, Bamessing, Babanki, Bamunka and Bambalang;
- People living near the project sites;
- Organized groups (NGOs, GICs, etc.).

These consultations took place in three main phases:

- contacting the administrative authorities for the scheduling of collective meetings;
- individual consultations (resource persons identified in deconcentrated public administrations)
- meetings with traditional dignitaries
- meetings extended to the general public.

The minutes of each individual and public consultation are attached.

(1) Individual Consultations

1) Northwest Region

From 18 to 21 July 2016, meetings were held with the administrative authorities in the department of Ngoketunjia (MINEPDED, MINADER, MINDCAF, MINFOF and MINAS), UNVDA, and sub-prefects and mayors of Ndop and Balikumbat, to summarize the project and to explain the execution of the consultation of the local inhabitants. The content of these discussions is as shown in the table below.

Table 5.1.14 Synthesis of Exchanges with Resource Persons (Northwest Region)

Topics	Opinions
Acceptation of the Project by the local authorities of Ngoketunjia	- Irrigating rice fields will improve the yield of rice production - Transforming rice causes pollution that impacts on global warming - Maintaining roads will improve the agricultural market - To promote the substantial improvement of the living conditions of the riparian populations through the opening up of their locality, by boosting agricultural production - Facilitate the flow of products to markets - Unlocking the district of Balikumbat undoubtedly helps to boost agriculture
Fears and negative impacts that the project is likely to generate	- Large-scale destruction of the already very hostile natural environment - Disposal of the populations of their land - No compensation or misappropriation of funds - Multiplication of land and family conflicts - Increase in social scourges
Recommendations of the authorities for the success of the project	- To carry out studies in the identification of the species that can benefit from reforestation in view of the regulation of the water regime - Involve local populations - Evaluate affected populations and destroyed property - Compensation and psychosocial support for victims - Recruit massively local youth - Provide good water piping to avoid flooding, as the area is essentially swampy. - To be in close collaboration with the administrative and traditional authorities

2) Central Region

From 16 to 19 August 2016, meetings were held with the departmental delegates of MINADER, MINEPDED and MINTP in Lékié, Nyong and Mfoumou and with the sous-préfet of Akonolinga. The content of these discussions is summarized in the table below.

Table 5.1.15 Synthesis of Exchanges with Resource Persons (Central Region)

Structures encountered	Vision of the project by resource persons	Concerns and Recommendations of Resource Persons
Departmental Delegate of MINADER (Nyong and Mfoumou)	- In the opinion of Mr. ZE FOUDA Jean Marie, the Department of Nyong and Mfoumou is very enclosed and several roads are impassable in the rainy season. As a result, people have enormous problems in evacuating agricultural products. Thus the project is a very good thing for this locality whose most important products are coffee and plantain.	- It advocates the inclusion of the sectors concerned by the project to a total inclusion of the work of realization of the project.
MINTP Departmental Delegate (Nyong and Mfoumou)	- According to Jean Pierre NOAH, the project is very important in view of the practicable road infrastructures that will be increased.	- The problem that one might encounter when rehabilitating a road is its slippery character in the rainy season. So motorists and motorcycle drivers will have to be very careful. It's not about building roads, but about maintaining them. Also the populations will have to reorganize themselves in committee of route for the weeding of the approaches of the roads and the clearing of the channels.
The Sub-Prefect of the Borough of Akonolinga	- For Mr. WOULSOU Jacques, the project to rehabilitate rural roads, particularly that of Menguemessi-Koundou, passing through the village of Até is a very good project for local people. Especially since it was long ago that a bulldozer did not redo the route of this road.	- The problem we could face is insecurity. To remedy this, road committees should be revitalized effectively.
Departmental Delegate of MINADER (Lékié)	- Mr. NDOMO Mathurin welcomed the arrival of this project for the rehabilitation of rural roads. The rehabilitated roads will certainly allow the local populations to easily evacuate their productions. This will alleviate the cost of living in the locality.	- The problem we may encounter would come from the trucks of sand and gravel that will strew these roads. We can add the loggers. All use heavy equipment that easily damages the road. To address this problem, barriers to crossing structures and the deployment of rangers on some of these roads should be installed. We should not feed populations of hopes in vain. We all wish here that the project is carried out as soon as possible.
Departmental Delegate of MINEPDED (Lékié)	- The project will have many positive impacts, in particular the creation of employment for young people and the socio-economic development of villages on the routes.	- The risks that we can have are: the proliferation of STDs, lung diseases and especially the increase in the cost of food during work and accidents at work.

Source: JICA Study Team

3) Southern Region

The meetings were carried out from 2 to 5 August 2016, with the Delegates of decentralized services of MINADER, MINEPDED, MINFOF and MINTP. They welcomed the project. With the exception of the Delegate of MINFOF, who did not see the project as a good thing, because the open and improved roads will increase poaching and illegal trade of timber. The main results of these discussions are as shown in the table below.

Table 5.1.16 Synthesis of Exchanges with Resource Persons (Southern Region)

Structures encountered	Vision of the project by resource persons	Concerns and Recommendations of Resource Persons
Departmental Delegate of MINADER (Mvila)	- - According to Mr. Eyame Gustave, the initiative of the Ministry to take charge of the opening up of the production basins is to be congratulated and to encourage. On the agro pastoral level, this will allow a good evacuation of the products that will be delivered in the markets at residual prices.	- The problem would arise from the quality of the work carried out during the implementation of the project. The promoter of the project should recruit a credible and well-known provider to carry out the work. There should also be permanent control of the work from the beginning to the end by approved experts.
Departmental Delegate of MINEPDED (Mvila)	- For Mr. BARE Salihou, the implementation of this project will enable local populations to easily transport their products to marketing areas. This will improve the living conditions of the population.	- The risks are mainly related to the waste generated during the implementation of the project. We can retain domestic and hazardous waste. We can also cite the felling of trees in places. To remedy this problem, it is necessary to collect the household waste and make it available to the Commune for transport and storage in communal landfills. For hazardous waste to be tied with an approved structure for the treatment of the said waste. And we need to educate employees. It is also necessary to create green spaces.
MINTP Departmental Delegate (Mvila)	- According to Jean Marie ZIBI NDONGO, everything concerning road maintenance makes it possible to improve the living conditions of the populations. In addition, the road from Ngoulemakong-Biwong-Bane will be a shortcut to get to Kribi.	- The road will improve the movement of people. This will accentuate STDs, theft, sale of land, conflicts, trials, etc. We can add the non-respect of the achievement standards caused by the modesty of the envelope and amateurism. - It proposes that the work be realized according to the respect of the norms with a minimum of seriousness
MINFOF Departmental Delegate (Mvila)	- For Mr. Christian Manga-Bell Epie, the project to improve rural infrastructure in the southern region is a worthwhile and encouraging project.	- These rehabilitated tracks can facilitate or accentuate poaching. And roads should not be created in managed forests (UEFA, communal forest). Moreover, these rehabilitated trails could lead riparian populations to create fields in managed forests.
The Sub-prefect of the Borough of Biwong-Bulu	- In favor of Mr. ABALI Simon AKIME, the project is welcome in the locality which is missing almost everything.	- There are still many roads to be rehabilitated in the Borough. We are hopeful that this project is only the beginning of a series of projects that will open up the Borough.
Mr. Sub-Prefect of the NNgoulemakong Borough	- For Mr. NAMA Cosmas Thierry, Sub-prefect of the NNgoulemakong Borough, the project is a good thing because it is strongly awaited by the local populations. This project will substantially improve the living conditions of local populations. The NNgoulemakong-Biwong-Bané axis will easily connect the city of Sangmélima to Kribi. There will be only positive impacts. He is also ready to make every effort to facilitate the work	

Source: JICA Study Mission

(2) Public Consultations

Following separate interviews with the administrative organizations, public consultations were conducted to gather the people's opinions on the basis of the explanations for the need to conduct studies on environmental considerations and Social partnerships.

1) North West Region

From 20 to 28 July 2016, public consultations were held in each of the seven targeted villages. The following table adequately illustrates the level of community participation at scheduled community

meetings.

Table 5.1.17 Level of Participation in Public Consultation Meetings (Northwest Region)

Arrondissement	Concerned Village	Meeting place	Date	Number of participants			
				H	F	Total	Including traditional dignitaries
Ndop	Bamali	Chefferie	2016/07/20	41	16	57	7
	Babungo		20160/7/23	11	3	14	4
	Bamessing		2016/07/25	25	1	26	13
	Babanki	Party hall	2016/07/26	43	19	62	1
	Bamunka	Chefferie	2016/07/27	23	3	26	1
	Bambalang		2016/07/28	17	8	25	3
Balikumbat	Balikumbat	Town hall	2016/07/21	35	12	47	1
			TOTAL	195	62	257	30

Source: JICA Study Mission

The main concerns, expectations and proposals of the inhabitants with regard to the implementation of the project are as presented in the table below.

Table 5.1.18 Synthesis of Concerns and Expectations of Populations (Northwest Region)

Stakeholders	Preoccupations	Expectations / Suggestions
Villages of the district of Ndop	- Will the Project generate employment in the village; - Road rehabilitation problems; - Problems of the people impacted by the project; - Risk of destruction of property - Right-of-way; - Staffing problems in the project; - Development of infrastructure other than that provided for in the project; - Lack of communication. - Risks of a new deportation of the project to Ndop	- Improving the living environment of local populations; - Provide local communities with school, health and sports facilities; - Provide villages with health centers with adequate facilities for first aid in case of accidents or serious illness; - Involvement of local organizations in the restitution of ESIA to explain and educate the public on the findings of the study during the public hearings. - Effective rehabilitation of agricultural equipment on the UNDVA site still existing in Babungo. - We are eager to see the project come back to its source.
Villages of the district of Balikumbat	- Removal of the base-life from the village; - Concerns about the impact of the project on communities; - Risk of destruction of people's property; - Risk of accidents related to the project.	- Make recruitment on an objective basis giving equal opportunities to all applicants and relying as much as possible on traditional leaders; - Support the populations in improving their living environment.

Source: JICA Study Mission

2) Central region

From 17 to 19 August 2016, public consultations were organized in each of the three target villages (Nkolédouma, Koundou and Menguemessi). In each village, the number of participants was as shown in the table below.

Table 5.1.19 Level of Participation in Public Consultation Meetings (Central Region)

Arrondissement	Concerned Village	Meeting place	Date	Number of participants			
				H	F	Total	Including traditional dignitaries
Obala	Nkoledouma	Chefferie	2016/08/17	45	2	47	3
Mengan	Koundou	Chefferie	2016/08/18	15	2	17	4
Akonolonga	Menguemesi	Chefferie	2016/08/19	19	2	21	7
			TOTAL	79	6	85	14

Source: JICA Study Mission

The main concerns, expectations and proposals of the inhabitants with regard to the implementation

of the project are as presented in the table below.

Table 5.1.20 Summary of Population Expectations and Concerns (Central Region)

Stakeholders	Preoccupations	Expectations / Benefits
Nkoledouma	- Destruction of private property (land, plantation fields) - Soil vibrations caused by gear that can crack the walls of habitats - Accident increase	- Development of playgrounds near the Edouma River, Bilon and Mbelle II; - Construction of drinking water points in Nkolnana, Bilon, Mbelle I; - Recruitment of young people during the execution of works; - Reduction of turns; - Reinstatement at a reasonable height of electric cables trailing on the ground - Bitumage of the different axes; - Development of donkey backs along roads; - Installation of signs.
Koundou	- Non-realization of the project - Failure to respect local customs and practices on the part of the workers	- Grading of the current site of the primary school located at the chieftaincy; - Development of a playground; - Recruitment of young people during the execution of the work - Construction of water points (wells or boreholes) in the following districts: Effanden, Nkodo, Chefferie - Rehabilitation of the transformer whose defection caused the absence of electricity in the Nkodo district for 17 months; - Rehabilitation of 10 defective poles; - Extension of the electricity network on the axis: Nkodo-Mindie: 3 km - Respect for local customs and customs
Menguemessi	- Non-realization of the project	- Rehabilitation of the axes : ✓ Ngulbitangan-Menguemesi 25 km ✓ Menguemesi-Mekomo 35 km ✓ Menguemesi-Nkoloboudou 15 km ✓ Menguemesi-Nlembéyezoum 35 km - Implementation of an agricultural project framed with maize, rice, bananas and plantains - Opening of the road on the axis Carrefour Assia-Ngoulmeboo 2 km.

Source: JICA Study Mission

3) Southern Region

On 3 and 4 August 2016, public consultations were held with the inhabitants of the two targeted villages (Nkolbityé and Enamngal). In each village, the number of participants was as shown in the table below.

Table 5.1.21 Level of Participation in Public Consultation Meetings (Southern Region)

Arrondissement	Concerned Village	Meeting place	Date	Number of participants			
				H	F	Total	Including traditional dignitaires
Niwong Bulu	Nkolbityé	Chefferie	2016/08/03	27	3	30	8
Ngoulemakong	Enamngal	Chefferie	2016/08/04	13	0	13	5
			TOTAL	40	3	43	13

Source: JICA Study Mission

The main concerns, expectations and proposals of the inhabitants with regard to the implementation of the project are as presented in the table below.

Table 5.1.22 Summary of Population's Expectations and Concerns (Southern Region)

Stakeholders	Preoccupations	Expectations / Benefits
Nkolbityé	- Non-realization of the project	- - Extension of culverts to allow passage of two trucks at the same time - - Quality work during the execution of the project
Enamengal	- Non-realization of the project	- Rehabilitation of roads leading to these villages: Essingang- Milaba- Mfida- Nsoumou- Bekong

Source: JICA Study Mission

(3) Other

The ESIA reports should be submitted by the promoter of the Project (MINADER), to MINEPDED. MINEPDED will determine whether or not a public hearing will be held after receipt of the report, disclose the report and create an opportunity to hear stakeholder input at the local level (in the case of a detailed study. No public hearing will be held). With respect to the Northwest Region, given that a detailed study will be conducted, a public hearing should be held normally, but it was not held due to the MINEPDED's decision. Together with the simplified ESIAs not requiring public hearing, debriefing meetings with stakeholders were held for their consent. The results of those stakeholders meetings are as described below (5.2.10 Public consultation).

5.1.8 Results of Environmental and Social Considerations (including expected results)

(1) Summaries of the results

The results of the study of environmental and social considerations carried out on the basis of the framing are as summarized in the table below.

Table 5.1.23 Summary of EIA Study Results

Evaluation item	Survey results
1. Air	During the construction phase, releases to air will be constituted of fumes and exhaust gases (CO2, NOx) resulting from the combustion of fuels, dust from earth-moving activities and the movement of vehicles and gear. These dust in particular dry season and gas emissions are likely to contribute to air pollution on the one hand and, creating certain health problems to people exposed on the other hand. In sum, degradation of air quality may affect the general health of the riparian population. This impact is negative but very weak because it is short-lived, punctual, low intensity. During the operation phase, there will be small amounts of dust because the quality of the work (reprofiling with laterization) will limit the dust and this will only last for dry seasons (6 months maximum). On the other hand, vehicle exhaust emissions will be observed throughout the year. This impact is negative and very low because not all vehicles will produce gas and road traffic will certainly be increased but of low intensity.
2. Water	Surface waters that are very abundant in the study area could be affected by accidental spills of hydrocarbons, oils or any other liquid effluent generated by project activities. These include the activities of the pre-construction / construction phase (clearance of rights-of-way, waste management, and maintenance of equipment). These waters could also be affected during the exploitation phase of the irrigated perimeters following the accidental spills of the phytosanitary products. These pollution risks can be direct or indirect. They constitute a potential danger both for the populations that make use of water and for the fauna and the aquatic flora that lives there. Groundwater, on the other hand, may be affected by the phenomenon of infiltration into the aquifers of hydrocarbons or oils spilled on the ground. We will therefore have a negative impact of low intensity, of short duration, of punctual, direct and indirect, reversible and probable extent.
3. Waste	From the beginning of the work of much solid and liquid waste will be generated. For solid wastes (biodegradable and non-biodegradable), it is possible to note food, plastic, vegetable waste ... As far as liquid waste is concerned, it could be used wastewater and waste oils, Lives. During the operating phase, solid wastes (plastics, damaged parts of vehicles, etc.), liquid waste (oil and other hydrocarbons) and gaseous waste (exhaust gases) will also be observed. During the construction or operation phase, with poor waste management (in the worst case scenario), the impact will be low intensity, long-term and one-off, direct and indirect, irreversible but likely.
4. Soil	Soil pollution could occur at all phases of the project, from accidental spills of oil (when draining or repairing construction equipment), from uncontrolled discharge of toxic solid waste, such as product packaging Chemicals used to boost agricultural production and liquid effluents, etc. The embankments and / or cuttings made during the clearing of the rights-of-way and the development of the site of the storage silo will lead to a compaction and a localized rearrangement of the soils. This may result in soil compaction and soil sealing due to the repeated passage of gear, slowing the re-growth of the vegetation and, on the other hand, soil leaching due to the phenomenon of erosion, the consequences of which could be eutrophication, sedimentation and siltation of watercourses. In either case, there will be a disruption of soil properties. Changes in soil properties could also occur during the exploitation phase of irrigated areas with the use of unapproved agricultural chemical inputs (pesticides) from contraband products / even from neighboring countries, Subject to homologation by the National Commission. However, this impact cannot be attributed to the project because the use of unregistered fertilizers is very often the result of farmers who want to maximize their profit without taking account of the rules. There will be a negative impact of low intensity, long duration, point, probable, cumulative but reversible.
5. Noise and vibration	In the pre-construction / construction phase, the main sources of noise will be related to civil works (excavations, earthworks, excavations); The transportation / unloading of materials and the movement of heavy machinery. These noises may be liable to affect the hearing ability of the workers performing the tasks and those of the neighboring populations. During the operating phase, there will be very little vibration but there will be constant noise from vehicles passing through. Noises whose intensities will vary according to the quality of the vehicles (old, new, well maintained or poorly maintained). We will have a negative impact of low intensity, long duration, point, direct, unlikely and irreversible extent.
6. Ground subsidence	There is no indication of the subsidence of land in the context of the present project.
7. Offensive odors	The development of the canals will generate foul odors that will harm the tranquility of the riparian populations. These odors can also come from the use of certain chemicals, including phytosanitary agents. We would like to point out that this is not an impact attributable to the project, but rather to the local residents who will show civic responsibility or not.
Natural environment	
8. Protected area	No protected area presence in the project area to date

Evaluation item	Survey results
9. Ecosystems	During the construction phase, the clearing of the rights-of-way and the earthworks of the sites will lead to an insignificant destruction of the vegetation cover. Because the roads are existing and no road will be open. These activities will lead to the disappearance of the vegetation cover and the development (annual and perennial crops) of the populations of the project area. In addition, some non-wood forest products (medicinal plants), such as Voacanga sp., Which are highly valued in the study area for their therapeutic properties, will be destroyed. The development of irrigated perimeters (earthworks, transport and spreading of laterite) and farming (use of agricultural inputs) will disrupt fish species (fish, crabs, etc.) in their biotope. This could lead to their disappearance.
10. Hydrology	The construction of 1 bridge and 2 culverts (scuppers) on the NW1 axis and 1 culvert on the NW2 axis and the rehabilitation of 9 bridges on the S2 axis are planned. Channel placement during bridge and culvert construction can cause disturbance downstream of streams. There is no impact on hydrology on the S2 axis because the bridge works are the rehabilitations of the upper part of the architecture. No impact is expected during construction on the hydrology of the project areas. Given that it is not expected that the quantities of water supplied to irrigated land will not increase by the completion of the works, no water impacts are envisaged. The coating of wheels reducing erosion mud deposits in streams should decrease
11. Geographical features	No disturbance of topography or relief is expected.
Social environment	
12. Land acquisition, Involuntary resettlement	Clearing the right-of-way of the road will result in loss of individual and collective property. For individual goods, these are constructions, annual crops and perennials. As for public goods, the sacred trees (Bamali-Balikumbat and Balikumbat-center boundaries), communal infrastructure in particular in Balikumbat (Small Market) and annual and perennial crops of institutions (schools, churches, etc.) The study area. The rehabilitation of roads will affect about 1.44 ha areas of land (residence 0.07 ha, arable land 1.36 ha) and 435 people and will not cause any displacement among the populations as roads already exist. The same applies to the processing plant and the storage silo which will be built on a site belonging to the UNVDA.
13. Poor	Vulnerable people are not at risk throughout the project. On the contrary, they will see their living conditions improved with the roads rehabilitated which will allow them to make easy movements. There are women heads of households among vulnerable people find themselves having property to be destroyed in the project, the necessary compensation will have to be proposed.
14. Indigenous or ethnic people	To the sociable character of the societies of three regions involved in the project, all ethnic minorities are well integrated into their host community. Thus, if it turns out that people from ethnic minorities end up with property to be destroyed, they would be compensated in the same way as indigenous peoples. In the project area, there are no minority or indigenous peoples who should be given special attention to their rights In the project area, there are no minority or indigenous peoples that should be given particular attention to their rights
15. Local economies, such as employment, livelihood	The Project is undeniably an opportunity to boost the economy in the departments that will benefit from the project. Indeed, the economies of the zones are highly dependent on agrarian activities and especially on rice cultivation. The reorganization of agricultural roads is awaited by farmers who see it as a panacea for agricultural development. It will undoubtedly generate positive externalities on all other sectors of the economy. The labor requirements will be quite high in this project. Apart from the teams of workers settled in the bases during the construction period, young people from the neighboring villages can be recruited as a priority for the project's work. Because of the proximity of the project, and especially for activities not requiring a proven expertise. Increased requirements for food and other staple foods due to the high presence of this workforce can increase trade and other lucrative activities around the project site, including subcontracting (cleaning , Guarding, etc.). So we will have a positive impact. Moreover, this impact can be perpetuated in the exploitation phase with an agricultural sector that has become more attractive.
16. Land use and utilization of local resources	The land constitutes a very important economic resource in the project area. Indeed, the economy of the locality is highly dependent on agrarian activities. There will be no negative impact on land use because in the Ndop area the land to be cultivated is already owned by UNVDA. Although the cultivated land in the road right-of-way (total about 1.55 ha) 397 people are affected ,. This is a virtually nil impact. Although the system for the equal reduction of agricultural land is applied by UNDVA, the redevelopment area will greatly exceed the current crop area, the reduction of land that compensation is required is not necessarily foreseen. In addition, this is even a positive impact since the redevelopment of irrigated perimeters will enable the efficient use of land, including those currently exploited.

Evaluation item	Survey results
17. Water usage	The water resource is very abundant in the study area. We do not see a scarcity of this resource during the works. At the time of operation, irrigation facilities are not expected to be removed more than now, and the lack of water resources is not assumed. At the time of operation, irrigation facilities are not expected to be removed more than now, and the lack of water resources is not assumed.
18. Existing social infrastructures and services	Existing social infrastructures such as roads are far from satisfying the needs of the populations, and they are sharply lacking. This project is therefore highly anticipated by the populations who see it as a panacea. The development of roads will make it possible to improve the living environment of the riparian populations by facilitating easy access to the various social services which are sometimes very distant such as: education, health, wells and boreholes. This is a positive impact. As part of the rural road development in the North West region, a toll and a bouchérie belongs to the commune of Balikounbat (total 46,5 n ²), the hedges of school of Bambalang (30 m ²) The object of land acquisition. As part of the rural road development in the North West region, a toll and a bouchérie belongs to the commune of Balikounbat (total 46,5 n ²), the hedges of school of Bambalang (30 m ²) The object of land acquisition.
19. Social institutions such as social infrastructure and local decision-making institutions	Decision-making at the local level takes place within the Chefferies, which are auxiliaries of the administration. The Chief (Fon) and his notables are highly respected by the populations, as regards the Ndop region. In the Central and South regions decisions are made in a collegiate manner between the village chief and his notables. The project will have a positive impact in all three regions because it will facilitate the accessibility of populations to decision-making bodies in their locality (sub-prefecture, town hall, borough delegations and even at the departmental level)
20. Misdistribution of benefits and damages	In all three regions, inequities would arise in the sharing of benefits in terms of compensation and employment for local populations (some families may benefit more than others). But this is likely because if the compensation authorities are working properly and the people are recruited fairly, there will be no problems. If the re-allocation of the plot in irrigation facilities will not be carried out properly, it may be a factor in the unequal distribution of damage and benefits. It is necessary to make an equitable distribution in consultation with the water management committees. If the re-allocation of the plot in irrigation facilities will not be carried out properly, it may be a factor in the unequal distribution of damage and benefits. It is necessary to make an equitable distribution in consultation with the water management committees.
21. Local conflicts of interest	Poor management of recruitment and / or unfair dismissals of local employees could lead to frustrations that could lead to social conflicts in the study area. Moreover, the management of irrigated perimeters, notably the fragmentation (establishment of plots with a surface area of 100m x 30m each), is likely to lead to conflicts (farmers - farmers). Indeed, the existing compartments have been constituted in a random manner and are generally of reduced dimensions. The setting up of the new plots will cause unrest among farmers who do not wish to share their plots.
22. Cultural heritage	The realization of this project in addition to the loss of property, could result in the partial loss of a sacred forest (Bamali). In addition, earthworks will result in the exhumation of four (04) tombs including 01 falls in Bamali and 03 in Bamessing. This impact remains null because the populations, in their totalities, gave their approval in return for a symbolic compensation
23. Landscape	The dislocation of the landscape during the works, but significant negative impacts on the landscape are not expected.
24. Gender	The social relations between men and women are likely to promote local development. These women are the leading actors in agricultural activity. During the construction phase, women will see their activities disrupted for work. This is insignificant in view of the profit they will make during implementation. They will have the opportunity to increase their incomes and to take better care of themselves and therefore be more autonomous. This is a positive impact.
25. Children's rights	In the study area, children are generally enrolled in school. However, there is insufficient health coverage due to a lack of health facilities. In general, local mentalities do not endorse child labor. Thus, whether in the construction or implementation phase, there will be very isolated cases of children not attending school. This cannot be attributed to the project. The impact will be positive because, given the economic development of remote areas thanks to rehabilitated roads, the rights of children will be better taken into account by the populations.
26. Infectious diseases such as HIV/AIDS	The presence of a large number of workers to complete this project poses a risk of new diseases, including STI / HIV / AIDS and unwanted pregnancies. But this will be done only during the duration of the work so the impact is certainly negative but too weak. During implementation, no impact was recorded from the changes made by the project.
27. Working condition	During the construction phase, if all the measures of the law 92/007 of August 14, 1992, bearing the labor code are respected, the workers will work in good conditions. However, we cannot omit the risk of accidents. In the exploitation phase, at the Ndop level, rice farmers will work under better conditions, thanks in large part to the rehabilitated roads and the monitoring of UNDVA.

Evaluation item	Survey results
Others	
28. Accidents	Whether in the phase of construction or implementation of accident prevention measures will be applied throughout the construction site. Nevertheless, one cannot omit the fact that accidents could occur during these two stages.
29. Trans-boundary issues / climate change	No impact is expected. During the construction phase, since the sites will not reach any borders, we see no impact. In the operating phase especially in Ndop neighboring Nigeria represents a large potential market to conquer. Moreover, the possible arrival of Nigerian nationals will foster sub-regional integration and inter-community understanding

(2) Environmental Checklist

The environmental checklist is as set out in the Annex.

5.1.9 Impact Assessments

The table below summarizes the environmental and social impact of the Project on the basis of the results obtained under the ESIA.

Table 5.1.24 Environmental and Social Assessment Results

Evaluation items	Scoping result		Evaluation		Reason
	PC/C	O	PC/C	O	
Pollution					
1. Air	B−	B−	B−	B−	C : Releases to air of fumes and exhaust gases (CO2, NOx) resulting from combustion of fuels, dust from earth-moving activities and vehicular traffic O : Air pollution due to dust removal caused by road traffic, exhaust and speeding
2. Water	B−	D	B−	B−	C : Accidental spills of hydrocarbons, oils or other liquid effluent generated by project activities. These discharges could affect groundwater through the phenomenon of seepage into the aquifers of hydrocarbons or oils spilled on the ground. O : These waters could also be affected during the exploitation phase of the irrigated perimeters following the accidental spills of the phyto-sanitary products. These pollution risks can be direct or indirect. They constitute a potential danger both for the populations that make use of water and for the fauna and the aquatic flora that lives there.
3. Waste	B−	D	B−	B−	C : Contamination of water and soil can occur due to inappropriate management of solid and liquid waste. O : Respect of the use of approved chemicals is required. Soil contamination due to unauthorized chemical use may occur.
4. Soil	B−	C	B−	B−	C : Soil pollution due to the accidental spill of hydrocarbons; Site remodeling due to site work. O : Probability of soil pollution due to the use of unapproved chemical inputs (uncontrolled discharges of toxic solid waste, etc.)
5. Noise and vibration	B−	B−	B−	B−	C : Noises due to heavy machinery traffic and civil works are likely to affect the hearing power of workers and neighboring populations. O : Noise pollution due to road traffic
6. Ground subsidence	D	D	D	D	No activity is expected that causes land subsidence
7. Offensive odors	D	D	D	B−	C : The development of the canals can generate foul odors. O : Odors can come from the use of certain chemicals (phyto-sanitary)
Natural environment					
8. Protected area	D	D	D	D	No protected area presence in the project area to date

Evaluation items	Scoping result		Evaluation		Reason
	PC/C	O	PC/C	O	
9. Ecosystems	C	D	B−	D	C : Wildlife is virtually non-existent, it is important to preserve the aquatic fauna still present, which could be disturbed by the development work. In addition, clearance of the right-of-way could result in minimal loss of vegetation cover. O : It is not planned to intake more water than the current situation. The water stays in the rainy season, after the service is applied, there is a change in the extent to which the drainage to the downstream is improved only about two months before the rainy season. Impact on aquatic life in downstream by maintenance is not assumed
10. Hydrology	D	B+	B−	C	C : The installation of temporary canals during the construction of bridges / culverts could be disturbed downstream of the rivers O : Lining roads that would reduce erosion would likely result in decreased mud deposits in streams.
11. Geographical features	D	D	D	D	No impact is expected on topography and relief
Social environment					
12. Land acquisition, Involuntary resettlement	B−	D	B−	D	PC : According to field investigations, no physical relocation will be made, just economic displacement (about 300 people could be compensated for the loss of their property).
13. Poor	B−	B+	B−	B+	C : Many female heads of household are in the project area. Most of these women will see their crops destroyed, so special attention should be paid to them in the compensation provided for this purpose. O : Improved road conditions will allow vulnerable people to move easily to markets, schools, health centers and other social services in neighboring communities.
14. Indigenous or ethnic people	D	D	D	D	There are no ethnic minorities and indigenous peoples in the Project area
15. Local economies, such as employment, livelihood	D	A+	B+	B+/−	C : The presence of the local workforce in the project will increase the incomes of young people recruited. And the high demand for food by the site's employees will contribute to the development of local businesses. O : Improved road conditions will allow farmers easy access to urban markets to market their crops.
16. Land use and utilization of local resources	B−	C	B−	B−	PC : It will be necessary to wait for the completion of the land acquisition process to determine the expected level of land use. C : The construction of auxiliary roads could result in temporary land use. O : Exploitation of low-value areas will lead to better irrigation quality. In addition, the reallocation of arable land must be done fairly and fairly.
17. Water usage	B−	C	D	D	C : The water that will be used, for example, for watering roads will be small and therefore will not pollute the surrounding streams O : The water supply in the irrigated perimeters will not increase after the works have been completed. Aun impact has occurred
18. Existing social infrastructures and services	B−	A+	B−	B+	C : During the construction period, populations may have difficulty accessing the various services and infrastructures located in urban centers. Some municipal structures may be subject to compensation due to road rehabilitation works O : Improved road conditions will create several social infrastructures. In addition, it will allow easy access to the various administrative infrastructures.
19. Social institutions such as social infrastructure and local decision-making institutions	D	B+	D	B+	O : Easy access to the administrative services located in the department headquarters will allow the rapprochement between the administration and the populations, as well as rapid decision-making by the traditional authorities, for example, on the advice of the local administrative authority.
20. Misdistribution of benefits and damages	D	C	C	B−	C : The lack of qualification of the local young people could harm them to the benefit of an expertise coming from elsewhere. O : If repartition of parcels is not done correctly, it may be a factor in the unequal distribution of damage and benefits.

Evaluation items	Scoping result		Evaluation		Reason
	PC/C	O	PC/C	O	
21. Local conflicts of interest	D	C	C	B−	C : Poor management of recruitment and / or unfair dismissals of local employees could lead to frustrations that could lead to social conflicts in the study area. Relations between project staff and local residents could be a source of conflict O : The probability of poor redistribution of arable land to users could cause unrest.
22. Cultural heritage	C	D	B−	D	C : There will be a loss of some sacred properties (07 sacred trees and 4 graves), However a reduction in the width of the road is possible depending on the context on the ground.
23. Landscape	B−	D	B−	D	C : Scattered landscape during construction
24. Gender	D	B+	D	B+	O : Women will have the opportunity to take care of themselves
25. Children's rights	D	B+	D	B+	C : In general, people in the project area are not used to child labor. O : In the study area, children are generally enrolled in school. The realization of the project will make it possible to satisfy more the need of the children.
26. Infectious diseases (HIV/AIDS)	B−	D	B−	D	C : The presence of large numbers of workers in the project area will increase the risk of disease outbreaks, including STI / HIV / AIDS and even unwanted pregnancy.
27. Working condition	B−	B+	C	B+	C : If all the measures of the labor law are respected, the workers will work in good conditions. However, we can omit the risk of accidents O : the rice farmers will work under good conditions mainly thanks to the rehabilitated roads and the follow-up of the UNDVA
Other					
28. Accidents	B−	B−	C	C	C/O : Accident prevention measures will be applied throughout the project and even after commissioning, it should not be forgotten that possible accidents could occur during these two stages.
29. Trans-boundary issues / climate change	C	B+	D	C	C : Since the rehabilitated roads will not reach the border, we see no impact O : Neighboring Nigeria represents a large potential market to conquer and the possible arrival of Nigerian nationals will promote sub-regional integration and inter-community understanding

Source: JICA Study Mission

PC: Pre Construction stage
C: Construction stage
O: Operation stage

A+/−: Impact important (positif/négatif)
B+/−: Impact moyen (positif/négatif)
C: Impact probable (nécessité de vérifier pendant l'étude)
D: Impact presque nul

5.1.10 Environmental and Social Measures

The environmental measures examined on the basis of the above study results are as set out below.

Table 5.1.25 Summary of Measures

N°	Impact	Measures
« During Construction »		
Biophysical environment		
1	Dust Emission and Air Pollution	− Cover trucks carrying tarpaulin materials − Control the emission of these dusts by watering the soil as necessary; − Protect workers exposed to this nuisance by Personal Protective Equipment (PPE). − Limit traffic speed on roads and crossing residential areas; − Maintain regularly and appropriately (replacement of the oil, diesel and air filters at the times indicated).
2	Noise	− To minimize the different effects of this impact, it is necessary to limit as far as possible the sources of impact activities at certain periods of the day − Provide workers, especially those working in the vicinity of noise sources, with adequate personal protective equipment (PPE), in order to protect them and thus preserve their auditory acuity.

N°	Impact	Measures
3	Risk of erosion and disturbance of soil properties	− Limit the opening of the surfaces to the strict minimum necessary − Decapate the topsoil throughout its thickness and on sites for temporary use (borrowing, lateritic career). The choice of these sites must respect the minimum distances in relation to the rivers − Rehabilitate sites that are no longer used − Once the roads have been rehabilitated, carry out the grassing of the road berms with plant material appropriate to the characteristics of the local biotope
4	Risk of soil pollution	− Develop a site waste management plan − Avoid the dumping of solid waste or liquid effluents (waste water and waste oil) on the ground − Systematically recover any hazardous waste (oil drain, grease, batteries, oil filter and gas oil etc.) and route it to the approved structures for their treatment.
5	Degradation of surface and ground water	− Avoid the dumping of solid waste or liquid effluents (waste water and waste oils) on the ground and in watercourses; − prohibit the washing or emptying of project vehicles and vehicles in rivers or near bodies of water; − Prevent washing or rinsing of watering cans and vases containing pesticide residues. − Adopt a method (as a sand basin) to minimize disturbed downstream water when building bridges
6	Reduction of vegetation cover and NWFP	− Limit, as far as possible, the right-of-way of the road to the needs of the project − To accompany the populations affected by the project, particularly those who have lost perennial crops, to restore a new floristic diversity − Put the berms on the road with plant material appropriate to the agro-pedological conditions of the study area.
7	Disappearance of aquatic fauna	− Promote fish farming activities in communities in the project area.
Socio-economic and human environment		
8	Loss of individual and collective assets	− Granted to the Persons Affected by the Project (PAP) fair and equitable compensation should be. MINADER, which is the promoter of the project, will have to pay particular attention to vulnerable people, especially female heads of households, who constitute an important part of these PAPs. − For the loss of sacred trees and graves, it must have agreed on the basis of appropriate measures between the community and / or the target population in the presence of the traditional authorities − Plan construction work that minimizes the impact of deviation due to the construction of the bridge is the minimum; And reach agreement by prior consultation with residents if compensation is required
9	Loss of cultural and archaeological heritage	− Before the start of the project, the promoter must organize ceremonies in the villages concerned in order to receive the total consent of the populations..
10	Risks of social conflicts	− Establish a platform for communication with local populations − Inform people about recruitment procedures − Develop a policy of equitable recruitment of premises in collaboration with the traditional authorities − Raise employee awareness of local people's customs and practices − Provide, to the extent possible, multifaceted assistance to the development needs expressed by local populations − Carry out the equitable re-allocation of the irrigation plots in the irrigation area
11	Contribution to the development of the local economy	− Encourage private initiative with the development of related activities (trade, transport, fishing, ecotourism, etc.).
12	Job creation	− n terms of measures, the recruitment of unskilled local labor should be encouraged, in order not only to offer jobs to unemployed young people, but also and above all, local ownership of the project, where the frustration born The use of "premises" may result in vandalism during and after construction. While their recruitment can constitute an element of security and guarantee of preservation and protection of the various sites and the future infrastructures. − It is therefore advisable for the future prime contractor that, with equal competences, priority should be given to the nationals of the villages in the study area.
13	Risk of accidents at work	− Most of the work can be done without too many dangers, Establish strict safety instructions to be enforced by the site supervisor, display safety instructions in hazardous areas − Provide appropriate PPE staff according to the workstation and make it mandatory to use them under penalty of penalty − Provide workers' insurance for possible accidents; − To institute frequent checks on the blood alcohol content of the workers concerned.

N°	Impact	Measures
14	Risk of road accidents	− Ensure that drivers and drivers of recruited gear have a driver's license of the required category − Provide each fire extinguisher vehicle − Making the use of seat belts compulsory for all passengers in a vehicle − Recycle the conductors periodically; − Subscribe to all-risk insurance policies; − Install speed limitation panels. − Extend the roadside 1 m near public facilities such as schools and market (500 m)
15	Risks of increased STI / HIV / AIDS prevalence and unwanted pregnancy	− In order to minimize the impacts of the project on workers' health, the STI / HIV / AIDS program will be strengthened. This program will include an important part of raising awareness of all the categories of the employees who will intervene in the various points of the site and the surrounding populations.
16	Increase in municipal and state revenues	− To improve this positive impact, it will be necessary to ensure that the Project Manager responsible for carrying out the work in the field, as well as all contractors, are in good standing with the Tax Administration and the CNPS; That is, they make their declarations of use, and regularly pay their social contributions and taxes, in accordance with the regulations in force.
« During Operation »		
Biophysical environment		
1	Dust Emission and Air Pollution	− Watering on the roads by the population in the dry season
2	Noise	− To sensitize drivers of vehicles so that they maintain the engines of their vehicles so that they produce less noises
3	Risk of erosion and disturbance of soil properties	− Limit the use of phyto-sanitary products in agricultural areas
5	Degradation of surface and ground water	− Prevent washing or rinsing of watering cans and vases containing pesticide residues − Evaluate the impact of sediment deposition
6	Reduction of vegetation cover and NWFP	− To accompany the populations affected by the project, particularly those who have lost perennial crops, to restore a new floristic diversity − Establishment of monitoring committees against poaching and regular surveillance
Socio-economic and human environment		
10	Risks of social conflicts	− Equitable distribution of irrigation plots by UNVDA
11	Contribution to the development of the local economy	− Encourage private initiative with the development of related activities (trade, transport, fishing, ecotourism, etc.).
14	Risk of road accidents	− Install speed limitation panels.

Source: JICA Study Mission

5.1.11 Environmental Management Plan and Environmental Monitoring Plan

Based on the results of the ESIA, the Environmental and Social Management Plan (ESMP), the ESMP Monitoring Plan, and the Monitoring Form have been developed (see tables below).

The Project Management Unit (PMU) to be established within MINADER will be responsible for the monitoring of the ESMP. The PMU will be composed of experts with appropriate expertise and experience in the areas covered by the Project. The PMU will monitor the Project in close collaboration with the deconcentrated technical services, including UNVDA, and the municipalities concerned.

In addition, the departmental committees in charge of monitoring the implementation of the ESMP, which will be chaired by the Prefects, will be set up in the departments concerned, and external monitoring will have to be carried out semi-annually. These surveillance reports are sent to the Ministry of environment.

Table 5.1.26 Summary of the Environmental and Social Management Plan (ESMP)

Environmental Measure	N° Impact	Objective	Activity	Actor (s) of implementation	Period	Indicators	Monitoring Actors	Cost (fcfa)
Construction phase								
Development of the environmental component in the company's internal regulations	All impact	- Ensure the effective implementation of the ESMP	- Recruitment of an environmental manager - Integration of social and environmental considerations into company practices and employees	- Enterprise - Environmental manager	- Before the start of work	- Recruitment Contract of person in charge of environment and its presence at the post - Presence of the revised rules incorporating all socio-environmental concerns - Number of sanctions related to non-compliance with environmental requirements	- MINEPDED	
Control of dust emissions	1	- Limit the air pollution	- Cover trucks carrying tarpaulins materials (dust offal) - Sprinkle worksite regularly - Require the use of PPE	- Enterprise and / subcontractors	- From the beginning to the end of work	- Number of covered trucks - Number of complaints from neighbors / residents - Area of worksite sprinkled - Number of workers wearing PPE	- MINADER - MINEPDED - MAIRIE - MINSANTE	14 000 000
Protection against noise	2	- Avoid the health hazard of workers and neighbors/ residents	- Acquire and distribute protective equipment against noise - Adaptation of construction schedules to the habits of the area - Inspection of engines	- Environmental manager	- From the beginning of work until the exploitation phase	- Material discharge sheet - Technical inspection sheet of engines	- MINEPDED - MINSANTE - MINTSS	3 000 000
Limitation of water and soil pollution	3, 4 and 5	- Avoid pollution of soil, surface water and groundwater	- Recovery and shipment of used oil, batteries and filters for recycling supplier	- Environmental manager	- From the start of work	- Environmental activities report - Recovered drums - Monitoring sheet	- MINADER - MINEPDED - MINEE - MINMIDT	
Limitation of the destruction of vegetation and habitat of aquatic fauna	6 and 7	- Reduce the impact of the destruction of trees and medicinal plants - Protect the stream banks and aquatic fauna	- Reforestation of worksites temporarily - Grassing of berms of the road	- Enterprise and / subcontractors	- During the construction phase	- Company's environmental activities report	- MINEPDED - MINADER - MINFOF - Communes	3 000 000

Environmental Measure	N° Impact	Objective	Activity	Actor (s) of implementation	Period	Indicators	Monitoring Actors	Cost (fcfa)
Prevention of conflicts	8 to 10	- Preventing conflict between the company carrying out the work, staff and residents and between residents themselves	- Respect the customs and habits of local people - Creation of a consultation platform for compensation to be paid to people living	- Environmental manager	- From the start of work	- List of PAPs - Complaints registered a result of violations of customs and traditions - Receipt of compensations' payment - Existence of the platform for dialogue to resolve problems certified by a document specifying its mission	- MINEPDED - MINATD	8 000 000
Establishment of a transparent recruitment policy	10	- Recruitment of local labors	- Publication of job offers - Involvement of traditional authorities in the recruitment process - Subscription of employee insurance policy	- Enterprise	- From the start of work	- Number of job offers - Job applications - Employment contract - Insurance Contracts - Number of employed residents	- Enterprise - MINEPDED - MINTSS	
Contribution to local economic development	11 and 12	- Promote the improvement of living conditions of local residents	- Construction of social infrastructures - Promotion of local entrepreneurship	- Enterprise and / subcontractors - Populations - MINADER - Administrative authorities	- From the start of work	- Number and types of social and economical infrastructures built and/ or rehabilitated - Number and type of economic activities developed and / or boosted	- MINADER - MINEPDED - Mayor - EMP monitoring committee	
Observation, evaluation and compensation of lost property	8 and 9	- Compensate People Affected by the Project (PAP) - Comply with legal requirements and international and national standards on involuntary displacement	- Inventory of goods which could beings lost (agricultural products and constructions) - Identification of owners - Compensation	- Commission of observation and evaluation of properties - People Affected - Environmental manager	- Before the start of work	- Rapport du plan d'action et de 5-38laints5-38lation (PAR) - Nombre de personnes indemnisées - Nombre de 5-38laints enregistrées - Rapport du comité local d'indemnisation	- MINEPDED - MINADER/ JICA - MINDCAF - MINTP - MINAS - MINATD	Including in the overall cost of PAR

Environmental Measure	N° Impact	Objective	Activity	Actor (s) of implementation	Period	Indicators	Monitoring Actors	Cost (fcfa)
Prevention of disease and accidents	13 to 15	- Prevent diseases and injuries	- Provision of PPE - Installation nameplates - Alcohol Tests - Information for the residents about the prohibited area and the zone at the risk on worksite - Regular monitoring the health condition of workers - Application of existing measures in health and safety - Awareness against STI / AIDS - Labeling of dangerous products - Insurance of workers	- Environmental manager	- During Pre-Construction / construction and operational phases	- EPI discharge sheets by staff - Construction of signaling - Reporting and outreach report - Plan of Equipment maintenance - Insurance sheet for workers - Sheets for realized awareness (STIs, HIV / AIDS)	- Enterprise MINEPDED - MINSANTE - MINTSS	23 000 000
Operation phase								
Control of dust emissions	1	- Limit the air pollution	- Sprinkle roads regularly	- Population	- Operation phase	- Complaints from neighbors / residents - Frequency of road sprinkled	- MINADER	-
Protection against noise	2	- Avoid the health hazard of workers and neighbors/ residents	- Vehicle driver's awareness so that they maintain the engines of their vehicles so that they produce less noise	- MINADER	- Operation phase	- Material discharge sheet - Technical inspection sheet of engines	- Enterprise - MINEPDED - MINSANTE - MINTSS	1 000 000
Limitation of water and soil pollution	3, 4 and 5	- Avoid pollution of soil, surface water and groundwater	- Limit the use of pesticides in agricultural areas	- UNDVA	- Operation phase	- Monitoring sheet	- MINADER	
Limitation of the destruction of vegetation and habitat of aquatic fauna	6 and 7	- Prevent poaching	- Sensitization - Monitoring of forests by the population	- MINFOF - Population	- Operation phase	- Activity report - Monitoring sheet	- MINADER - MINFOF	500 000
Prevention of conflicts	8 to 10	- Preventing conflict due to the redistribution of irrigation plot	- Equitable distribution of irrigation plots by UNVDA	- UNVDA	- Operation phase	- Situation of redistribution of plots - Complaints des users	- MINADER	
Prevention of disease and accidents	13 to 15	- Prevent and accidents	- Sensitization	- Mayor	- Operation phase	- Activity report - Number of accidents	- MINADER	1 000 000
ESTIMATED GLOBAL COST OF PRESENT EMP								**53 500 000**

Table 5.1.27 ESMP Monitoring Plan

Environmental item	Element	Site	Frequency	Responsible organization	Cost (FCFA)
« Construction Phase »					
- Air quality	- Number of covered trucks - Number of complaints from neighbors/ resident - Area of worksite sprinkled - Number of workers wearing PPE	Construction site and nearby	Monthly	- MINADER - UNVDA	360 000
- Water quality - Waste - Soil contamination	- Recovered drums which contains used oil, batteries and filters - Waste disposal	Construction site and nearby	Monthly	- MINADER - UNVDA	360 000
- Noise and vibrations	- Material discharge sheet - Technical inspection sheet of engines	Construction site and nearby	Monthly	- MINADER - UNVDA	360 000
- Ecosystems - Landscape	- Area cleared - Site restored by plantation - Area grassed on road berks	Construction site and nearby	Quarterly	- MINADER - UNVDA - MINEPDED - MINFOF	120 000
- Land acquisition - Poor - Heritage	- Public Consultations - State of acquisition of land - Proof of Claim Settlement - Number of complaints - Traditional ceremony - Deviation and necessity of compensation	Concerned villages	Quarterly	- CCES - MINADER	120 000
- Monthly MINADER - UNVDA Land use and utilization of local resources	- Complaints registered	Construction site and nearby	Quarterly	- MINADER - UNVDA	120 000
- Existing social infrastructures and service	- Accessibility to the city	Construction site and nearby	Half-yearly	- MINADER - UNVDA	120 000
- Misdistribution of benefits and damages - Local conflict of interest	- Complaints registered a result of violations of customs and traditions - Existence of the platform for dialogue to resolve problems certified by a document specifying its mission - Number of job offers - Job applications - Employment contract - Insurance Contracts - Number of employed residents	Construction site and nearby Concerned villages	Half-yearly	- MINADER - UNVDA	60 000

Environmental item	Element	Site	Frequency	Responsible organization	Cost (FCFA)
- Infectious diseases such as HIV/AIDS - Working condition - Accident	- EPI discharge sheets by staff - Construction of signaling - Reporting and outreach report - Plan of Equipment maintenance - Insurance sheet for workers - Sheets for realized awareness (STIs, HIV/AIDS)	Construction site and nearby	Half-yearly	- MINADER - UNVDA	60 000
« Construction Phase »					
- Water quality - Waste - Soil contamination	- Recovered drums which contains used oil, batteries and filters - Waste disposal - Use of chemical products in irrigated areas	Project site and nearby	Half-yearly	- MINADER - UNVDA	60 000
- Noise and vibrations	- Material distributed - Results of technical inspection of engines - Complaints registered	Project site and nearby	Half-yearly	- MINADER - UNVDA	60 000
- Ecosystems - Landscape	- Site restored by plantation - Area grassed on road berks - Number of illegal logging or poaching	Project site and nearby	Half-yearly	- MINADER - MINFOF	60 000
- Land acquisition	- Number of complaints	Concerned villages	Half-yearly	- MINADER	60 000
- Misdistribution of benefits and damages - Local conflict of interest	- Allocation of irrigation plots for users - Number of complaints	Project site and nearby	Half-yearly	- MINADER	60 000
- Accident	- Maintenance of vehicles - Accidents occurred	Project site and nearby	Half-yearly	- MINADER - UNVDA	60 000
				- **Total**	**2 040 000**

Environmental Monitoring Form (Draft)

Construction phase

1. Development of the environmental component in the company's internal regulations

Monitoring Item	Monitoring results during report period
Recruitment of an environmental manager	
Integration of social and environmental considerations into company practices and employees	

2. Control of dust emissions

Monitoring Item	Monitoring results during report period
Cover trucks carrying tarpaulins materials	
Sprinkle worksite regularly	

Require the use of PPE (personal protective equipment)	
Complaints by local residents	

3. Noise

Monitoring Item	Monitoring results during report period
Acquisition and distribution of protective equipment against noise	
Adaptation of construction schedules to the habits of the construction area	
Inspection of engines	
Complaints by local residents	

4. Water and Soil pollution and Waste

Monitoring Item	Monitoring results during report period
Recovery and shipment of used oil, batteries and filters for recycling supplier	
Quality of river water (pH, TSS, COD, BOD, HC)	

5. Conservation of Ecosystem

Monitoring Item	Monitoring results during report period
Reforestation	
Grassing of berms of the road	

6. Conflict prevention

Monitoring Item	Monitoring results during report period
Distribution of irrigation plots for the users	
Complaints registered and the measures taken	

7. Transparent recruitment policy

Monitoring Item	Monitoring results during report period
Job offers	
Recruitment	
Employee insurance policy	

8. Evaluation, Assessment and compensation

Monitoring Item	Monitoring results during report period
Frequency of public consultation	
Identification of loss of property (area, amount of compensation)	
State of acquisition of land and compensation	
Nbr of deviation put in place, and the need for compensation	
Complaints and Measures	

9. Prevention of disease and accidents

Monitoring Item	Monitoring results during report period
Provision PPE	
Installation of sign, Information for local population	
Awareness against STI/ HIV/AIDS	

Operation phase

1. Noise

Monitoring Item	Monitoring results during report period
Inspection of engines	

2. Water and Soil pollution and Waste

Monitoring Item	Monitoring results during report period
Recovery and shipment of used oil, batteries and filters for recycling supplier	

Utilization of phyto-sanitary products	

3. Conservation of Ecosystem

Monitoring Item	Monitoring results during report period
Reforestation	
Grassing of berms of the road	

4. Conflict prevention

Monitoring Item	Monitoring results during report period
Complaints registered and the measures taken	

5. Evaluation, Assessment and compensation

Monitoring Item	Monitoring results during report period
Nbr of deviation put in place, and the need for compensation	
Complaints and Measures	

6. Prevention of accidents

Monitoring Item	Monitoring results during report period
Accidents occurred	

Source: JICA Study Mission

5.2 Land Acquisition and Relocation of the Populations

5.2.1 Necessity for Land Acquisition and Relocation of the Populations

In the irrigation development component and installation of agricultural equipments component, this project does not involve the acquisition of land and the relocation of the populations. In the access road development component, the acquisition of land will be required in certain areas where the road is to be extended in accordance with Cameroonian standards.

Existing unpaved roads, especially where the shoulders are eroded over time, do not have the original standard width due to the spread of vegetation and crops of nearby residents. Compensation for cropland extending to the roadside is assessed on the basis of the number of agricultural products or the size of the cultivated area and the inhabitants identified during the study have demonstrated Understanding about expropriation for the widening of the road. But since this area has already been expropriated for public use, the inhabitants who cultivate it cannot be compensated under the Cameroonian system.

On the other hand, where the road crosses the villages, in some places it is not possible to obtain sufficient road width because of the presence of buildings or external structures. According to the results of the study, there will be no land acquisition accompanied by physical movement, residents are in favor of rehabilitating the road, and all people affected by the acquisition of land have confirmed their consent.

In order to avoid expropriations, it is possible, if necessary, to make the road less wide than the standard width. In the field study, it was confirmed that the rehabilitation of the road in accordance with the standard will not involve the involuntary resettlement of any of the inhabitants.

5.2.2 Legal framework for Land Acquisitions and Population Displacement

(1) Legal framework

In Cameroon the Ministry of State Property, Cadaster and Land Affairs (MINDCAF) is responsible for the expropriation, populations' relocation and procedures relating to the Law No. 9 of July 4, 1985 and Decree 1872 of December 18, 1987 relating to expropriations for public interest and compensation. The amount of compensation for losses incurred on buildings and crops due to public purpose expropriation is calculated on the basis of the standards and unit prices defined in the November 20th,

1987 Order No 00832-Y.15.1[12]-MINUH-D 000 fixing the venal value calculation basis for the buildings affected by expropriation for public utility purpose and the February 25th, 2003 Decree No2003-418-PM fixing compensation tariffs to be paid to owners whose crops and trees have been destroyed for public interest. The expropriation procedures for public interest as set out in the laws and decrees of Cameroon are shown in Table below.

Table 5.2.1 Expropriation Procedure for Public Interest in Cameroon

	Expropriation procedure for public interest	Deadline
DUP request	▸ The administration which monitors the works seizes the department of State Property and sent him 2 copies of documents describing the particularities of works and the DUP request with goals. The papers should indicate : - The surface area of expropriations - The approximate amount of the project costs including compensations - The date provided to start the work - The means provided to raise funds use for compensation budget	
DUP works	▸ The Minister of State Property appreciates the project's utility. in case the file is accepted, he orders the public interest works and defines the competency level of the commission responsible of the expropriation survey	between 2 weeks and 1 month
Establishment of monitoring and evaluation committee	▸ The order to set up the monitoring and evaluation commission is ratified by the governor or Senior Divisional Officer.	
Committee's meeting	▸ The commission's meeting is made upon presence of the president within 15 days before the meeting	15 days
Survey on the field	▸ Once the order signed, the president of monitoring and evaluation commission forwards to the S.D.O or mayor of the locality to make public. The concerned sector's population is informed within 30 days	30 days
	▸ The commission achieves expropriation survey, set the amount and conditions of the property and prepares the following papers : - Notification including expropriation impact and populations observations - Plan of plots and expropriations limits - Crops state on the field - Building state on the field ▸ The commission presents the survey's outcomes to the department of State Property as well as the divisional order and creation	Depending of expropriation size
Nature of compensation	▸ The department of State Property examines the survey's outcomes and prepares a project of decree set on the amount of compensation by the administration ▸ The decree is promulgated after agreement of the Prime Minister's Office, signed and published by him	It depends on the case
Payment of compensation	▸ The compensation is paid to the expropriated populations in the presence of the monitoring and evaluation commission	

According to this system, the responsible administration should address a Public Interest Declaration to MINDCAF (Déclaration d'utilité publique: DUP). The DUP to be passed through ministerial orders are simultaneously established with the monitoring and evaluation committee; the Commission opens public consultation, carried out the demarcation and limits the parcel plans, verifies property rights, identify the owners, number the cultivated land and buildings. The monitoring and evaluation commission sends report to MINDCAF who studies and defines the amount of compensation on the expropriations decrees basis for each type of work.

Expropriation orders are differentiated according to whether it relates for instance to the determination of compensation, classification of protected areas, state property, even if it is the same owner (Prime Minister's order for determining allowances, Head of State decree for the classification of protected areas). Once the order is issued, the Committee may pay the compensation amount. In fact, expropriation is validated by the payment of compensation, but in some cases the recipient organization takes possession of the land before payment of compensation as soon as the expropriation order is promulgated.

12 Order N° 00832-Y-15.1-MINDUH 000 of November 20, 1987 to set up the basic calculation of the real value of constructions under expropriation for public interest

The deadline required for the expropriation procedure for DUP depends on the size of expropriation because it takes more time for the committee to complete its investigation if the size is bigger. Even if the investigation can be conducted within 1 month, a deadline of four months will be settled between the DUP application request and compensation payment. It will take time if the administration does not have the budget to address field studies and compensation. Therefore at the project completion, it is necessary to make sure of the budget by MINADER for committee and compensation.

(2) Legal texts

The legal framework for compensation and relocation includes:

- The Constitution of the Republic of Cameroon of 1972, revised in 1996
- Orders 74-1 of 6 July 1974 fixing the land regime
- Ordinances 74-2 of 6 July 1974 fixing the land regime
- Law 85/009 of 4 July 1985 on expropriation for reasons of public utility
- Law n ° 91.008 of 30/07/1991 on the protection of the cultural heritage,
- Law N ° 2007/006 of 26 December 2007 on the financial system of the State of Cameroon
- Decree No. 87/1872 of 16 December 1985 laying down the procedure for expropriation and compensation;
- Decree N ° 2003/418 / PM of February 25, 2003 fixing the tariffs of the indemnities to be allocated to the owners victims of destruction for public utility of crops and fruit trees.
- Order No. 0832/Y.15.1/MINUH/D000 of 20 November 1987 laying down the bases for calculating the market value of constructions subject to expropriation for reasons of public utility

1) The January 18th,1986 Constitution

It recognizes for the citizens the right to choose their residence and the right to property. They have for this property the possibility to own and use disposing of and enjoying them, the only restriction being imposed on them only by reason of a DUP, and under condition of a prior compensation the terms of which are laid down by law.

2) Ordinance n ° 74-1 and n ° 74-2 of 06 July 1974 fixing the tenure of land and law

This text makes the State the legal owner and guardian of the land. It gives it the prerogative to intervene to ensure the rational use of land, according to the development priorities of the country. According to this text, the lands of Cameroon are classified into three main categories: the private property, the public domain, and the national domain. Land intended for highways and / or parks is considered as public land, belonging to the State. In addition, private property and non-public land areas are all classified as State lands. In addition, the property, rights of use and tenant's right on a land are recognized by written law. Private lands correspond to lands with specific legal status of ownership. Many people do not see the need for it. They only start the procedure when there is a pressing need such as applying for bankers to accept a loan.

In addition, Ordinance N°74-2 was amended by Ordinance N°77-2 of 10 January 1977 defined public artificial domains within the framework of roads, railways, ports and / or Military establishments. The right-of-way for departmental roads and rural roads is defined as follows:

- The departmental roads and a right of way of twenty-five (25) meters on each side of the axis of the roadway. The right-of-way is reduced to ten (10) meters from the outer edge of the sidewalk in built-up areas and five (5) meters in the city;
- Trails of local interest and a ten (10) meter right-of-way on each side of the pavement. This right-of-way is reduced to five (5) meters in built-up areas and in town.

3) Law n°85/009 of July 4th, 1985 relating to the expropriation for public utility and the modalities of compensation and Decree n°87/1872 of 16 December implementing Law n°85/009 of 04 July 1985

The above texts define the procedures for expropriation for the public utility of the land and determine the compensation to be granted to the victims in relation to the constitution and the land legislation. As a reminder, expropriation affects only private property as recognized by laws and regulations. Expropriation provides entitlement to pecuniary or in-kind compensation. The compensation due to the evicted persons is fixed by the decree of expropriation. The expropriation order entails the transfer of ownership and permits the transfer of existing securities on behalf of the State or any other person governed by public law who is the beneficiary of the measure.

In principle, expropriation gives rise to entitlement to prior compensation. However, in certain cases, the beneficiary of the expropriation may, before the actual payment of the compensation, occupy the premises as soon as the expropriation decree is published. A notice of six (6) months from the date of publication of the expropriation order is given to the victims to release the premises. This period may be shortened to three (03) months in the event of an emergency.

The values of the buildings, crops and plantations destroyed are determined by the commission of assessment and evaluation, on the other hand, the dilapidated houses or those realized on the public rights of way will not receive compensation. The articles relating to expropriations do not deal with squatters, who in fact represent the majority. Nevertheless, Article 17 of Ordinance 74-1 recognizes them as beneficiaries when they occupied the land in a personal, real, evident and permanent manner, and develop it.

4) Law n ° 91.008 of 30/07/1991 on the protection of the cultural heritage[13].

It defines the regulatory framework for the preservation of all cultural heritages.

5) Act No. 2007/006 of 26 December 2007 on the financial system of the State of Cameroon[14]

It shall specify the procedure for the execution of expenditure corresponding to the claim for compensation of the public body beneficiary of the expropriation.

6) Decree No. 2003/418 / PM of 25 February 2003 fixing the rates of compensation to be granted to landowners who are victims of crops and cultivated trees' destruction for public purposes[15]

This decree fixes the tariffs of the compensations to be allocated to the owners who are the victims of crop and tree destruction, for the purpose of public utility.

7) Order No. 0832/Y.15.1/MINUH/D000 of 20 November 1987 fixing the bases for calculating the market value of the buildings under expropriation for public utility reasons [16]

For compensation purposes, this text classifies constructions into six (06) categories or standings, depending on the nature of the materials used. Each category benefits from a particular compensation rate which also takes into account the state of obsolete investment. The existing rates of compensation run from 1960 to 1990. They were during this period, adjusted annually on the basis of a rate of 7%, certainly to account for inflation.

(3) Differences between JICA guidelines

The differences between the JICA policy in terms of population resettlement and applied system in Cameroon are reported in Table 5.2.2 below. In JICA guidelines on environmental considerations, completed from the World Bank operational policies (OP 4.12 - notably for lines 11 to 16 of the table),

[13] Loi n°91.008 du 30/07/1991 relative à la protection du patrimoine culturel
[14] La loi N° 2007/006 du 26 décembre 2007 portant régime financier de l'Etat du Cameroun
[15] Décret n°2003/418/PM du 25 février 2003 fixant les tarifs des indemnités à allouer aux propriétaires victimes de destruction, pour cause d'utilité publique, des cultures et arbres cultivés
[16] Arrêté n° 0832/Y.15.1/MINUH/D000 du 20 Novembre 1987 fixant les bases de calcul de la valeur vénale des constructions frappées d'expropriation pour cause d'utilité publique

«verifies that in respect of the project, they are close to the World Bank safeguard policy.

Table 5.2.2 Differences Between JICA System and Cameroon System

No.	JICA guidelines	Cameroon system	Difference	Resettlement policy for this project
1.	The unwilling resettlement and populations revenues loss should be avoided by operating all possibilities	-	No provision provided by Cameroon law	Adoption JICA guidelines
2.	Despite no solution is found, efficient measures are set down to reduce impacts and proposed compensations	-	No provision provided by Cameroon law	Adoption JICA guidelines
3.	Affected populations should be given compensations to improve their living environment and project production level	Compensation is slow. However, regarding land, compensation in kind is possible. If the allocated land value is higher than the occupied one, money is paid by recipient of the compensation. If it is lower, the recipient pays an allowance corresponding to the land. (Art. 8 Law N° 85-09)	The Cameroon system concerns compensation for land losses, crops and buildings to destroy	In case of displacement, compensations must be studied the compensations non covered areas
4.	Compensation shall base on revised costs	The amount of compensation is calculated from standards inscribed in order 832-Y.15.11[17] de 1987and 418[18] of 2003	The amount is calculated during the decree to create a disparity as acquisition costs are revised	Study of provision aiming at filling price differences on market
5.	Compensations are available before the material resettlement.	In fact, the payment is prior made and in some cases, the expropriation recipient can occupy the site upon publishing of the decree. A period of six month is given to the victims to leave the areas. . (Art. 4 Law 85-09)	According to the situation of applicants of the non-authorized decree	Adoption JICA guidelines
6.	Projects concerning great resettlement shall be subject of a resettlement plan to be make public	-	No provision provided by Cameroon law	Adoption JICA guidelines
7.	Information related to the resettlement plan should be make public and then prepare meetings with people or communities affected by the displacement	-	No provision provided by Cameroon law	Adoption JICA guidelines
8.	During meetings with affected populations, explanations shall be clearly formulated	Meetings forms are not set by the president of the contract commission and examines the properties with the displaced populations. (Decree N°87-1872)	No provision provided by Cameroon law	Adoption JICA guidelines
9.	Affected populations mobilization should be encouraged to participate to the planning , implementation and monitoring of resettlement plans and maintenance of their living means	The commission achieves the survey in the presence of populations, properties and impacted communities (Decree N°87-1872)	The public interest compensation procedures require the communities efficient participation	When losses on living means are known, JICA guidelines are applied
10.	A treatment mechanism must be provided for populations or communities.	In case the commission decision is contested, the court decides (Art. 12. Law N°85-09)	no difference	Application of Cameroon system

[17] Arrêté N°00832-Y.15.1-MINUH-D 000 du 20 novembre 1987 fixant les bases de calcul de la valeur vénale des constructions frappées d'expropriation pour cause d'utilité publique

[18] Décret N°2003-418-PM du 25 février 2003 fixant les tarifs des indemnités à allouer au propriétaire victime de destruction pour cause d'utilité publique de cultures et d'arbres cultivés

No.	JICA guidelines	Cameroon system	Difference	Resettlement policy for this project
11.	In order to draw the compensation rights, it is necessary to register initial reference points (survey, properties and socio-economic study) to avoid the great number of population available to receive compensation and aids. as a matter of fact, this must be done as from the beginning (PO 4.12§ 6)	The monitoring and evaluation commission identifies the expropriated lands and people to displace , set the amount of compensation and register each recipient (DécreeN°87-1872)	The large number of people available to receive compensation payment	Adoption JICA guidelines
12.	Persons available to receive compensations and aids are those who possess land rights and those who have land title recognized by the law of the country(PO 4.12 § 15)	The expropriation for public interest affects only the private property as provided by the law and regulations in force. (Art. 2. Law N°85-09). no compensation is paid for destruction made against the legal provisions set by the land regime. (Art. 10. Law N°85-09)	illegal occupants are not considered as recipients	Adoption JICA guidelines
13.	The land resettlement strategies should be a privilege to the displaced populations who live from agriculture (BM PO4.12 §11)	In case of compensation in kind, the attributed land must be situated in the same municipality as the expropriated land. (Art. 8. Law N°85-09)	no difference	Application of Cameroon system
14.	Aid available during resettlement (PO4.12 §.6)	-	No provision provided by Cameroon law	Adoption JICA guidelines
15.	A particular attention is reserved to vulnerable groups, notably the poor, workers without land, women, children, indigenous populations and minorities (PO4.12 § 8)	-	No provision provided by Cameroon law	Adoption JICA guidelines
16.	A detail resettlement plan is prepared when the number of displaced is lower than 200 people or during land acquisition request (PO4.12 § 25).	-	No provision provided by Cameroon law	Adoption JICA guidelines

(4) JICA's Displacement Policies

JICA's policies on population displacement and acquisitions are outlined below.

The key principle of JICA policies on involuntary resettlement is summarized below.

I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.

III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

IV. Compensation must be based on the full replacement cost* as much as possible.

V. Compensation and other kinds of assistance must be provided prior to displacement.

VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.

VIII. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.

IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.

X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.

XI. Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

XIII. Provide support for the transition period (between displacement and livelihood restoration.

XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

* Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

5.2.3 Scope of Land Acquisitions and Population Displacements

(1) Evaluation criteria

There is a unit price list for the value of crops, buildings and land.. These are the bases of calculation that can guide the expropriation commission. The crop tariff is recent (2003). The one relating to buildings is older (1990), but nevertheless takes account of categories and standings of houses. The one relating to the value of the land is old (1994) and above all corresponds to the price of land that is very low compared to the market price. In reality, for registered land, value is determined on a market-based basis, while for non-registered land, the price of public lands may be monitored. It can therefore be noted that the reality is a little different from what is provided for by law.

In addition, although the amount of compensation is assessed in this study by examining compensable buildings and crops, it is the assessment and evaluation commission that ultimately investigates and establishes the amount of compensation, the latter being adopted by the announcement of a Decree based on the minutes of the agreement between the affected populations and the commission.

Although buildings and crops are subject to monetary compensation, on the Cameroonian system, lands for acquisition under the scope of a project are those belonging to the State, and should not give raise for compensation. In the resettlement action plan, compensation for building and crops is calculated in accordance with the experiences of the country. For the land without title, measures to reconstruct life have been proposed based on the price of land reacquisition, since the compensation in kind can become a social problem.

1) Buildings

The basis of calculation is Order No. 00832/Y.15.1/MINUH/D00 of 20 November 1987 laying down the bases for calculating the market value of constructions subject to expropriation for reasons of public utility which presents rates per m² for the six types of houses for the year 1987. However, the existing buildings on the ground sometimes differ from the six categories listed up in this Order. Nearly 80% of the houses are made of temporary materials and clay. A field survey was conducted in 2003 to assess the unit price of a house in the categories based on a house of about 100 m². On the basis of this survey and the evaluation supported by the practices of the competent services in the project area, the houses listed were categorized in each type. This classification and the prices corresponding to the different types of construction have been approved by the MINTP. In this Study, the assessment of compensation for constructions is based on this approved list of unit prices by applying the discount rate (7.5% for the MD type, 4% for the MSD type). However, it does not take into consideration the decline in asset value due to aging, in order to compensate for other damage of affected residents.

2) Crops

As regards the amount of compensation for crops affected by expropriation for public purposes, unitary criteria and prices were established by Decree No. 2003/418 / PM, as shown in the table below. As the unit price is not established for decorative plants and flowers that of vegetables was used for calculations. The compensation amount of crops in this survey was evaluated with 1.414 times (= 1.027^{13}) of this unit price, taking into account price increase rate (2.7% per year).

Table 5.2.3 Food Crop and Crop Compensation Payments

Crops/ Cultivated trees		Price per unit	
		Monoculture/ Young	Polyculture/ Adults
Annual crops	Legumes (groundnuts, voandzou, soybeans, beans, and the like)	150 FCFA/m²	200 FCFA/m²
	Cereals (maize, millet, sorghum, rice, and similar crops)	150 FCFA/m²	250 FCFA/m²
Fruits	Banne plaintain	1 000 FCFA/plant	1 500 FCFA/plant
	Sweet Banana	800 FCFA/plant	1 200 FCFA/plant
	Pineapple	150 FCFA/plant	200 FCFA/plant
Tubers	Yam, macabo, taro, potato, cassava, potato, and similar crops	100 FCFA/plant	300 FCFA/plant
Vegetable crops	Every type	3000 FCFA/m²	
Industrial crops	Cotton, Tobacco	100 FCFA/plant	200 FCFA/plant
	Sugar cane	25 FCFA/plant	75 FCFA/plant
	Cocoa, Coffee maker	(~3 years) 5 000 FCFA/plant	(3~25 years) 25 000 FCFA/plant (25 years~) 2 000 FCFA/plant
	Palm tree with local oil	(~3 years) 2 500 FCFA/plant	(3~25 years) 10 000 FCFA/plant (25 years~) 4 000 FCFA/plant
	improved oil palm	(~3 years) 10 000 FCFA/plant	(3~25 years) 35 000 FCFA/plant (25 years~) 4 000 FCFA/plant
	raffia palm	500 FCFA/plant	1 000 FCFA/plant

Crops/ Cultivated trees		Price per unit	
		Monoculture/ Young	Polyculture/ Adults
	local coconut	(~3 years) 2 500 FCFA/plant	(3~25 years) 10 000 FCFA/plant
	Cocotieramélioré	(~3 years) 7 500 FCFA/plant	(3~25 years) 20 000 FCFA/plant
	Hévea	(~5 years) 5 000 FCFA/plant	(5~30 years) 35 000 FCFA/plant
	Theater	150 FCFA/m²	250 FCFA/m²
Perennial crops	Citrus fruits (lemon, orange, mandarin, pomelo, grapefruit and similar plants)	5 000 FCFA/plant	35 000 FCFA/plant
	Mango tree, Avocado, Olive	5 000 FCFA/plant	35 000 FCFA/plant
	Papaya	1 000 FCFA/plant	3 000 FCFA/plant
	Kolatier, Safoutier	20 000 FCFA/plant	50 000 FCFA/plant
	Pine tree (corossolier, guava tree, apple tree)	10 000 / FCFA/plant	25 000 FCFA/plant
	Moabi, Shea, Wild Mango	5 000 FCFA/plant	75 000 FCFA/plant
	Other fruity trees	7 500 FCFA/plant	25 000 FCFA/plant
Medicinal plants	Quinquina, Voacanga	2 500 FCFA/plant	7,500 FCFA/plant
	Pygeum	2 500 FCFA/plant	5,000 FCFA/plant
	Yohimbé	3 000 FCFA/plant	75,000 FCFA/plant
	Shade trees	5 000 FCFA/plant	10 000 FCFA/plant
	Other Cultivated Trees	(~3 years) 10 000 FCFA/plant	(3 years~) 20 000 FCFA/plant

(2) Identification of project affected peoples

Surveys were conducted for the seven roads listed in the table below. Surveys have also been carried out for roads that are currently outside the scope of the Project (NW3, C2, S2). The execution periods for the surveys are given below.

- Northwest Region: July 17-30, 2016
- Central Region: from 15 to 19 September 2016
- Southern Region: from 10 to 13 September 2016

Table 5.2.4 Roads Covered by the Surveys

Region	District	N°	Road	Length	Type of Pavement
North West	Ndop, Balikumbat	NW1	Bamali (N11) ~ Bamali 3 Corners ~ Balikumbat (une partie du D72)	15 km	Asphalt
		NW2	Bambalang ~ Bamali 3 Corners(D72)	15 km	Laterite
		NW3	Bamessiing (N11) ~ Mbelue ~ Nsemi Junction (N11)	14 km	Laterite
Centre	Obala	C1	1) Mboua I (N4) ~ Mbele II ~ Edokassi 2) Mbele II ~Bilon - Nkoledouma (N4) 3) Mbele II ~ Nyeanam ~ Nkolodogo ~ Mengama ~ Lepomo ~ Mvan 4) Mengama ~ Ntsaekang (P13)	26 km	Laterite
	Akonolinga	C2	Koundou(N10) ~ Até ~ Menguemesi(P23)	37 km	Laterite
South	Ngoulemakong	S1	Ngoulémakong (N2) ~ Enamngal ~ Biwong Bane (D42)	40 km	Laterite
	Biwong Bulu	S2	Nkoetye ~ Nkolbitye(D39)	8 km	Laterite
Total				155 km	

Source: JICA Study Mission

In the field study, crop occupation was targeted to land within 14 m for a standard road width of 11.4 m for departmental roads (including gutter), and 12 m for a width of Standard road of 8.96 m for the communal roads. At present, the width of roads is between 5 and 8 m. If a school or market exists along the roadside, the road shoulder width is supposed to be increased by 1 m at a distance of 500 m before and after the facility, and a survey was conducted based on the plan.

1) Buildings

The list of buildings that could be acquired for land acquisition and population displacement in the Northwest Region is shown in the table below. None of the affected persons has a land title. Roads

in the Central and Southern Regions are not subject to either land acquisition or population displacement. In addition, tollgates, butchers, and counters belong to the market managed by Balikumbat Commune and all other buildings are only part of the house, therefore physical relocation or suspension of business is not assumed.

Table 5.2.5 PAPs by the Land acquisition (Buildings) in the Northwest Region, Targeted Properties and Estimated Amount of Compensation

N°	Village	Name of Affected person	Type infrastructure	Building type	Surface (m²)	Unit price (FCFA/m²)	Amount of compensation (FCFA)
NW1 : Bamali ~ Balikumbat							
1	Bamali	Mbighop Nui Martina	Veranda	MSD3	9	101 763	915 867
2	Balikumbat	Bitoa Michael Peyin	House	MD2	12.5	306 493	3 831 163
3	Balikumbat	Balikumbat Commune	Toll station	MD2	9.61	306 493	2 945 398
4	Balikumbat	Sama Bertrand	Case	MP2	4.84	48 262	233 588
5	Balikumbat	Kemi David	Shop	MSD2	78.02	106 810	8 333 316
6	Balikumbat	Kemi David	Shop	MP2	10.175	48 262	49 1066
7	Balikumbat	Kemi David	Counter	HAN	11.34	775	8 789
8	Balikumbat	Balikumbat Commune	Butcher	MD3	36.9	296 190	10 929 411
9	Balikumbat	Momat William De Yepga	Hedge	MP3	100	9 193	919 300
10	Balikumbat	Dohmung Augustine Nwanyan	Hedge	MP3	150	9 193	1 378 950
11	Balikumbat	Yonglema Suzanne	Hedge	MP3	20	9 193	183 860
					442.385		30,170,707
NW2 : Bamali 3corners~Bambalang							
12	Bamali	Christina	Hedge	MP3	50	9 193	459 650
13	Bamali	Monbeh Adeline Mandoh	Shop	MD2	34.77	306 493	10 656 762
14	Bamali	Mbongo Blaise	Bar	MSD1	23.2	113 883	2 642 086
15	Bamali	Nelleng Calvin Lanu	Case	MD3	4.8	296 190	1 421 712
16	Bamali	Tapeni Lawrence	Veranda	MP2	17.5	48 262	844 585
17	Bamali	Ndikang Mombe Daouda	Veranda	MD3	16	296 190	4 739 040
18	Bamali	Jomy Gerald Billa	Case	HAN	10	775	7 750
19	Bambalang	Kindergarten and primary school	Hedge	MP3	30	9 193	275 790
20	Bambalang	Yenyi Awah	Hedge	HAN	5	775	3 875
21	Bambalang	Pijinu Lucy	Shop	HAN	6.25	775	4 843.75
22	Bambalang	Nelson Tachi Yakum	Shop	MP3	9	9 193	82 737
23	Bambalang	Tasob Wanu Mungho	Housing	MSD2	24	106 810	2 563 440
24	Bambalang	Deborah	Case	HAN	40	775	31 000
25	Bambalang	James Ngwi Tajenkunu	Case	MP3	6	9 193	55 158
					276.52		23,788,428
NW3 : Bamessing ~ Mbelue ~ Nsemi Jnuction							
26	Bamessing	Ganyi Fidelis Gwain	House	MD3	30	296 190	8 885 700
27	Bamessing	Reuben Songmala	Veranda, pit	MD3	10	296 190	2 961 900
28	Bamessing	Nyineh Innocent Funtong	Gutter	MD3	12	296 190	3 554 280
29	Bamessing	Gwe Browndon Yafeh	Case	MD3	12	296 190	3 554 280
30	Bamessing	Ghanseh Mary Menah	Hangar	HAN	18.55	775	14 376.25
31	Bamessing	Tifung Christopher	Housing	MD3	40	296 190	11 847 600
32	Bamessing	Mbekene Tenabu	Case	MP2	7	48 262	337 834
33	Bamessing	Alphonse Nkoko	Hedge	MP3	20	9 193	183 860
34	Bamessing	Chembu Olange Kehnsang	Hedge	MP3	10	9 193	91 930
35	Bamessing	Tiajua Paul Kiadah	Hedge	MP3	100	9 193	919 300
36	Bamessing	Bahkuhbe Honorine	Hedge	MP3	10	9 193	91 930
					269.55		32,442,990

Note: Type of buildings are as follows:
MD2: Foundation made of reinforced concrete or solid aggregates / Wall made of concrete blocks or cemetery brick / Timber framing / Corrugated sheets with or without ceilings / Cement screed
MD3: Foundation made of reinforced concrete or solid aggregate / Wall made of concrete blocks or cemetery brick / Wood framing / Without ceiling / Cement screed
MSD1 : foundation base in agglo full / Brick wall of plastered earth / timber framing / Corrugated sheets with or without ceilings / Cement screed
MSD2 : Foundation in solid aggregate / Brick wall of plastered earth / Timber framing / Corrugated sheets with or without ceilings / Smoothed mortar screed
MSD3 : Foundation in solid aggregate / Brick wall of plastered earth / Wooden framework / Corrugated sheets with or without ceilings / Lean mortar screed
MP2 : Foundation general framework in wood / Wall filling in jointed board / Frame in wild wood / Roof in corrugated sheet plywood ceiling / Single screed
MP3: Foundation in general wood frame / Wall filling in jointed board / Wooden framework in wood / Without ceiling / Flooring in earth
HAN: Hangar, Boukarou, Fence
Source: JICA Study Team

2) Crops

The number of crop owners who could be compensated, the number of people in the range of the estimated amount of compensation, and the estimated total amount are shown in the table below. In addition, the number of identified crops / number of trees, and area are shown in the table below. The estimated amount of compensation per person affected has been compiled in the annexed table. Roads NW3 and C2 are currently excluded from this Project.

Table 5.2.6 Populations Affected by Land Acquisition (crops) and Estimated Amount of Compensation

Route	Nbr total PAPs	Nbr PAPs /village	Nbr PAPs (1,000 FCFA)						Total amount to be compensated (FCFA)	Route
			< 100	< 250	< 500	< 750	< 1 000	< 1 250		
NW1	164	Bamali (63) : Balikumbat (101)	106	28	21	6	1	2	22,106,900	6,438
NW2	167	Bamali (74) : Balikumbat (20) : Bambalang (73)	98	41	16	5	4	3	26,620,530	7,203
NW3	68	Balikumbat (2) : Bamessing (56) : Babanki (10)	40	16	8	2	1	1	9,786,930	N/A
C1	64	Mboua I (1) : Ntase-ekang (1) : Mengama (6) : Mban (8)	52	9	2	0	1	0	4,379,582	1,788
C2	22	Ebola Kounou (8) : Omgbang (1) : Athe (4) : Dounga (4) : Biba (5)	21	0	1	0	0	0	968,731	N/A
S2	2	Nkolbitye (2)	2	0	0	0		0	77,770	75

Source: JICA Study Team

Table 5.2.7 Cultures / arbres ciblés par l'acquisition de terrains (cultures)

Culture and trees to lose	Unit	Road					
		NW1	NW2	NW3	C1	C2	S2
Banne plaintain	plant	250	179	45	223	23	
Sweet Banana	plant	1,022	667	255	64	62	
Macabo	plant	66	160	103			
Cassava	plant			43			
Vegetable crops and Ornamets	m²	19	83	40.5			
Sugar cane	plant	12		10		8	
Cacayer	plant	3	14		18	10	
Coffee Maker	plant	205	149	2			
Palm tree with local oil	plant	142	139	22	3	10	
improved oil palm	plant	18	24	3	37		
raffia palm	plant	51	9	22		1	
local coconut	plant		1			2	
Lemon, Orange, Mandarin	plant	27	109	44	27		1
Mango, Avocado	plant	11	6	4			
Papaya	plant	12	5	3	3	2	
Kolatier	plant	3	17				
Safoutier	plant	18	10	6	1	2	
Corossolier, Goyavier	plant	13	13	10	1	13	2
Voacanga sp.	plant	61	62	120			
Shade trees	plant	116	24	34		12	
Eucalyptus	plant	191	314	60			
Other Cultivated Trees	plant	79	93	144	16		

Note: in the study, crops are counted in two distinct categories: young trees and adult trees, but here the table shows the total
Source: JICA Study Mission

The survey to evaluate the proportion of the assets loss of affected inhabitants was carried out. A sample survey was conducted to evaluate the cultivated area and the estimated monthly income of 100

PAPs in total on NW1 and NW2. The result shows that the area of productive assets to be lost was 0.7% on average, and most PAPs (97%) lost farmland less than 10% of the cultivated area.]The average monthly income was estimated to be about 60,000 FCFA, and the average of annual income of most PAPs was estimated to be within 200,000 FCFA.

Table 5.2.8 Results of Household Sample Survey

PAP	Surface lost	Productive asset area	Percentage of lost	Income estimation
100	45 m^2 (average)	Total 6,555 m^2	0.7 % (average)	60,354 FCFA (average)

Percentage of loss	PAP	Monthly Income	PAP
~ 1 %	54	~ 50,000	72
1 ~ 5 %	38	50,000 ~ 100,000	14
5 ~ 10 %	5	100,000 ~ 200,000	11
10 ~ 15 %	3	300,000 ~	3

Source: JICA Study Mission

3) Common Goods and Tombs

Besides these individual crops, two sacred trees were confirmed at the border between the village of Bamali and the village of Balikumbat, three in the center of the village of Balikumbat, and two in Bamessing. The compensation proposed for each of these trees is 100,000 FCFA.

It was also confirmed that the NW2 and NW3 roads had a grave. The Cameroonian system has no official regulation concerning the amount of compensation for the expropriation of cemeteries. On the basis of interviews with companies displacing graves and the experience of similar projects, the amount of compensation for the removal of graves is estimated as follows.

- Exhumation and burial: 100,000 FCFA,
- Reconstruction of the tomb: 90,000 FCFA (tiled), 60,000 FCFA (cemented) and 30,000 FCFA (burial)
- Meeting expenses: 50,000 FCFA.
- The amount of compensation for the removal of graves for this Project is shown in the table below.

Table 5.2.9 Estimated Costs for the Movement of Tombs

Route	Village	Nbr tombs	PU (FCFA)	Compensation (FCFA)	
NW2	Balikumbat	1	180 000	180 000	Ground
NW3	Bamessing	3	180 000 130 000 130 000	440 000	Land: Meeting fees once
C1	Boua I	3	210 000 160 000 160 000	530 000	Cemented: One-time meeting fees
		4	210 000 160 000 160 000 160 000	690,000	Land: Meeting fees once
	Mbelle II	1	210 000	210 000	Cemented
	Edokassi	1	210 000	210 000	Cemented
		1	210 000	210 000	Cemented
	Mban	3	210 000 160 000 160 000	530 000	Cemented: One-time meeting fees
C2	Koundou	3	180 000 130 000 130 000	440 000	Land: Meeting fees once

Source: JICA Study Mission

4) Others

It was also confirmed that water lines and power lines were along the NW1 and NW3 roads and that

special attention will be required during the work.

On the other hand, if deviation is not available, deviations must be implemented, which can affect the use of the surrounding land. If a new deviation is to be established, it is recommended to plan in consultation with the persons concerned and to consider the need for compensation. In other places, it is necessary to consider a work plan so as not to affect the cultivated land without greatly impairing the lives of the residents.

5.2.4 Concrete Measures of Compensation and Assistance

A study of the affected populations is carried out within the framework of this study, but with regard to the decision-making process concerning the amount of compensation to be paid to the affected populations under the Cameroonian system, the competent authorities of the project (MINADER) Being subject to the DUP, procedural formalities must be initiated. At present, given that the Project is at the preliminary design stage and the scope of the Project is not established, the formalities in question cannot begin. With regard to the study on population displacement / land acquisition under this project, DUP procedures will not be considered, field investigations may be initiated by the Commission of Inquiry, after completion of the detailed design of the Project.

The cut-off date (expiry date) for the land acquisition is usually the date of commencement of the study of the PAP and the persons claiming occupation of land after that date are not entitled to compensation. Based on the Cameroon low, a cut-off date should be the time of investigation by the Committee. The assessment of PAP and the amount of compensation is done through interviews with populations in this study, and the last dates after the field survey (North-West region on November 05, 2016, Central and Southern Region on October 25 2016) as cut-off date and was confirmed with stakeholders.

For the purposes of this Project, in the case of crops on roadsteads, given that occupation by farmers is considered unfounded, under the Cameroonian system they are not compensable. According to the JICA Environmental and Social Consideration Guidelines, the resident relocation plan included monetary compensation or measures to support the rebuilding of livelihoods for occupants.

With regard to land acquisition, particular attention is required in order to minimize losses of farmers taking into account the harvest period in particular annual crops.

Moreover, as regards the assessment of the amount of compensation, the unit price varies according to the type of crop, the area and the age of the plantations. Since the land acquisition procedure will take time, the compensable crops will have to be confirmed again (Commissions for Assessment and Evaluation will be set up at departmental level).

(1) Compensation de perte

The loss of buildings, crops and graves of the affected persons and their compensation was defined in the previous paragraph. The evaluation of each element by road is shown in the table below.

Table 5.2.10 Assessment of loss compensation

Road	Building	Culture	Community property	Falls	Total
NW1	30,170,707	22,106,900	500,000	0	52,777,607
NW2	23,788,428	26,620,530	0	180,000	50,588,958
C1	0	4,379,582	0	2,380,000	6,799,582
S2	0	77,770	0	0	77,770
Total	53,959,135	53,184,782	500,000	2,560,000	110,243,917

(2) Measures to restore the standard of living

Most affected residents of the project are agricultures; it is difficult to convert the standard of living of farmers' households into monetary income. According to the survey results, the average area of cultivated land lost per person affected by the project is approximately 29 m² (10 562 m² total along the N1, N2, C1 and S2 roads, 363 PAP), and the re-acquisition price was about 2,500 FCFA/m², the re-acquisition price of the affected land is equivalent to about 26,41 million FCFA. Since compensation is not paid for land without title in Cameroon's legal framework, for compensation to PAP for land occupied without legal basis in the right-of-way, the measures which does not depend on monetary compensation are considered.

Although compensation for buildings and crops to PAPs is included in the plan, community support measures, focusing on training in agro-pastoral activities, are recommended to mitigate the source of lost income. These training seminars in modern agricultural techniques will take place over 2 years at the rate of 2 seminars per year and 50 auditors per training.

Table 5.2.11 Support to the Restoration of the Standard of Living

Title of training	Nbr session	Duration session	Nbr of listeners	Cost/session (FCFA)	Total cost (FCFA)
Eucalyptus-based Agro-forestry	4	10 days	50 /session	2 500 000	10 000 000
Setting up nurseries: Voacanga eteucalyptus	4	10 days	50 /session	2 500 000	10 000 000
Manufacture of compost from household waste	4	10 days	50 /session	2 500 000	10 000 000
Agroforesterie à base de cacaos	2	5 days	25 /session	625 000	1 250 000
Total					31 250 000

(3) Assistance to vulnerable people

Among the PAPs, female heads of household and elderly people (older than 65) are considered vulnerable persons, who are 68 people, or 17 % of the total. On the basis of experience in similar cases in Cameroon, an additional 10% allowance on crops to be compensated has been integrated as additional support for vulnerable groups. The distribution and the additional amount of compensation for vulnerable PAPs for each route is shown in the table below.

Table 5.2.12 Affected Persons Vulnerable by Road

Road	Total PAP	Nbr vulnerable PAPs			Indemnisation for vulnerable PAPs	
		Total	Women head of household	Old people	Amount of compensation to the vulnerable PAPs	Additional compensation (10 %)
NW1	164	27	21	6	3,312,578	331,258
NW2	167	23	16	7	4,049,979	404,998
C1	64	17	13	4	1,916,253	191,625
S2	2	1	1	0	49,490	4,949
Total	397	68	51	17	9,328,300	932,830

(4) Entitlement matrix

The beneficiaries of the compensation and the loss of assets affected by the implementation of the project, the institutions responsible, are summarized in the table below Entitlement Matrix. The PAPs who should receive compensation are the owners of buildings, the farmers along the existing road (including the vulnerable peoples), the owners of the graves and the managers of the community assets. In addition to assessing the construction and compensation of crops on the basis of the Cameroonian system, the compensation amount based on the cost of land acquisition and measures to restore the standard of living are included. On the basis of experience in other similar cases in Cameroon, the amount of the additional allowance of 10% was proposed for vulnerable PAPs.

Table 5.2.13 Entitlement Matrix

Item No.	Type of loss	Application	Entitled Persons (Beneficiaries)	Entitlement	Implementation issues/Guidelines	Responsible Organization
1	Loss of primary structures (shops, houses) & secondary structures (barns, garages, fences)	Structures located in the project site (7 m on each side of the central axis to the paved road and 6 m of each side of the central axis for rural road)	Owner of the structure	Compensation in cash for the structures based on the type of structures No application of the decrepit rate Additional measures for all PAPs	Arrêté N°0083tu2-Y.15.1-MINUH-D provides the price list of structures by type Classification and prices for the different types of construction adjusted in current market value and approved by the MINTP will be applied	MINDCAF MINTP MINADER MINATD
2	Loss of public structures	Structures located in the project site	Owner of the structure	Compensation in cash for the structures	Arrêté N°00832-Y.15.1-MINUH-D provides the price list of structures by type Classification and prices for the different types of construction adjusted in current market value and approved by the MINTP will be applied	MINDCAF MINADER MINATD
3	Standing crops and cultivated trees	Crops and trees located in the project site	Farmers who cultivate the land (without land title) Vulnerable farmers (female householder, elderly person) who cultivate the land (without land title)	- Compensation in cash for crops and trees based on the size, age or area - Increase of 10 % for vulnerable people. - Revaluation of 41.4% of crops for all PAPs -Additional measures for all PAPs	Décrêt N°2003-418/PM provides the price list of affected crops and trees. Should be considered the harvest time	MINDCAF MINADER MINATD
4	Relocation of tombs and graves	Tombs/graves located in the project site	Owners of tombs and graves	Compensation in cash for relocation of tombs and graves at current market value	The tombs/graves will be replaced with the agreement of the tomb/ grave owner.	MINADER MINATD
5	Sacred trees	Trees on the sacred community forest located in the project site	Manager of the sacred forest (traditional chief)	Compensation in cash for holding traditional ceremonies (to remove the trees), or provide another area for rites	Compensatory measures will be implemented as presented in the concerned villages.	MINADER MINATD

5.2.5 Complaints Handling Mechanism

(1) Complaint Management

1) Types of complaints and disputes

Complaints and litigation may relate to:

- Errors in the identification and valuation of assets
- Disagreement on boundaries of plots, either between the affected person or between two neighbors
- Conflict over ownership of property (two or more affected persons claim to be the
- Owner of the same property)
- Disagreement on the assessment of a parcel or other property
- Successions, divorces, and other family problems, resulting in disputes between heirs or members of the same family, ownership, or ownership of a particular property.

2) Legal action

When the affected person does not reach an amicable agreement on the amount of the compensation, he/she sends his/her complaint to the MINDCAF. If he fails to obtain satisfaction, he shall, within one month, apply to the competent court of the place of the place of the expropriated property. After hearing the parties, the Court rules on the amount of compensation.

(2) Overview of the proposed mechanism

In compensation programs such as the one contemplated for the present project, complaints and disputes may arise from misunderstandings of compensation policies or neighborhood conflicts that are sometimes unrelated to the project but which can often be resolved by "arbitration, using rules of mediation derived from tradition. Thus, many disputes can be resolved:

- For additional explanations (e.g. explain in detail how the project calculated the complainant's compensation and show him that the same rules apply to all);
- By arbitration, appealing to elders or persons respected in the community while being outside.

It should be noted that recourse to the courts under Cameroonian law often requires long delays before a case is dealt with, can entail substantial costs for the complainant, and requires a complex mechanism, with experts and lawyers, who can often escape to the complainant and eventually turn against him. In addition, the courts are not expected to hear disputes involving untitled properties, which in the case of the project are proven.

For this reason, the prime contractor (MINADER) will set up an extra-judicial mechanism for the handling of disputes involving third-party explanations and mediation. Each person affected, while of course retaining the possibility of resorting to Cameroonian justice, will be able to use this mechanism according to the procedures specified in the following lines. It will consist of two main stages;

1) Recording of complaints

The project will put in place a complaint record maintained by the community relations department. The existence of this register and the conditions of access (where it is available, when to have access to complainants, etc.) will be widely disseminated to the affected populations as part of the consultation and of information.

2) Mediation Committee - Friendly Resolution Mechanism

i) Mediation Committee

The project will set up a mediation committee for each village concerned by the compensations, composed for example of the following persons:

- Two representatives of the territorial administration (the sub-prefect and the village chief concerned);
- Three representatives of the population, chosen, for example, from grass-roots community organizations, elders, traditional authorities, as appropriate;
- A representative of an NGO or religious organization present on the ground in the area concerned and enjoying high esteem from the population.

The sector mediation committee should meet approximately once a month (to be adapted as necessary), in the presence of the supervisor and the local representative of MINADER.

ii) Amicable resolution mechanism

After a complaint or litigation has been registered, the project will prepare the technical elements (example proposed compensation, list of interviews or meetings held with the complainant, exact reason for the dispute, etc.) for the mediation committee. The complainant (s) will be called before the mediation committee, which will try to propose a solution acceptable to both parties. Where appropriate, further meetings will be held and the Committee may designate one of its members to continue the arbitration in a less formal framework than monthly meetings. The eventual agreement shall be sanctioned by a protocol signed by the parties and signed by the chairman of the mediation committee.

5.2.6 Implementation Structure

This project is the fact that they are not eligible for the DUP, the project owner of this project (MINADER) will make a request to the MINDCAF for the setting up of a Commission of Observation and Special Evaluation in the concerned areas. The MINDCAF will establish the special assessment and evaluation committee. The Commission will be responsible for the payment of the compensation adopted by administrative decision on the amount of compensation.

The role and the composition of the commission of assessment and evaluation are stipulated by the Decree No. 1872 of 1987. The role of Commission of observation and evaluation is as follows:

- to select and have bound the land concerned at the expense of the beneficiary;
- to ascertain the rights and valuation and the property involved;
- identify their owners and owners; and
- to have the signs indicating the perimeter of the operation posted, at the expense of the beneficiary.

Moreover, the establishment of the assessment and evaluation commission at the national, regional or departmental level is dictated by a ministerial decree announced by the DUP according to the scope of the work. In the case of the present project, it is estimated that the assessment and evaluation commission will be set up at the departmental level. The members will be the departmental delegates of each ministry concerned.

- The Prefect or his representative (President)
- The responsible of the Department of Domains (Secretary)
- The head of the Department of Cadastre
- The head of the local planning and housing unit

- Responsible for mines and energy
- The head of the Department of Agriculture
- The head of the department of roads
- The representative of the applicant organization or organization
- The deputy (s) municipal (s) concerned (s)
- The municipal magistrate (s) concerned (s)
- Traditional authority (ies) concerned

The assessment and evaluation commission will notify the populations concerned of the implementation of the study 30 days before. The field study will be implemented by a team of at least three people. The results of the study will be handed over to the national authorities.

5.2.7 Implementation Schedule

This project is the fact that are not eligible for the DUP, the compensation procedures will be started on the request of the establishment of the Commissions of Observation and Special Evaluation to the MINDCAF by the promoter of project (MINADER). By the instructions of the MINDCAF, the Commissions of the localities concerned on the basis of the principle of compensation within the framework of the project. As well as the DUP process, the Commissions carry out field investigations to determine the amount of compensation.

However, there is a possibility that this project will be subject to DUP processes by MINADER. In this case, it is necessary to apply for DUP at the same timing as before "Request for the implementation of the Special Observation and Evaluation Commissions (CCES)" in the table below.

Completion of the detailed study of this project is foreseen in May 2019, that the field surveys will be completed by the Commissions in July 2019. c the schedule of the planned works is given in the table below. The payment of the indemnity is the fact that at the end of 2019, it is necessary to carry out budgeting during the year 2018 by the MINADER.

Table 5.2.14 RAP Implementation Schedule

Activity	Execution organism	Period
Preliminary evaluation	MINADER / JICA Preliminary study	September 2016
Loan agreement	MINEPAT/ JICA	June 2017
Selection of the Japanese consultant	MINADER	June 2017 ~ May 2018
Budgeting	Project Management Unit (PMU) / MINADER	June 2018
Detailed study	PMU / MINADER	June 2018 ~ May 2019
Application for expropriation by the organization concerned	PMU/MINADER	April 2019
Request for the implementation of the Special Observation and Evaluation Commissions (CCES) (DUP)	MINDCAF	April 2019
Establishment of the Commission of Observation and Special Evaluation	MINDCAF / Prefect of concerned localities	April 2019
CCES Meeting	Prefect of concerned district	June 2019 (inform the members 15 days in advance)
Population information	Prefect of concerned district	June 2019
Update of Asset Valuation	Prefect of concerned district, CCES	July 2019 (30 days in advance)
Determination of compensation / compensation	Prefect of concerned district, CCES	August 2019
Payment of compensation	PMU/MINADER, CCES	September - December 2019
Management of potential claims in case of failure or challenge of compensation	Prefect of concerned localities, CCES, MINDCAF or Judicial Courty, PMU/MINADER	September 2019 February 2020
Monitoring and Evaluation	PMU /MINADER, MINEPDED	January 2020 ~ December 2022 (for 2 years)
Construction	PMU /MINADER	March 2020 ~ February 2022

5.2.8 Costs and Sources of Funding

The estimated compensation costs for the NW1, NW2, C1 and S2 roads conducted in this survey cover a total of 149,238,125 FCFA (about 25.65 million yen at the rate of 0.1719 FCFA/JPY of October 2016 adjusted by JICA) (see table below). The compensation costs for this project shall be fixed by an administrative decision based on the results of the field study carried out by the Commission, 5 % of the compensation cost was posted as a reserve fund. The amount of compensation to be determined is budgeted by MINADER and it will paid by the Commissions.

Table 5.2.15 Estimated Amount of Compensation for Land Acquisition in Connection with the Implementation of this Project

Compensation	Selected Road					Non selected Road	
	NW1	NW2	C1	S2	**Total**	NW3	C2
1. Building	30,170,707	23,788,428	0	0	**53,959,135**	32,442,990	0
2. Culture	22,106,900	26,620,530	4,379,582	120,190	**53,227,202**	9,786,930	968,731
3. Frais additionnel pour vulnérabilité Additional fee for vulnerable people	331,258	404,998	191,625	4,949	**932,830**	-	-
4. Tomb	0	180,000	2,380,000	0	**2,560,000**	440,000	440,000
5. Communy property	500,000	0	0	0	**500,000**	200,000	200,000
Sub total compensation	**53,108,865**	**50,993,956**	**6,951,207**	**125,139**	**111,179,167**	**42,869,920**	**1,608,731**
6. Accompanying measures					**32,500,000**		
7. Reserved fund (5% of 1~5)	2,655,443	2,549,698	349,560	6,257	**5,558,958**		
Total	55,764,308	53,543,654	7,298,767	131,396	**149,238,125**		

Sorce: JICA Study Mission

5.2.9 Monitoring System by the Executing Agency

Payment of compensation will be monitored by the project management unit (PMU). The monitoring items include the payment of compensation to affected populations, the conditions for holding community meetings related to the sacred tree slaughter, and the conditions for holding meetings with fallen down. The monitoring of RAP will be done for 2 years after completion of compensation.

The draft monitoring form is presented below.

Table 5.2.16 RAP Draft Monitoring Form (draft)

1. Commission for assessment and evaluation

Region	Creation date	No. of text for creation	Meeting date
North West			
Central			
South			

2. Public Consultation

Village	Date	Place	Participants	Contents of the consultation / main comments and answers

3. Asset evaluation

Region	Investigation date	Number of PAPs	Total estimation cost

4. Administrative decision for compensation cost

Region	Date	No. of text	Number of PAPs	Total estimation cost

5. Compensation payment

No.	Name PAP	Village	Compensation price	Date payment	Remarks
1					

6. Complaint of PAP

No.	Name PAP	Village	Date	Complaints registered and the measures taken
1				

Source: JICA Study Mission

5.2.10 Public Consultation

Public consultation on land acquisition was held as part of the study on environmental and social considerations. On the basis of public consultation, land and property surveys to identify PAPs were conducted, and resettlement action plans were established.

The RAPs and the ESIA reports will be notified to the local stakeholders in December 2016 and January 2017, and the consensus of residents can be reached on the principle of compensation. The date of the stakeholder consultation and the participants are as follows.

Table 5.2.17 Public Consultation

Region	Arrondissemnt	Village	Date	Participants		
				Men	Wemen	Total
Nord Ouest	Ndop	Bamali	2017/01/09	41	5	46
		Bambalang	2017/01/11	19	2	21
	Balikumbat	Balikumbat	2017/01/10	37	15	52
			TOTAL	97	22	119
Centre	Obala	Nkoledouma	2016/12/20	30	11	41
	Akonolonga	Menguemesi	2016/12/16	15	6	21
			TOTAL	45	17	62
Sud	Niwong Bulu	Nkolbityé	2016/12/07	30	9	39
	Ngoulemakong	Enamngal	2016/12/09	16	1	17
			TOTAL	46	10	56

This stakeholder meeting aims to :

- to improve the understanding of the project by the stakeholders;
- to enable the public to become aware of the environmental impacts of the project and the measures to mitigate or compensate them;
- to make people aware of the project, particularly regarding compensation, specifying in particular the cut-off date;
- to explain the principle of compensation, taking into account the rate of inflation.;
- to collect opinions, observations and other submissions from the public.

The comments made by residents through the meeting are as follows.

Table 5.2.18 Stakeholders Comments

Village		Comments
Northwest region	Bamali	▸ Why does it take so long until construction starts? ▸ The people could continue to occupy the right of way of the road (to practice agriculture)?
	Balikumbat	▸ Will everyone be entitled to the same compensation? ▸ The people could continue to occupy the right of way of the road (to practice agriculture)? ▸ We hope that the training of trainers would be included for the technical training component as the restructuring measures for living.
	Bambalang	▸ Remind the various components of this project ▸ What happens to the people who continue to occupy the right of way after the assessment of assets? ▸ The people will be penalized if they exploit their listed assets (located in the project area)?
Central region	Obala	▸ When will the works begin ▸ Let us know more about the compensation policy ▸ If the population will be informed of the rest of the process?
	Akonolinga	▸ Rice cultivation has been practiced here in the past, notably in the framework of the rainfed rice development project, but for lack of support young people have lost interest. ▸ Notwithstanding the fact that the Akonolinga site had not been taken into account, the rice cultivation can still be promoted? ▸ We dispose of the land and have few experiences. We will be delighted to leave it as an inheritance to our offspring ▸ When will the works begin
Southern region	Biwong-Bulu	▸ When will the works begin
	Ngoulemakong	▸ What an ESIA is? ▸ If the people along the road can still hope for something from this project? ▸ How to deal with the rodents that have devastated our rice plantations?

In response to these questions, responses were made as follows (excluding comments from sites not covered by the project).

- **Project summary:** The project revolves around 3 components: Improvement of irrigated perimeters, rehabilitation of roads and construction of the processing plant. It is the road

component that primarily addresses the Bambalang village. It is precisely in the framework of rehabilitation of the Bamali 3 corners - Bambalang axis that the populations of the village will be affected by the project.

- **Timing of start of construction:** JICA / MINADER is committed to ensuring that the project is carried out properly. For this, protocols and procedures remain to be carried out before the work begins. Thus despite the validation of the report by the Ministry in charge of the environment, the way to go remains long. For this year, for example, a convention will have to be signed between the government of Cameroon (represented by MINEPAT) and the Japanese government. Before the signing of this agreement, a JICA evaluation mission will come to Cameroon to assess the feasibility of the project in terms of funding.

- **Agricultural practice in the ROW:** it is difficult to ask the peoples to leave the area of right of way for the project when they have not yet been compensated. What is important to know is that any property brought into the project area after the cut-off date will not be taken into account. However, people will be allowed time to harvest the assets there before the work begins. This project is being carried out according to an international standard.

- **Compensation process:** The DUP procedure is started and the Prefect establishes the Commissions. The commission is therefore responsible for updating the RAP. The actual version will serve as a background document for the Commission in order to go in line with the requirements of the donor (JICA). People do not have to worry, transparency remains the major concern in this kind of work. Whenever the need arises you will be informed, it is a legal obligation to notify the populations in advance. The project to improve ultimately the living conditions of populations, JICA awards a prize to the principle of public participation. Not all PAPs receive the same compensation. Indeed, the field surveys carried out were aimed at identifying the types of assets of each PAP. The amount of compensation is therefore a function of the lost property.

Chapter 6 Plan of Rice Value-Chain Improvement Project

6.1 Overall Concept of the Project

The objective of the Rice Value-Chain Improvement Project in the Republic of Cameroon is to increase of rice sufficiency ratio in the Republic of Cameroon as well as to improve food security within central Africa through regional distribution, by 1) improving access roads connecting on-farm and markets to expand rice distribution network, 2) promoting irrigated farmland development and 3) disseminating agricultural equipment to improve quality and quantity of rice productivity, thereby contributing to the sustainable food security in Cameroon.

Considering the fact that 80 % of total consumed rice in Cameroon depends on the imported rice, it is indispensable to produce and supply the domestic rice having sufficient competitiveness against those imported rice from the perspective of its quality and price. Thus, this project focuses on the improvement of agricultural infrastructures such as irrigation facilities, access road and agricultural equipments in order to produce the highly competitive rice under the cooperation with the PRODERIP.

In addition, the capacity development of the human resources is required for the continuous production of high quality rice and further development of producing area; thereby increase the rice sufficiency ratio in Cameroon. Therefore, this project also proposes to include the soft components which focuses on the capacity development of human resources who takes responsibility for the O&M and management of the facilities and equipments introduced through this project and for the extension of the development model created through this project.

6.2 Irrigation Development Component

6.2.1 Basic Concepts for the Irrigation Improvement Plan

(1) Outline of Basic Concepts

Based on the field surveys conducted, basic concepts for the irrigation improvement plan were created as shown below. Concepts 1 & 2 are applied to whole the target area. On the other hand, concept 3 & 4 are added to the upstream area in the target area, and the upstream area will be regarded as an irrigation-model site for promoting national rice production in Cameroon. Each concept is described from the next section.

Concept 1: Increase of Rice Cultivation Area & Rice-Unit Yield by Drainage Network
Concept 2: Improvement of Accessibility to Farmlands & Promotion of Farm Mechanization by Farmroads
Concept 3: Increase of Rice-Unit Yield by Controlling Irrigation & Drainage Water
Concept 4: Promotion of Farm Mechanization by Land Leveling & Integration of Small Farm Lots

(2) Increase of Rice Cultivation Area & Rice-Unit Yield by Drainage Network (Concept 1)

Present status: In addition to rainfall in the target area, rainfall water from the Ndop town, which is located on the north of the target area, and river water from the Mufuo River, which is located on the south west of the target area, have flowed into the target area. On the other hands, drainage network is not prepared although earthen-drainage canals have been partially dug by farmers in the middle and downstream area.

In the rainy season, water overflows from farm lots and finally reaches to the Monkie River, which is located on the east of the target area. In the heavy rainy season (August to September), the middle and downstream area is partly covered with water, and the water level in the field reaches to 60 to 90 cm. Because of submergence in the beginning stage of rice cultivation (June & July), rice is not cultivated

in 360 ha located in the middle and downstream area. Water level in the field doesn't vary largely year by year, and rice yield is roughly 1.8 ton/ha in the middle and downstream area because of the much water.

Challenge: In the middle and downstream area, current rice-unit yield is very low because of the much water in the field. And some farmers cannot cultivate rice because of the same reason. Moreover, promoting drainage is also essential from the view point of use of agricultural machineries (Tractor or combine harvester).

Solution: By promoting drainage, especially in the beginning stage of rice cultivation (June & July), rice cultivation area will be expanded, and rice-unit yield will also be increased. Moreover, by promoting drainage in plowing (June) and harvesting season (Mid. of November to end of December), agricultural machineries will become available even in the middle and downstream area. For these purposes, proper drainage network will be constructed in the target area.

(3) Improvement of Accessibility to Farmlands & Promotion of Farm Mechanization by Farmroads (Concept 2)

Present status: In the target area, internal farmroads are partially constructed, and 20 % of farmlands can be accessed through existing farmroads. Height of these farmroads is 1.2 meter from the field with about 5 meter width, and these farmroads are compacted by compactors. As the result, existing farmroads haven't subsided although wheel tracks are observed in the rainy season.

Challenge: Length of existing farmroads is 3.8 km, and it is not enough to promote farm mechanization. And because tractor passages haven't been constructed only in some parts of the upstream area, farm machineries cannot enter to farmlands. Moreover, farmroads are also essential to maintain drainage canals newly created in this project.

Solution: Internal farmroads will be constructed to promote farm mechanization. Main purpose of farmroads is to carry in/out farming machineries in plowing (June) and harvesting season (Mid. of November to end of December). Regarding layout of farmroads, connectivity to existing access roads will be well considered. Moreover, farmroads will be rayed out along drainage canals to function as maintenance roads.

(4) Increase of Rice-Unit Yield by Controlling Irrigation & Drainage Water (Concept 3)

Present status: In the target area, an intake dam has been constructed in the Mufuo River since 2006, and irrigation canals have also constructed since 2012 (Length: 2.8km, Beneficiary area: about 35ha). However, many farmers depend on the rainfall for rice cultivation, and irrigation water is regarded as a supplemental method. In this regard, result of comparison between rainfall and water requirement based on the modified Penmman method (FAO24 & 56) is summarized as below.

- Water requirement in the rainy season (Rice cultivation) was basically satisfied with effective rainfall except for saturation and paddling.
- Water requirement in the dry season (Maize cultivation) was not satisfied with effective rainfall.

Challenge: In the target area, water requirement for rice was basically satisfied with effective rainfall from the modified Penman method. However, it was found that rice-unit yield with irrigation water (5ton/ha) was larger than the yield without irrigation (3ton/ha) within the upstream area by the farmers interview. This reason is thought of as; 1) effective rainfall is calculated based on the total rainfall in a month, and doesn't consider variation in rainfall within a month, 2) in the upstream area, moisture of soil is smaller than that in the middle and downstream area because ground water level is low and 3) the upstream area is not covered with water like the middle and downstream area because the land slope is not gentle (1/125 (0.8%)). Therefore, it is possible to increase rice-unit yield by providing

irrigation water[19]. On the other hand, it is not possible to provide irrigation water in the dry season because water discharge is only 0.04 to 0.06m^3/s in March. In fact, UNVDA has provided irrigation water from June to October (Rainy season).

Solution: In the upstream area, Rice-unit yield will be increased by irrigation canals. Regarding layout of irrigation canals, connectivity to the existing irrigation canals will be well considered, and repair of the existing canals will also be conducted. Moreover, irrigation & drainage canals will be laid out along all the standard plots, which are described in the next section, and thus all the standard plots can control irrigation & drainage water in the upstream area.

(5) Promotion of Farm Mechanization by Land Leveling & Integration of Small Farm Lots (Concept 4)

Present status: In the upstream area, plot (called "room") size is basically 20m x 10m, and the long side is laid out along contour line. Farmers tend to use 4 or 5 plots along the long-side direction (4 rooms: 10 x 80m, 5 rooms: 10 x 100m).

Challenge: Present small plots are split up by ridge, and degree of leveling is not same among plots. Therefore, current plot structure is not efficient for promoting agricultural machineries. Therefore, farmlands consolidation is necessary to promote efficient use of agricultural machineries considering present farming practice.

Solution: Standard plot size will be 100 m x 10m considering present farming practice. However, land leveling will be conducted every 100m x 30m, and then the plot will be separated to 100m x 10m with ridges to promote further efficient use of agricultural machineries and expansion of plot size.

[19] There is a possibility to increase rice-unit yield with irrigation even in the middle and downstream area. However, some farmers have strongly resisted to conduct a measurement survey in the assumed additional-intake area. Regarding the additional intake, not only farmers' agreement but also construction possibility based on the measurement result and cost effectiveness need to be well discussed. Therefore, it is difficult to include this matter from the detailed design stage. It is proposed that UNVDA would discuss the additional intake in their future business plan considering the effect of the model site constructed in the upstream area in this project.

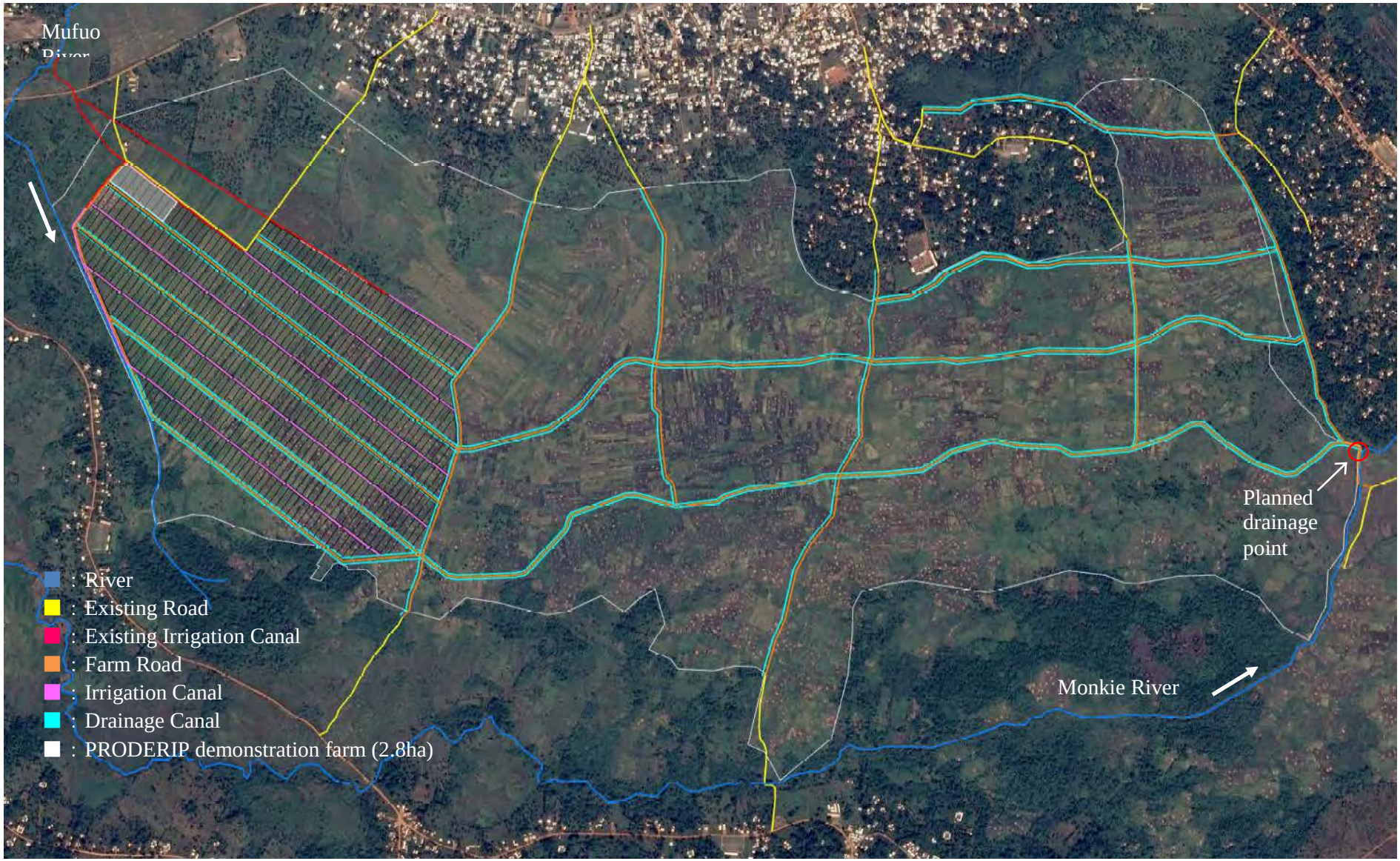


Figure 6.2.1 Outline Map of Improvement in the Target Area

6.2.2 Irrigation Improvement Plan

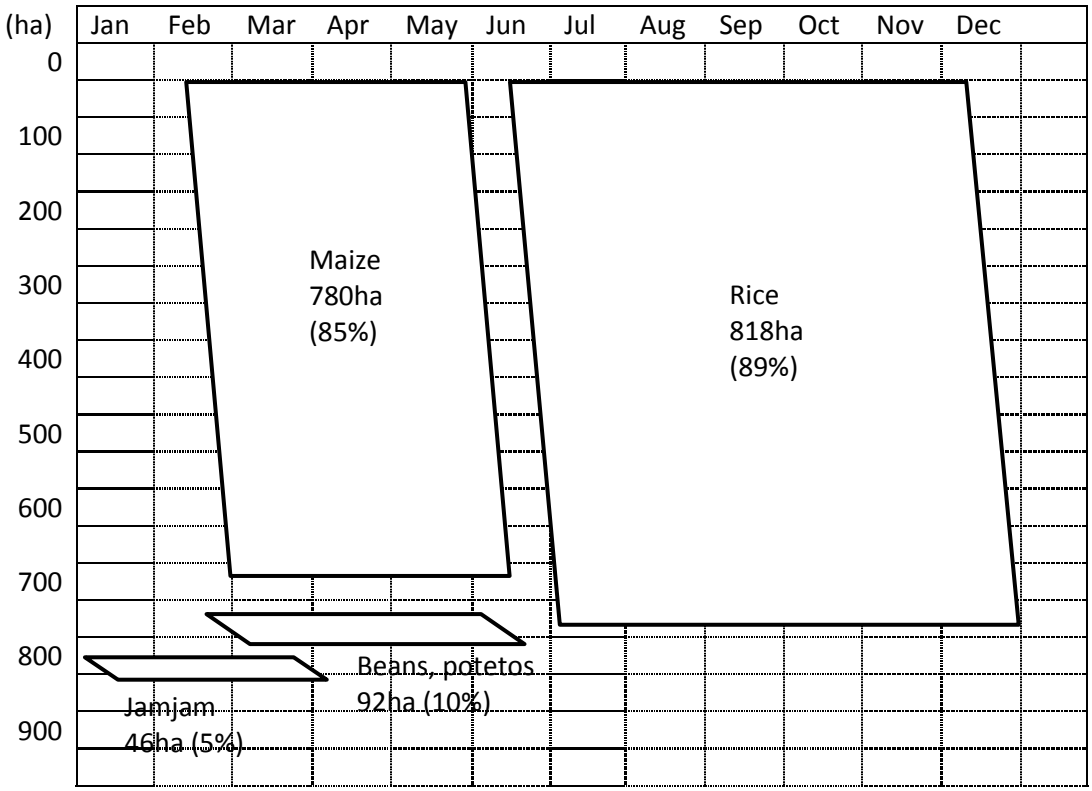
(1) Cropping Plan/ Farming Plan

Considering the basic concept for the irrigation improvement plan, cropping plan is assumed as shown in the following figure.

Because of too much water in the field, rice is not cultivated in 360 ha in the middle and downstream area. By promoting drainage, especially in a seedling & booting stage (June to July), rice cultivation area will be expanded. And Maize cultivation area will also be expanded.

By the way, in the middle and downstream area, farmers have conducted nursery raising in May and transplanted rice in the beginning of June to prevent damage by too much water. However, this schedule might prevent use of combine harvesters because the timing of harvest will become November, and water might still remain in the field.

To promote use of farming machineries, it is proposed that transplanting season in the middle and downstream area will be delayed from the beginning of June to the beginning to July as a draft cropping plan.



(Source: JICA Study Team)

Figure 6.2.2 Cropping Plan (Draft)

(2) Drainage Plan

Drainage canals will be installed to drain extra rainfall and river water flowing from inside and outside the target area. Water to be removed is not only the rainfall in the target area ($9km^2$) but also the rainfall water from the Ndop town ($5km^2$) located on the north of the target area (The chart below).

Regarding rainfall, probable 24-hour rainfall will be drained within 24 hours (Runoff volume I) (Maff, Design standard "Farmland consolidation").

Moreover, river water from the Mufuo River, which is located on the south west of the target area, has flowed into the target area. Regarding the water of the Mufuo River, design flood discharge will be regarded as a runoff volume and it will be smoothly drained (Runoff volume II)[2021].

1) Design Drainage Discharge

Daily Rainfall:	108.6mm/day (10 year probable rainfall intensity)
Catchment area I:	14km^2 (Upper Bamunka9km^2+Ndop5km^2)
Runoff rate I[22]:	0.9
Runoff Volume I:	14 x 1,000,000 x 0.1086 x 0.9 = 1,368,360m^3/day = 15.8m^3/sec
Catchment area II:	22km^2 (Mufuo River catchment area: 22km^2)
Runoff volume II:	Design flood discharge is 36.2m^3/sec (Refer to the next section). 36.2 x 50%[23] = 18.1m^3/sec
Design drainage discharge:	15.8 + 18.1m^3/sec = 33.9m^3/sec

[20] There are two methods to drain Mufuo river water. One is to expand cross sections of drainage canals to drain the Mufuo river water. Another is to construct embankment along the Monkie river after drain the Mufuo river water to the Monkie river in the upstream area. However, the latter option is more costly because it requires long embankment along the Monkie river.
[21] In August (heavy rainy season), outside water level (water level of Monkie river) becomes higher than farm field elevation at 0.4 m at around the planned drainage point. However, the situation will not constrain the rice cultivation because the inundation level is within an allowable inundation depth.
[22] Runoff rate 0.9 was adopted based on "Steep hill: 0.75～0.9, City area with high paved rate: 0.9～1.0, Rice field under irrigation: 0.7～0.8 (MAFF, Design Standerd "Drainage planning")".
[23] Tailend of the Mufuo River is divided into some tributaries. Cross sectional area of tributaries which flow into the target area was about half of that of the Mufuo River.

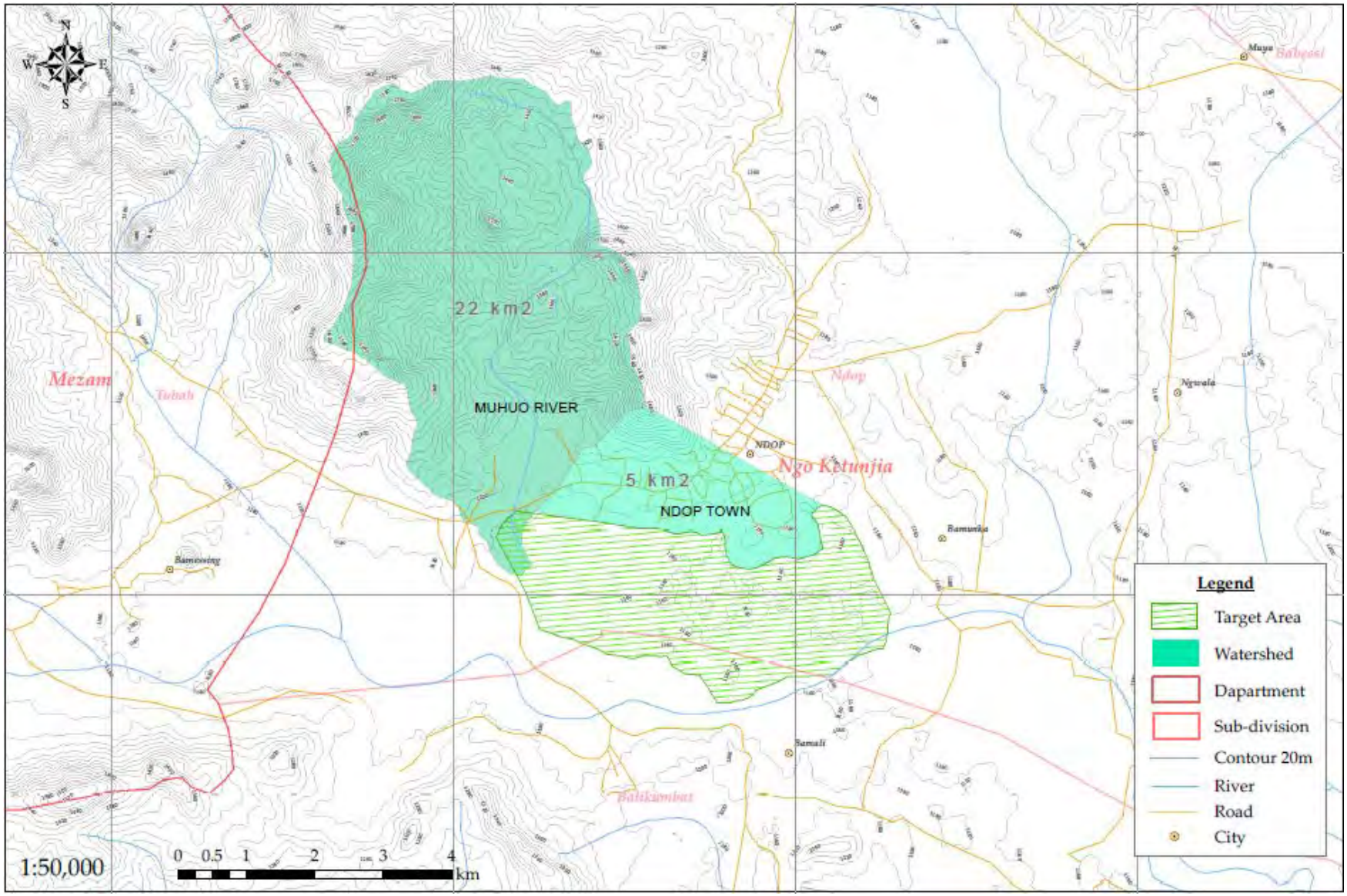


Figure 6.2.3 Map of the Catchment Area

2) Design Flood Discharge of the Mufuo River (Analysis of Runoff Volume II)

i) Analysis of Design Flood Discharge

For analysis of design flood discharge in Cameroon, the formulas below are adopted depending on size of catchment area. Since the catchment area of the Mufuo River is 22km^2, Auvray-Rodier formula was used. To verify the accuracy of design flood discharge led by Auvray-Rodier, flood discharge was also calculated by cross-section survey considering the flood trace and hydraulic analysis.

Table 6.2.1 Formulas for Analysis of Design Flood Discharge

Size of Catchment Area	Formula for Analysis of Design Flood Discharge
<10km^2	Rational formula or IRD1 (Auvray-Rodier (ORSTOM)) or CIEH (Methode regional de PUECH-CHABI-GONNI)
10km^2< <1500km^2	IRD1 (Auvray-Rodier) or CIEH
<1500km^2	CIEH or IRD2 (Francou-Rodier)

ii) **A**nalysis by Auvray-Rodier Formula

Precipitation data from Bamenda meteorological station is the most reliable in the NorthWest region since it has records of long period for 25 years from 1991 to 2015. Probable rainfall intensity with certain year return period were calculated by Gumbel method and shown in the table below.

Table 6.2.2 Daily Maximum Rainfall (Bamenda Meteorological Station)

Year	Daily rainfall (mm)	Year	Daily rainfall (mm)	Year	Daily rainfall (mm)
1991	82.5	2000	75.9	2009	96.10
1992	86.5	2001	70.2	2010	63.70
1993	104.8	2002	71.4	2011	86.80
1994	82.4	2003	69.9	2012	93.00
1995	73.7	2004	118.3	2013	62.10
1996	85.9	2005	89.00	2014	84.50
1997	86.0	2006	84.10	2015	60.30
1998	64.1	2007	73.00		
1999	80.4	2008	129.30		

Table 6.2.3 Probable Rainfall Intensity with Certain Year Return Period

Return period	Rainfall intensity (mm/day)	Return period	Rainfall intensity (mm/day)
2	80.5	20	119.3
5	97.4	30	125.5
10	**108.6**	50	133.2
15	114.9	100	143.6

Adopting 108.6mm/day as rainfall intensity in Auvray-Rodier formula, 36.2m3/sec is led as flood discharge with 10 year return period.

Runoff Discharge (Qmax) = Peak Coefficient (k) × Runoff Coefficient (Kr) × [Reduction Coefficient (C) × Daily Probable Rainfall with 10year Return Period (P) × Catchment Area (S) / 3.6 × Flood Basic Time (Tb)]

where Peak coefficient (k): Gentle slope 2.4
Runoff coefficient (Kr): Based on the geographical features of the site 17.65
Reduction coefficient (C): 1-((161-0.042*Pan)/1000)*logs = 0.874
Daily probable rainfall (P): 108.6mm/day
Average annual rainfall (Pan): 1,594mm /year

Catchment area (S): 22km^2
Flood basic time (Tb): 678minutes[24]

iii) Analysis by Cross-Section Survey Considering the Flood Trace

Flood water level was confirmed at the site hearing from farmers nearby. Based on the cross-section survey considering the flood water level, flood discharge with 10year return period was calculated using the following Manning formula.

Runoff Discharge (Qmax) = Water Area (A) ×Velocity (V)

Velocity (V) = 1 / Coefficient of Roughness (n) × Hydraulic Mean Depth (R)2/3 × Gradient of Canal (I)1/2

$Q = 38.79\ (m^2) \times 0.959\ (m/s) = 37.2 m^3/s$

$V = 1 / 0.04 \times 1.703^{2/3}\ (m) \times (1/1383)^{1/2} = 0.959 m/s$

As the table below shows, there is no big difference between the discharges. We use 36.2m^3/sec led by Auvray-Rodier formula as flood discharge.

Table 6.2.4 Design Flood Discharge

Analysis method	Flood discharge (m^3/sec)
Analysis by Auvray-Rodier formula	36.2
Analysis by cross-section survey considering the flood trace	37.2

3) Layout of Drainage Canals

Runoff from the Mufuo River will be drained through a main drainage canal to the Monkie River. Main drainage canals will also be installed to east-west directions, and secondary drainage canal will be installed to south-north directions. Existing small drainage canals dug by farmers will be regarded as tertiary drainage canals. Water of farmlands will be drained through tertiary to secondary, and to main drainage canals. In the upstream area regarded as a model area, tertiary drainage canals will be installed to all the standard plots. Regarding layout of main drainage canals, water paths, which have been naturally formed based on the topography, and existing drainage canals dug by farmers will be well considered.

4) Drainage Diagram

Based on the drainage canals laid out, catchment area of each drainage canal was prepared (The chart below). And design drainage discharge is also shown as drainage diagram (The chart below).

[24] ORSTOM "Predetermination of the flow for floods in west Africa for small catchment areas" Graph 13

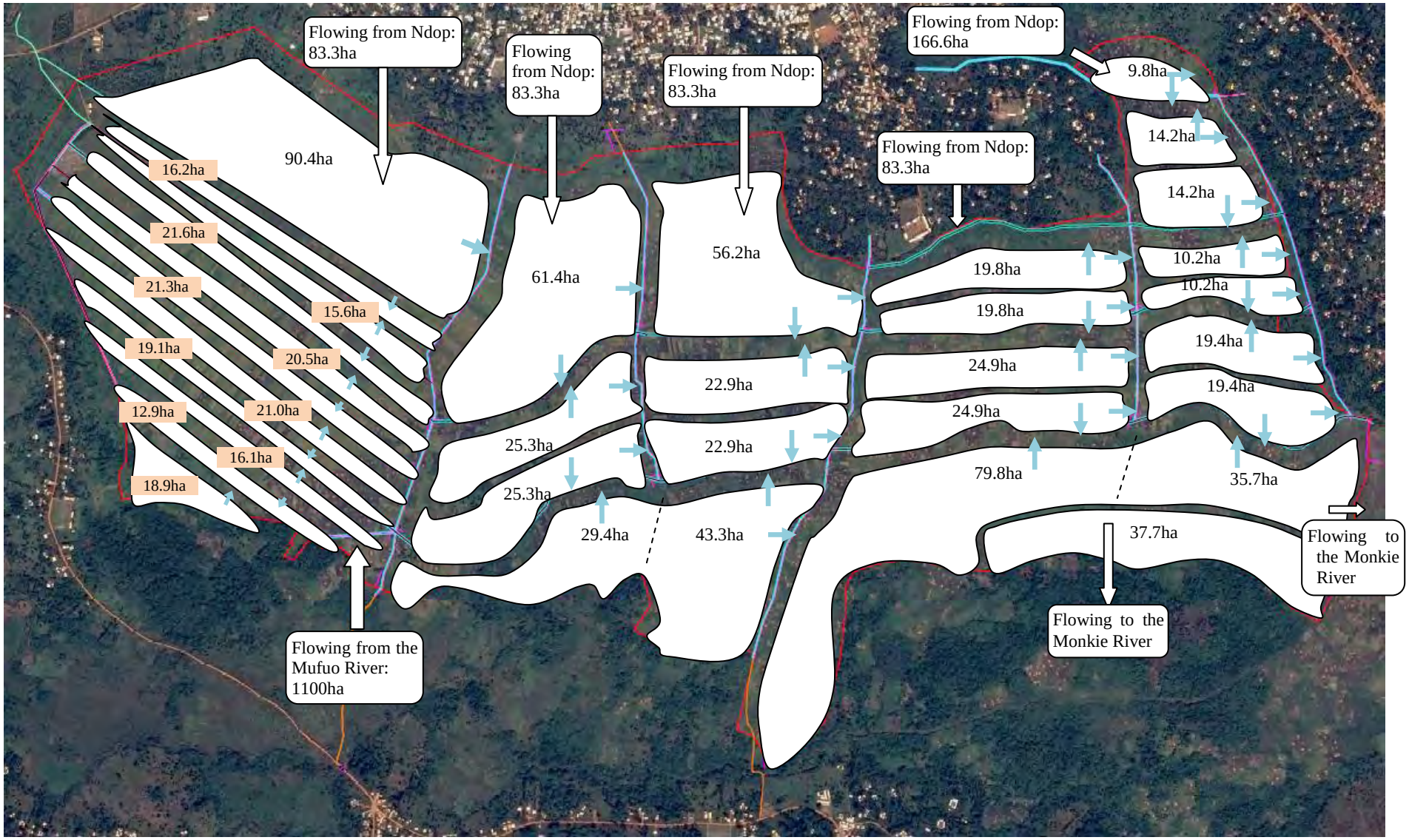


Figure 6.2.4 Catchment Area of Each Drainage Canal

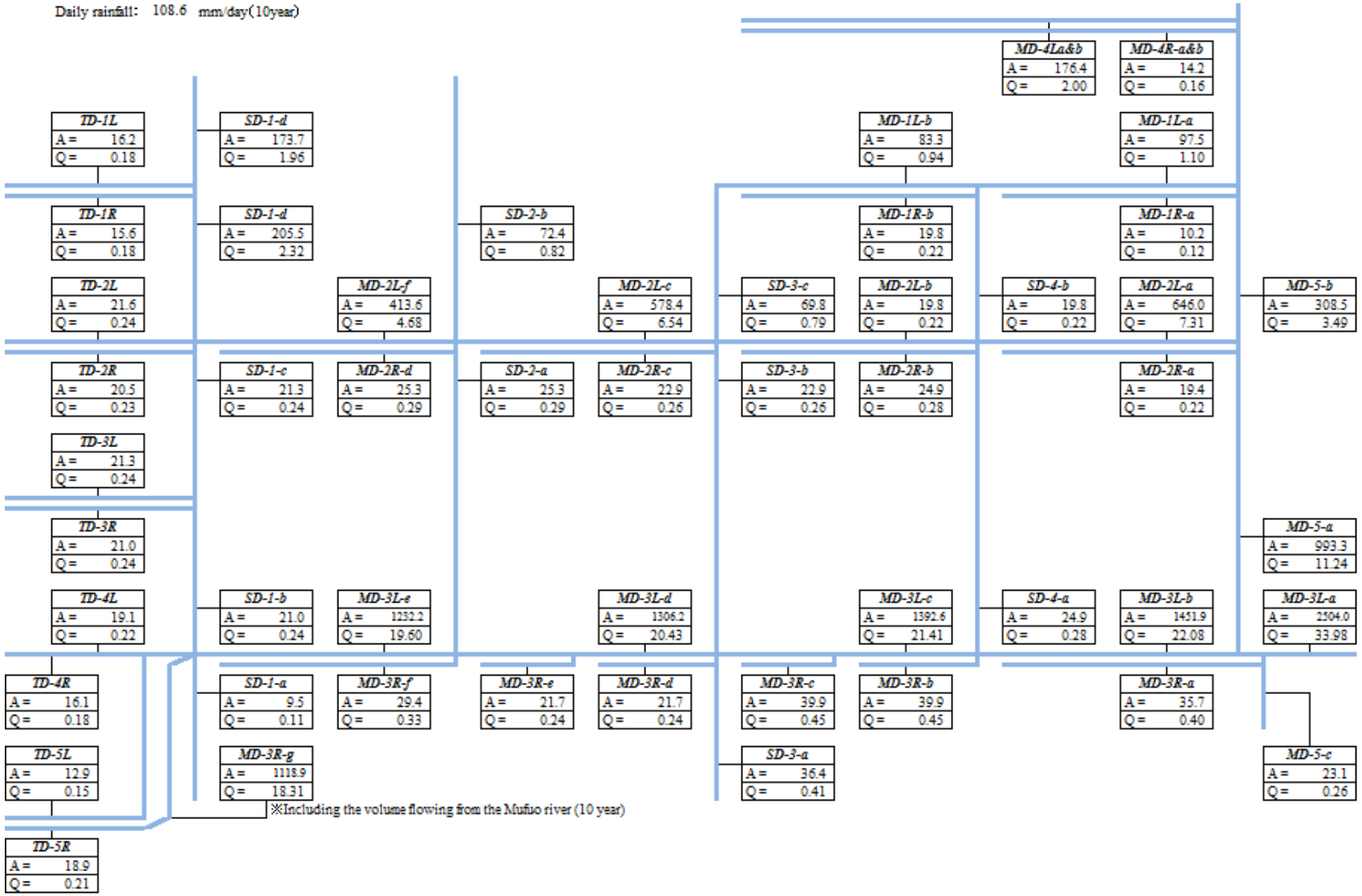


Figure 6.2.5 Drainage Diagram

5) Cross Section of Drainage Canals

Cross sections of drainage canals were calculated by Manning formula to drain the design drainage discharge for each section (Refer to the drawing). Points considered in calculation are shown in the following table.

Cross-Sectional Flow Area (A) = Discharge (Q) / Mean Velocity (V)

Mean Velocity (V) = 1 / Coefficient of Roughness (n) x Hydraulic Radius (R)2/3 x Hydraulic Gradient (I)1/2

Table 6.2.5 Points Considered in Calculating Cross Sections of Drainage Canals

1	Regarding small drainage canals (Width of bottom is less than 1.6m), cross sections were calculated considering hydraulic most efficient section. The other drainage canals, cross sections were decided considering altitude of the river bed to be drained. At the tail end of the main drainage canal, related altitudes are summarized as shown below. River bank: 1154.19m, Bank of drainage canal: 1153.95m, Bed of drainage canal: 1151.75m, River bank: 1151.14m
2	Free board was decided to satisfy the formula below (Maff, Design standard "Drainage planning"). Fb = 0.07d + hv + (0.05 to 0.15) Fb: Freeboard(m), d: Water depth at design discharge (m), hv: Velocity head (m) If Fb < 0.3m, then, Fb=0.3m
3	Cross sectional areas and slopes of drainage canals were set up based on the 10 year probable daily rainfall. Moreover, it was confirmed that the planned slope is within allowable maximum velocity (Clay: 1.0m/s x 1.5) based on the Japanese design standard (Maff, Design standard "Drainage planning").

(3) Internal Farmroad Plan

Internal farmroads will be constructed considering accessibility and connectivity to existing access roads (Length: 28.22km). Distance between farmlands to roads will be improved from 1.5km to 0.5km at a maximum. Moreover, in the upstream area regarded as a model area, farmroads will be constructed to all the standard plots.

Width of farmroads will be 5m (road: 4.5m, road shoulder: 0.25m x 2). The width was set up so that a tractor with more than 50 h.p. (Width: 2.3m) and a small track (2ton, width: 1.7m) could pass each other (road: 2.3m+1.7m+0.5m (margin width)) (Maff, Design standard "Farm road"). Design height of farmroads is 1.2 meter from the field in the middle and downstream area which too much water in the field (submergence) is observed in. On the other hand, design height of farmroads is 0.3 meter from the field in the upstream area which too much water is not observed in. Slope gradient will be 1:1.2 considering banking material and banking height based on the Japanese standard (Maff, Design standard "Farm road"). The planned gradient is same as that of existing internal farm road, and the slope failure has not occurred. Regarding pavement structure, 10cm thickness of gravel (Laterite including much gravel) will be executed (Refer to the drawing).

(4) Irrigation Plan

1) Reference Crop Evapotranspiration (ETo)

Reference crop evapotranspiration (ETo) was calculated by FAO Penman-Monteith method (FAO Irrigation Drainage Paper No. 56). Six items, namely, latitude, altitude, temperature, wind speed, relative humidity and sunshine hours were used as parameter for calculation. The calculation result of monthly ETo is described in the following table.

Table 6.2.6 Monthly Reference Crop Evapotranspiration (ETo)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
ETo	mm/day	4.05	4.63	4.52	4.19	3.93	3.51	3.21	3.22	3.39	3.60	3.87	3.91
	mm/month	126	130	140	126	122	105	100	100	102	112	116	121

2) Crop Evapotranspiration (ETCrop)

Based on FAO Irrigation Drainage Paper No. 56 & 24, Crop Evapotranspiration (ETCrop) is calculated as followings.

ETCrop = Crop Coefficient (KC) x Reference Crop Evapotranspiration (ETo) x Crop Ratio

In the upstream area which irrigation water is provided, the crop ratio is assumed as Rice with 100% in rainy season, and ETCrop is shown in the following table. As shown in the table, maximum monthly ETCrop was 4.06mm/day in September.

Table 6.2.7 ET Crop

Crop	C/R (%)	Month	Jul	Aug	Sep	Oct	Nov	Remark
Rice	100	ETo (mm/day)	3.21	3.22	3.39	3.60	3.87	ET Crop = ETo * KC*C/R
		KC	1.1	1.2	1.2	1	0.18	
		ET Crop (mm/day)	3.65	3.99	4.06	3.72	0.70	

3) Irrigation Efficiency

Irrigation efficiency was calculated as 0.23 in rice regular season as shown in the following table (FAO No.24). On the other hand, water requirement for saturation and paddling is 180 mm from the Japanese standard. And this value includes field application efficiency (Ea). Therefore, field application efficiency is 1 for calculating irrigation efficiency in saturation and paddling. Thus, irrigation efficiency in saturation and paddling was calculated as 0.72.

Table 6.2.8 Irrigation Efficiency

	Conveyance Efficiency (Ec)*1	Field Canal Efficiency (Eb)*2	Field Application Efficiency (Ea)*3	Irrigation Efficiency (Ep=Ec*Eb*Ea)
Rice (Regular season)	0.9	0.8	0.32	0.23
Rice (Saturation & Paddling)	0.9	0.8	1	0.72

*1) Ratio between water received at inlet to a block of fields and that released at the project headworks.
*2) Ratio between water received at the field inlet and that received at the inlet of the block of fields.
*3) Ratio between water directly available to the crop and that received at the field inlet.

4) Unit Water Requirement

Unit water requirement (UWR) is determined by peak ETo, irrigation efficiency and irrigation hours. UWR at regular period of rice cultivation and UWR for saturation and paddling need to be compared, and the larger value is adopted as UWR for designing facilities. Irrigation hours are assumed as 24 hours including night time because it is easy to irrigate water by opening inlets in gravity irrigation system. From the calculation below, UWR for saturation and paddling (2.89 l/s/ha) was adopted as UWR for designing facilities.

Unit Water Requirement = ETCrop (mm/day) / Irrigation Efficiency / Irrigation Hours

UWR at regular period of rice cultivation

= 4.06 (mm/day) / 1,000 × 10,000 (m^3) / 0.23 / 24 (hr) / 3,600 (s) ＝ 2.04 l/s/ha
UWR for saturation and paddling
= 18 (mm/day)[25] / 1,000 × 10,000 (m^3) / 0.72 / 24 (hr) / 3,600 (s) ＝ 2.89 l/s/ha

5) Availability of Water Resources

Water level in the feeder channel near the intake was about 22.5 cm in saturation and paddling period (June) according to the interview to UNVDA staff. Quantity of water intake was calculated as 0.145m^3/s using Manning formula. Because irrigation hours are assumed as 24 hours, available quantity of water intake was calculated as 12,528m^3/day.

Discharge (Q) = Cross-sectional Flow Area (A) x Mean Velocity (V)

V = 1 / Coefficient of Roughness (n) x Hydraulic Radius (R)2/3 x Hydraulic Gradient (I)1/2

Q ＝ 0.553 (m^2) × 0.263 (m/s) ＝ 0.145m^3/s

V ＝ 1 / 0.035 × $0.193^{2/3}$ (m) × $(1/1313)^{1/2}$ ＝ 0.263 m/s

From the actual situation of cropping in the field, saturation and paddling period was set up as 33 days (about 1 month), and available area for irrigation was calculated as shown below. Thus, irrigation water can be provided to 165ha.

Available Area (A) = Available Quantity of Water Intake (Q) / Water Requirement at Saturation and Paddling (q) x Available Days for Saturation and Paddling (D)

= 12,528 (m^3/day) / [180 (mm) / 1,000 x 10,000 (m^3) / 0.72] x 33 (days) = 165 ha

6) Layout of Irrigation Canals

In the upstream area, irrigation water is gravitationally provided to roughly 35ha by damming up the Mufuo River. In this project, irrigation area will be expanded to 164.3ha by construction of new irrigation canals including repair of existing canals[26]. Regarding layout of irrigation canals, a secondary irrigation canal (0.8km) will be installed along contour line connecting to existing irrigation canal. And tertiary irrigation canals will be installed to all the standard lots in the perpendicular direction to the contour line (Length: 6.7km).

7) Irrigation Diagram

Irrigation diagram is described in the following figure and prepared based on the unit water requirement of q = 2.89 (l/s/ha) multiplying by beneficiary area.

[25] Water requirement for saturation and paddling is 180mm. On the other hand, in the calculation of unit water requirement, 18mm/day (=180mm*0.1day) is used to calculate cross-section area which can provide 180mm of water to the target area (164ha) in 10 days.
By the way, saturation and paddling period is set up as 33 days (about 1 month) as described later. However, an allowance is added to the cross section area in terms of facility design.

[26] Palm, Banana and dry-land rice are traditionally cultivated in the upstream area of the current irrigation area. It is geographically difficult to provide irrigation water to this traditional farming area by the existing irrigation canals. Moreover, it is required to conduct roots cutting of Banana or Palm trees to change from the traditional farming to rice farming. Therefore, this area is excluded based on the advice of UNVDA.

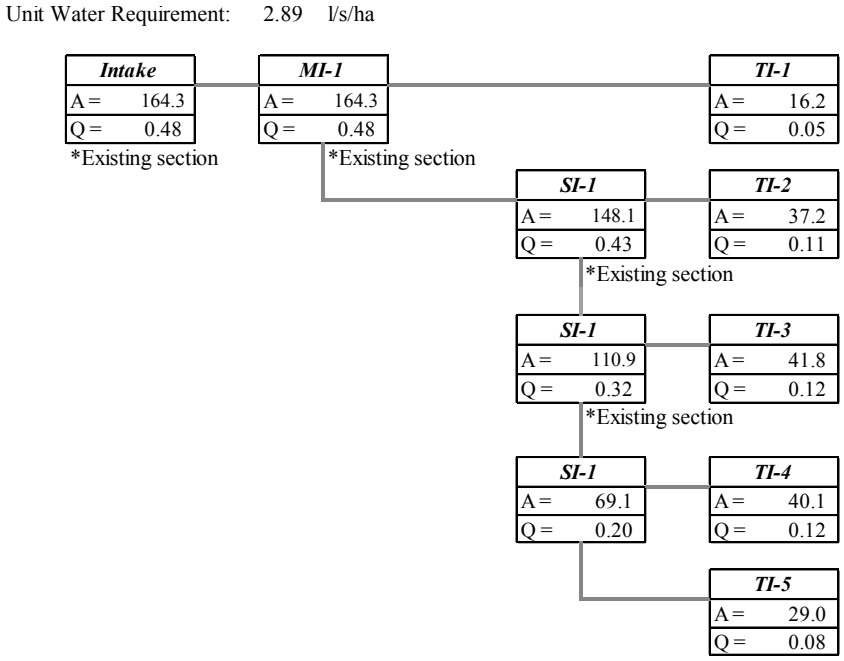


Figure 6.2.6 Irrigation Diagram

8) Cross Section of Irrigation Canals

Cross sections of irrigation canals were calculated by Manning formula same as drainage canal to distribute the design irrigation discharge for each section (Refer to the drawing).

(5) Farm Land Consolidation Plan

In the model area (164ha) of the upstream area, existing small plots will be integrated to create standard plots, and land leveling will also be conducted. Standard-plot size will be 100m x 10m considering current farming practice. However, land leveling will be conducted every 100m x 30m, and then the plot will be separated to 100m x 10m with ridges to promote further efficient use of agricultural machineries and expansion of plot size.

(6) Agreement of "Farm (Water Users Association)" for the Project

Regarding reallocation of farmlands needed for irrigation or road projects, UNVDA has held meetings with management committee of the "Farm", and finally made "Farm" conduct necessary reallocation. In this project, similar manner will be adopted. Agreement obtained from 6 "Farms" covering the target area is shown as follows.

Regarding a cadastral map, individual plots are not shown in the map although "Farm committee" is keeping a land registration booklet. It is necessary to prepare a cadastral map by confirming all the existing plots with farmers in the field and to get agreements of individual farmers for reallocation of their farm lands in coming detailed-design stage. In the detailed design stage, individual agreement of related farmers will be obtained through the works shown in the following table. Consultant will monitor all the works in the table. Moreover, the consultant will prepare educational materials for land consolidation and strengthen the capacity of UNVDA staff based on the necessity.

Table 6.2.9 Consensus building for irrigation component

	Item	Activities	Role sharing of activities
1	Present cadastral map	To prepare a present farm plots map and to specify their users.	1) Consultant will prepare a present farm plots map. 2) Users of each plot will be specified by UNVDA and Farm Committee based on the map.
2	Detailed design	To prepare a layout drawing of planned irrigation facilities.	1) Consultant will prepare the layout drawing of irrigation facilities.
3	Planned cadastral map	To prepare a future cadastral map based on the layout drawing of planned irrigation facilities. To obtain individual agreement of related farmers for the planned cadastral map.	1) The planned cadastral map will be formulated by UNVDA and Farm Committee. 2) Individual agreement will be obtained by UNVDA and Farm Committee.

AGREEMENT FOR REALLOCATION OF FARM LAND FORCONSTRUCTION OF IRRIGATION FACILITIES

In the Upper Bamunka irrigation project, construction of drainage canals, farm roads, irrigation canals, integration of small farm lots and leveling of farm lots are planned to be executed.
For smooth execution of the project, we agreed to conduct all the necessary reallocation of farm lands. We also agreed to reallocate those lands based on the equal principle under the supervision of UNVDA.

On behalf of Upper Main Farm members
Name: JOHN SUH — Signature:
Post: President — Date: 28/09/2016

On behalf of Upper Middle Farm members
Name: DUFA CYPRIAN — Signature:
Post: President — Date: 28/09/2016

On behalf of Tumba Farm members
Name: FONGKONYI SIMON — Signature:
Post: President — Date: 28-09-2016

On behalf of Lower Middle Farm members
Name: NJOFUH ALBERT — Signature:
Post: President — Date: 28/09/2016

On behalf of Muakwe Farm members
Name:NJENGEH PATRICK — Signature:
Post: President — Date: 28-9-2016

On behalf of Mbueh Farm members
Name: NDEMECH AUGUSTINE — Signature:
Post: President — Date: 28/09/2016

On behalf of Bamali main Farm members
Name: NGOPUH TIAMAH GEORGE — Signature:
Post: President — Date: 28/09/2016

General Manager
UNVDA

Chin Richard Wirnkar
Ingénieur d'Agriculture

Figure 6.2.7 Agreement of "Farm" for Reallocation of Farmlands

(7) Bill of Quantity

Bill of quantity is as follows.

Table 6.2.10 Bill of Quantity for Irrigation development component

Structure	Unit	Quantity	Remarks
Drainage canal (Side slope1:1.0)	km	46.34 (Total)	Earthen canal
Drainage canal Type A (Bottom width0.4, Top width1.4, Depth0.6)	km	19.61	
Drainage canal Type B (Bottom width0.5, Top width2.1,Depth0.8)	km	9.00	
Drainage canal Type C (Bottom width0.6, Top width2.6, Depth1.0)	km	2.42	
Drainage canal Type D (Bottom width0.8, Top width3.2,Depth1.2)	km	4.67	
Drainage canal Type E (Bottom width1.2, Top width4.6,Depth1.7)	km	3.50	
Drainage canal Type F (Bottom width1.6, Top width5.6, Depth2.0)	km	1.91	
Drainage canal Type G (Bottom width4.0, Top width8.2, Depth2.1)	km	0.33	
Drainage canal Type H (Bottom width4.8, Top width9.0, Depth2.1)	km	1.98	
Drainage canal Type I (Bottom width5.2, Top width9.4, Depth2.1)	km	2.82	
Drainage canal Type J (Bottom width8.0, Top width12.4, Depth2.2)	km	0.10	
Internal farmroad (Side slope 1:1.2)	km	28.22 (Total)	
Internal farmroad TypeA (Width of bottom5.5, Width of top5, Hight0.3)	km	9.12	TypeA: Upstream area
Internal farmroad TypeB (Width of bottom7.9, Width of top5, Hight1.2)	km	19.10	TypeB: Mid&downstream area
Tractor passage	Spot	901 (Total)	
Tractor passage TypeA (Pipe: D800, L=3.5)	Spot	100	TypeA-E: Every 120m interval along farm road in mid&downstream area (West and east direction).
Tractor passage TypeB (Pipe: D1000, L=3.5)	Spot	18	
Tractor passage TypeC (Pipe: D1000 double, L=3.5)	Spot	37	
Tractor passage TypeD (Box: W1.5 x H1.0)	Spot	5	
Tractor passage TypeE (Box: W2.0 x H1.0)	Spot	10	
Tractor passage TypeF (Pipe: D300, L=3.4)	Spot	732	TypeF: Every 20m interval along farm road in upstream area.
Road crossing	Spot	314 (Total)	
Road crossing TypeA (Box: W1.0 x H1.5, L=8.0m)	Spot	1	
Road crossing TypeB (Box: W2.0 x H1.0, L=8.0m)	Spot	3	
Road crossing TypeC (Box: W2.0 x H1.5, L=8.0m)	Spot	1	
Road crossing TypeD (Box: W2.0 x H2.0, L=8.0m)	Spot	1	
Road crossing TypeE (Box double: W2.0 x H2.0, L=8.0m)	Spot	3	
Road crossing TypeF (Box double: W2.5 x H2.5, L=8.0m)	Spot	4	
Road crossing TypeG (Box triple: W2.5 x H2.5, L=8.0m)	Spot	1	
Road crossing TypeH (Pipe: D800, L=8.0m)	Spot	16	
Road crossing TypeI (Pipe: D1000, L=8.0m)	Spot	1	
Bridge	Spot	2	
Irrigation canal (Side slope 1:0)	km	7.43 (Total)	RC
Irrigation canal TypeA (Width0.4, Depth0.4)	km	6.68	
Irrigation canal TypeB (Width0.5, Depth0.5)	km	0.75	
Integration of small plots and land leveling	ha	164.3	
Division box	Spot	3	RC
Inlet	Spot	1,643	1plot=0.1ha ∴164.3ha/0.1=1,643
Repair of existing irrigation canal	km	0.04	Wet masonry

6.2.3 Drawings

Outline design drawings are attached in the Annex.

6.2.4 Construction Cost of Irrigation Development

Major construction works and their construction costs are shown in the following table[27].

Table 6.2.11 Major construction works and construction costs of Irrigation development component[28]

	Major works	Descriptions	Details	Construction cost (million FCFA)
1.	Irrigation canals Land reclamation	Main and secondary canals Land leveling and land gradation/degradation	Canal length: 7,430m, Diversion: 3 sites Total area: 164 ha	1,969
2.	Drainage canals	New drainage canal: 5 canals	Canal length: 46,340 m	2,454
3.	Farm roads Concrete culverts	Farm roads	Road length: 28,220m	2,993
			Total	7,416

6.2.5 Construction Plan

(1) Construction methods

1) Preparatory works

Before initiating the construction works, the contractor shall confirm an alignment of the irrigation, drainage canals and farm roads in the presence of government officials (UNDVA). It is also necessary to explain acquired area, construction schedule, temporary works (ex. temporary roads) for the construction to the beneficiaries.

2) Construction works

Detours shall be constructed to secure the access of farmers to their farmlands. Excessive surface and ground water shall be drained by water pumps especially in the lower beneficial area. Seepage water in around the base slab of the bridges and concrete culverts is also drained by pumps.

3) Earth works for farm road construction

Clayey foundation soil and unsuitable soil along the proposed farm roads will be spread on the farmland or transported to the designated disposal area. Well graded laterite material is collected in the borrow area.

4) Pavement works for farm road

Laterite soil with high gravel content is spread and compacted in around 0.1 m thickness.

[27] Exchange rate: US$1.00=¥101.3、US$1.00=FCFA592、€1.00=FCFA656 (October 2016) Physical contingencies and price escalation are not included in the cost.

[28] The construction cost is estimated based on the unit price of labor service, materials, equip ownership cost and their quantity per unit. The quantity is calculated based on the design drawing. The unit price of labor service, materials and equip ownership cost is estimated based on the minimum price of the quotation collected from the 3 local contractors. The quantity per unit is calculated based on the estimation standard of land improvement works published by Ministry of Agriculture, Forestry and Fisheries, Japan. The unit price of each works is validated by referring the results of quantity survey of Batchenga-Lena Road Project conducted in 2016.

Compaction work is conducted by bulldozer, macadam and tire rollers.

5) Concrete works

Job-mixed concrete is poured for small scale structures. Fine and course aggregates for concrete is obtained at the crushing plant in the vicinity. Concrete of the proposed bridges and culverts is also obtained from the concrete mixing plant to secure the required quality of the concrete. Crane bucket is used for concrete casting, and shoot type casting is for small structures and leveling concrete.

6) Drainage works

Clayey soil is hauled to a designated disposal area after excavation by backhoes and loading by wheel loaders. Slope of drainage canals are assumed as 1:1.

7) Land reclamation

Land leveling work is proposed for the area of 164 ha in the upstream of the beneficial area. Farm plot size is set to 10 m × 100 m (0.1 ha). However, land leveling will be conducted every 30 m × 100m, and then the plot will be separated to 10 m × 100 m with ridges. Land leveling is about 0.2 m grading and degrading in a farm plot on average. Furrow is embanked with manpower after the farm leveling work. 15 tons of bulldozers will be used for land reclamation.

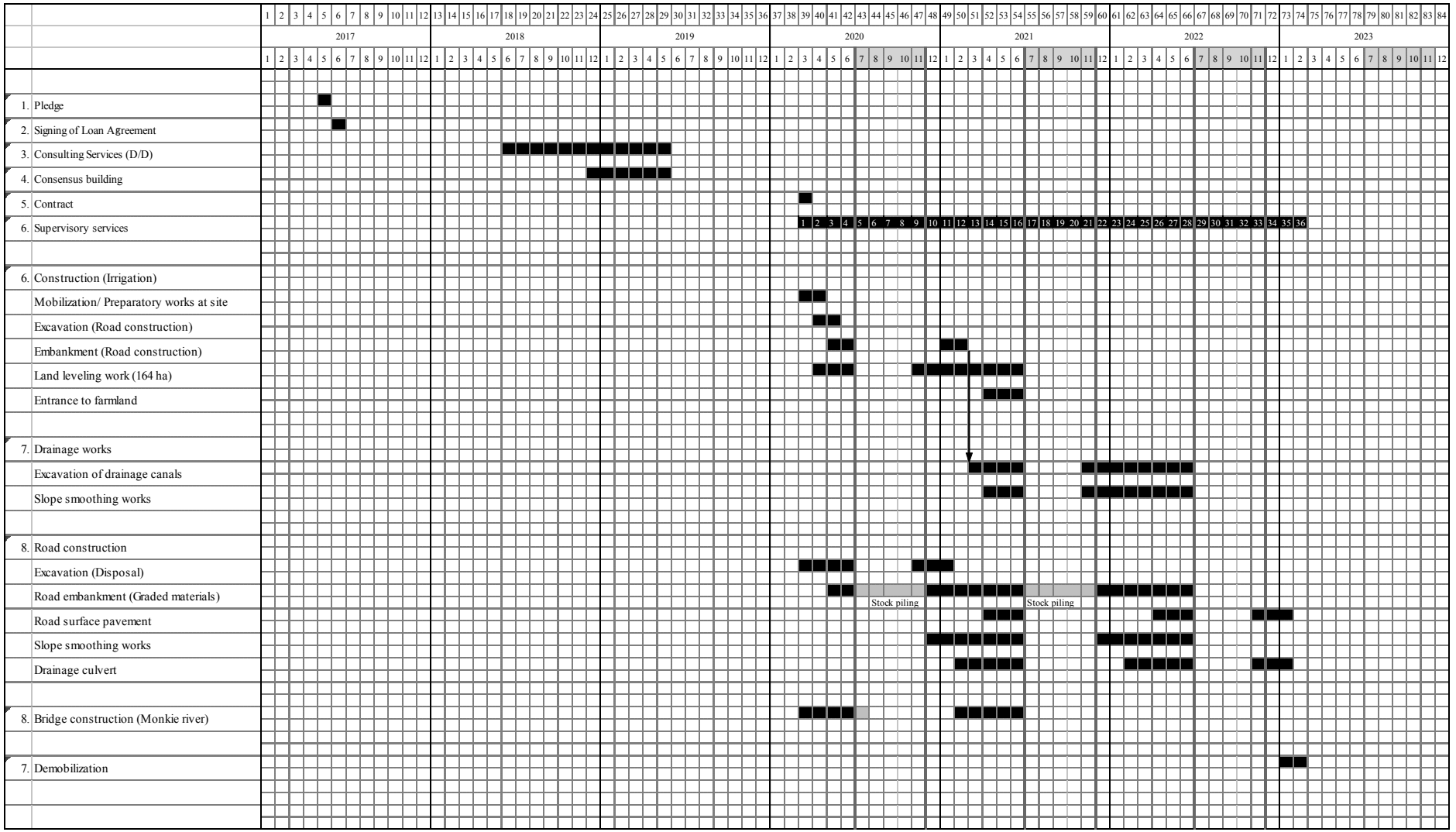
(2) Construction schedule

Construction schedule is shown in the following table. Construction is scheduled from March 2020. Construction works consist of irrigation and drainage works and farm road construction. Site office, warehouses, steel processing place, machinery parking lot is installed within two months from the beginning. It is notable that the construction schedule has to be properly proposed not to affect rice cultivation work from July to November.

Drainage work is started in March 2021 after the earth works of the irrigation work completes. Drainage work is mainly composed of canal excavation, soil disposal and canal slope leveling. Drainage work on the middle and downstream area of the beneficial area can be conducted from February when ground water level descends.

Farm roads and canal crossing drainage culverts are to be constructed concurrently with the drainage canal. The work is implemented in March 2021. Appurtenant structures such as drainage culverts are also constructed with pump to continuously drain ground water 1 to 1.5 m below from the ground surface. Well graded laterite material is available at quarry site located around 15 km south of the construction site. It is effective to continuously transport the road sub base materials to the stock pile even in the wet season so as to minimize the number of the trucks. Loading capacity of 10 to 20 ton dump trucks are available for the work.

Table 6.2.12 Proposed Construction Schedule (Irrigation Development Component)



6.2.6 Plan of Operation and Maintenance of Irrigation Facilities

After the construction of irrigation facilities, O&M and management of the facilities will be conducted based on the policy shown below.

- UNVDA is responsible for O&M of irrigation facilities in UNVDA area. On the other hands, UNVDA has also adopted participatory approach for O&M of the facilities, and Water Users Association named "Farm" has played an important role in O&M. In this project, the role of "Farm" will be further strengthened.
- Ownership is a key to strengthen the role of "Farm". And timing of improvement of the facilities is a good chance to encourage ownership of "Farm". Therefore, from the planning stage of the project, "Farm" will be secured to participate in the project.
- "Farm" will start to keep records for O&M. And UNVDA will monitor O&M status conducted by "Farm".

Planned system for O&M and management is shown in the following table. To realize the plan, capacity development will be conducted through the soft component. On the other hands, UNVDA has enough experience for direct construction and repair works of irrigation facilities, and have various kinds of construction machineries; backhoe, bulldozer, leveler, compactor and others.

Table 6.2.13 Planned system for O&M and management of Irrigation Facilities

Item	Contents
Water distribution (Operation)	Water distribution will be conducted by Farm under the instruction of UNVDA.
Irrigation and drainage canals at primary and secondary levels	Cleaning of canals at primary and secondary levels will be conducted by Farms every year (Before rice cropping season). UNVDA takes a responsibility for the repair of canals.
Irrigation and drainage canals at tertiary level	Cleaning and repair of canals at tertiary level will be conducted by Farms every year (Before rice cropping season).
Internal farm road at primary and secondary levels	Maintenance of internal farm road at primary and secondary levels will be conducted by UNVDA based on the result of annual assessment of farm road condition.
Internal farm road at tertiary level	Maintenance of internal farm road at tertiary level will be conducted by Farms based on the result of annual assessment of farm road condition.
Water Tariff	Introduction of water tariff will be discussed to strengthen ownership of irrigation facilities based on beneficiary-payment principle. Water tariff is assumed to be charged based on the area basis.

Source: JICA Study Team

6.3 Access Road Development Component

6.3.1 Basic Concept of Access Road Development

According to the field investigation on the target route, most routes are laterite paving. Even though the road has no serious damages to the passage at this moment, it will become impassable if the erosion progresses in the future. Although there are some antiquated stone bridges and temporally constructed wooden bridges in the routes, it has no problem for the low speed operation. With consideration of such current condition of roads and road development policy in Cameroon, the basic concept of rural road development in this study is as follows.

- With consideration to the road network and topographical condition, asphalt paving and DBST paving would be applied to the target road where needed.
- Because the erosion of road surface is one of the dominant key factors to the deterioration of existing earth road, the concrete lining would be applied to the earth ditches and other drainage facilities where needed
- In-Place Stabilization of Subgrade must be applied for the improvement of pavement rate.

6.3.2 Access Road Development Plan

(1) Conceptual Design of Road Cross Section

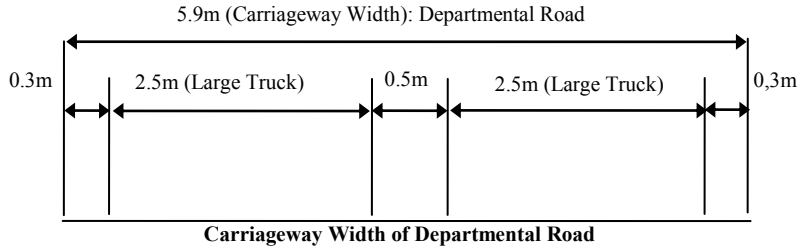
1) Carriageway Width

Carriageway width has been designed with consideration of current width of a road, design traffic volume, and the design traffic model of a car.

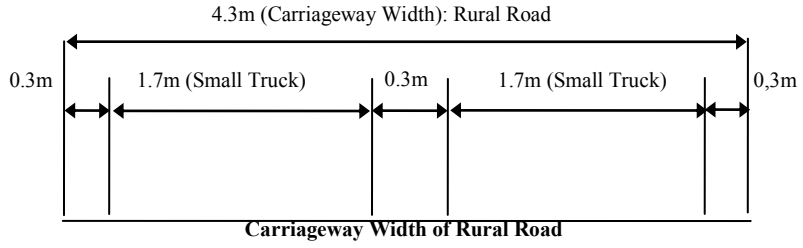
1. Current Width of a Road:
   Rural Road (4.0m – 6.0m), Departmental Road (6.0m – 9.0m)
2. Design Traffic Volume:
   It consists of General Traffic Volume and Agricultural Traffic Volume. The highest design traffic volume is of NW1 Departmental Road and 345/day. The design traffic volume of target routes is less than 500/day.
3. Design Traffic Model of a Car:
   The models of car which would be passing the target routes are estimated by the result of traffic survey and current models of car which have been recognized in the area as the table below.

Road Classification	Target Routes	Composition Model of a Car & the Width of a Car
Departmental Road	NW1 (D72)	Large Truck (2.5m) ＋ Large Truck (2.5m)
Rural Road	NW2, C1, C2,S1,S2	Small Truck (1.7m) ＋ Small Truck (1.7m)

The schematic depiction of the table is as follows.



Carriageway Width of Departmental Road



Carriageway Width of Rural Road

Therefore, carriageway width was designed as follows.

Road Classification	Composition Model of a Car & the Width of a Car	Carriageway Width (Calculated)	Carriageway Width (Designed)
Departmental Road	Large Truck (2.5m) ＋ Large Truck (2.5m)	6.1m	7.0m
Rural Road	Small Truck (1.7m) ＋ Small Truck (1.7m)	4.3m	5.0m

2) Shoulder

The shoulder is established next to carriageway. The width of shoulder is depending on the carriageway width as follows. Besides, the width of shoulder of Rural Road may extend to 1.0m* at the section where there is a school.

Road Classification	Carriageway Width	Width of Shoulder (Standard)	Width of Shoulder (Designed)
Departmental Road	7.0m	0.50～0.75m	1.00m
Rural Road	4.0, 5.0m	0.25～0.75m	0.50m*

(2) Design Speed

Design speed was set with reference to the carriageway width as follows.

Carriageway Width	Design Speed
7.0 m	50 km
5.0 m	40 km

(3) Alignment

Even though the alignment of the target roads would follow the existing horizontal alignment and vertical alignment, necessary modification would be applied in accordance with the design speed.

1) Horizontal Alignment

Depending on the design speed, the minimum curve radius is set as follows.

Design Speed	Minimum Curve Radius
50 km	150 m (minimum 100m)
40 km	100 m (minimum 60m)

2) Vertical Alignment

Even though the vertical alignment of the target routes would follow the current vertical alignment of the route, necessary modification would be applied in accordance with the design speed.

Table 6.3.1 Criterion of the Vertical Alignment Design

Design Speed	Maximum Longitudinal Slope	Tolerance for Partial Section
50 km	6 %	～9 %
40 km	7 %	～10 %

Moreover, based on the above design principle, relax the maximum longitudinal gradient to 12% for the section where the current gradient is tight. In addition, even for laterite pavement, DMST pavement is applied to sections where the longitudinal gradient exceeds 5% in order to prevent erosion of the road surface.

3) Cross Slope

Depending on the type of paving, necessary cross slope would be set for road surface drainage as follows.

Type of Paving / Road Classification	Asphalt	DBST / Laterite	
		Standard Value	Designed Value
Departmental Road	1.5%	3.0～5.0%	3.0%
Rural Road	2.0%	3.0～6.0%	4.0%

(4) Drainage Design

1) Rainfall Intensity

Runoff discharge is calculated by the use of Rational Formula as follows.

$$Q = \frac{1}{3.6} f \times r \times A$$

Q: Peak Discharge (m^3/s)
F: Runoff Coefficient
R: Average Effective Intensity of Rainfall within flood Concentration Time (mm/h)
A: Catchment Area (km^2)

2) Drainage Facilities

i) Water Conducting Ability

Water conducting ability of drainage facilities is calculated by the use of Manning Formula as follows.

$$Q = AV$$

$$V = \frac{1}{n} \times R^{\frac{2}{3}} \times I^{\frac{1}{2}}$$

Q: Water Conducting Ability (m^3/s)
A: Cross Section Area of Flow（m2）
N: Coefficient of Roughness
R: Hydraulic Mean Depth (m)
I: Slope

ii) **Ditch**

V-shaped earth ditch, which is the popular shape of road ditch in Cameroon, would be applied to the target routes. Concrete lining or stone pitched concrete lining would be applied to the steep slope section where the gradient exceeds 4%. This is because where the gradient exceeds 4% the speed of a running fluid becomes more than 1.5m/s.

iii) **Off-chute**

In addition to the road surface runoff, rainwater from the hinterland also flows into the road ditches. In order to avoid an increase in the cross section of road ditch, the certain number of off-shoots must be installed at appropriate positions.

iv) **Road Culvert**

Reinforced concrete pipe and corrugated metal pipe are usually installed as a road culvert in Cameroon. Instead of using corrugated metal pipe which is rather temporally structure, reinforced concrete pipe must be selected as a culvert for the target routes in this project.

(5) Design of Pavement Structure

As mentioned above, the dominant pavement type of Departmental Road and Rural Road in Cameroon is laterite paving. Although laterite paving has less tolerance to external impacts or pressures generally in compare to asphalt paving and DBST paving, laterite paving with enough soil compaction and appropriate installation of drainage structures has been able to keep good condition.

In this project, the pavement structure of each target road would be decided with consideration of the construction cost and required durability which is related to future traffic amount of the road. In-place stabilization of laterite subgrade must be applied for the construction of asphalt paving. This method is to stabilize the subgrade by the use of the in-place crushing-mixing equipment (hereinafter called Road Stabilizer) to mix the additives such as lime, cements with the on-site existing material such as laterite, then compacting, and finally paving the surface layer on the top with hot asphalt mixture. This method would contribute to the improvement of paving rate in Cameroon.

1) Design Traffic Volume

Design traffic volume to be used in the design of pavement structure is determined from the traffic volume of large truck for agricultural use and for general use. Traffic volume of large truck for agricultural use was estimated from the production amount of agricultural products in beneficiary area. Traffic volume of large truck for general use was calculated by the result of traffic survey. The design period (2023-2032) is 10 years, and the funding would be started from 2023. Estimated traffic volume of the plan was the average value of the design period 2023 and 2032 (1.55 times that of 2016).

Table 6.3.2 Design Traffic Volume of Target Routes

Target Routes		Design Traffic Volume of Large Truck (number/day, direction)		Classification
		Observed Volume (2016)	Designed Volume	
North West	1. NW1 (D72)	68	105	I-4
	2. NW2	30	74	I-3
	3. NW3	1	2	I-1
Central	4. C1	1	2	I-1
	5. C2	11	27	I-2
South	6. S1	0	0	I-1
	7. S2	1	2	I-1

The growth rate of traffic volume is estimated with reference to GDP growth rate and determined as 5%.

Table 6.3.3 Annual GDP Growth

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Annual Growth (%)	4.51	4.01	4.03	3.70	2.30	3.22	3.26	2.88	1.93	3.27

Year	2011	2012	2013	2014	2015	Average
Annual Growth (%)	4.14	4.59	5.56	5.89	6.21	3.97

2001-2005 Average	3.71
2006-2010 Average	2.91
2010-2015 Average	5.28

Source: The World Bank

2) Subgrade

Target road's CBR value of subgrade is more than 6, and within permissible range. There are also sections seriously eroded in the target roads, and the replacement of such soils with Nodular Laterite must be required in the construction work.

3) Thickness of Pavement

As mentioned above, depending on the construction cost and required durability which is related to future traffic amount of the road, asphalt pavement, DBST pavement and laterite pavement would be conducted in this project. The thickness of laterite pavement is decided in 20 cm with consideration of general laterite pavement design in Cameroon. The desired thickness of asphalt pavement and DBST pavement was decided with reference to traffic amount and CBR value as follows.

Table 6.3.4 Desired T_A (Total Thickness of Asphalt Concrete)

Classification	Number of Wheel Passes Causing Fatigue (**N**)	Desired $\mathbf{T_A}$ (Total Thickness of Asphalt Concrete)			
		CBR3	CBR4	CBR6	CBR8
I-4	150,000	19	18	16	14
I-3	30,000	15	14	12	11
I-2	7,000	12	11	10	9
I-1	1,500	9	9	8	7
Reliability 90%	$T_A=3.84N^{0.16}/CBR^{0.3}$				

The depth equivalency factor of each material is as follows.

Table 6.3.5 Coefficients of Relative Strength

Layer	Materials	Quality Standard	Coefficients of Relative Strength
Surface Course	Asphalt	Straight Asphalt	1.00
Base Course	Cement Stabilization	Unconfined Compression Strength should be more than 2.9 MPa (Curing: 7days)	0.55
	Lime Stabilization	Unconfined Compression Strength should be more than 1.0 MPa (Curing: 10days)	0.45
Subbase Course	Laterite	CBR value should be more than 20	0.20

With consideration of criteria above, the pavement cross section suggested is as follows. AASHTO Guide for Design of Pavement Structure was also referred for the decision of pavement cross section (see also Annex).

Table 6.3.6 Pavement Cross Section

Target Route		Class	Surface Course, Binder Course	Base Course	Coefficients of Relative Strength (a)	Subbase Course	Coefficients of Relative Strength (a)	T_A	Total Thickness
North West	D72	I-1	As 5cm or	15cm	0.55	40cm	0.20	21.25	60cm
			DBST	15cm	0.55	40cm	0.20	16.25	55cm
Central	C1	I-3	DBST	15cm	0.55	20cm	0.20	12.25	35cm
South	S2	I-3	DBST	15cm	0.55	20	0.20	12.25	35cm

In summary, the width and the pavement structure of target roads are as shown below.

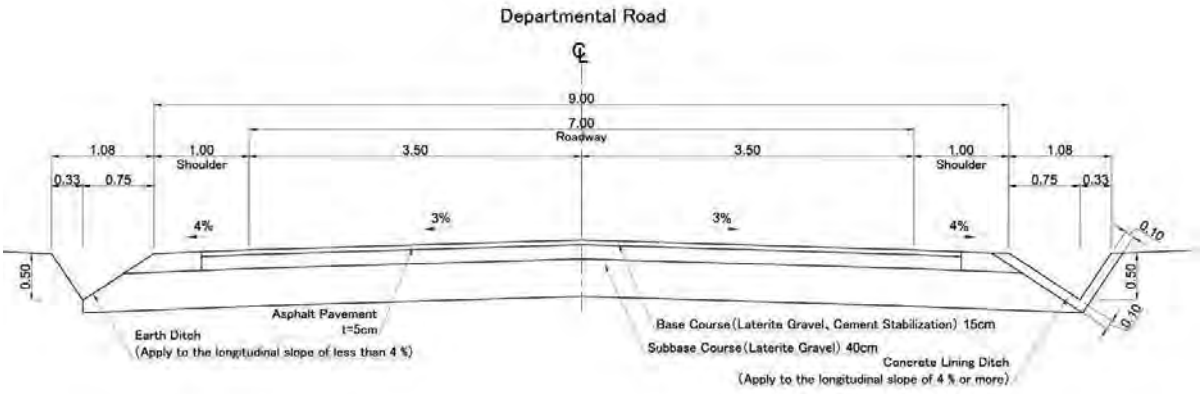
Table 6.3.7 Specification of Road

Item	NW1	C1(One section), S2	NW2, NW3, C1(A part of section), C2, S1
	D72	Rural Road	Rural Road
Road Way Section	9.00m	6.00m (7.00m)	6.00m (7.00m)
Road Way	3.50m+3.50m	2.50m+2.50m	2.50m+2.50m
Shoulder	1.00m+1.00m	0.50m+0.50m (1.00m+1.00m)	0.50m+0.50m (1.00m+1,00m)
Type of Pavement: Surface	Asphalt	DBST	Laterite
Base Course	Laterite mix with cement T=15cm	Laterite mix with cement T=15cm	Laterite T=25cm
Sub base Course	Laterite T=40cm	Laterite T=20cm	-
Design Speed	50km/h	40km/h	40km/h
Road Way Cross Slope	3%	3%	4%
Road Way Longitudinal Slope	6% Max 9%	7% Max 10%	7% Max 10%
*The number inside parentheses ( ) is applied for the section where there is a school			

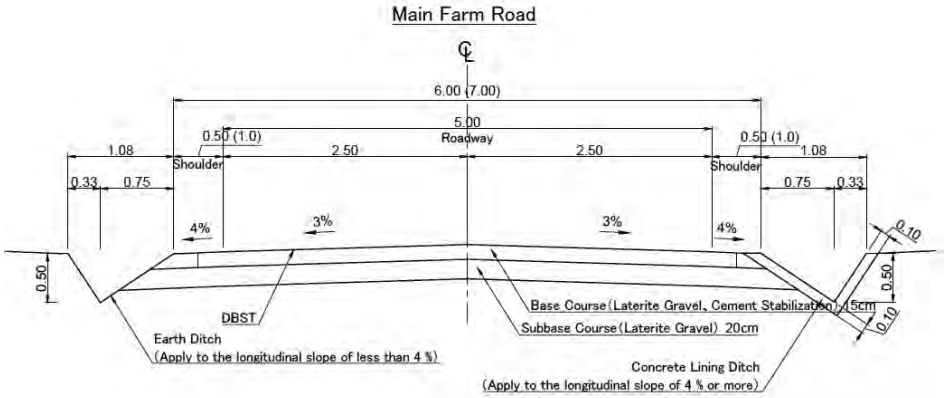
4) Typical Cross Section of the Target Roads

The typical cross sections of target road are as follows.

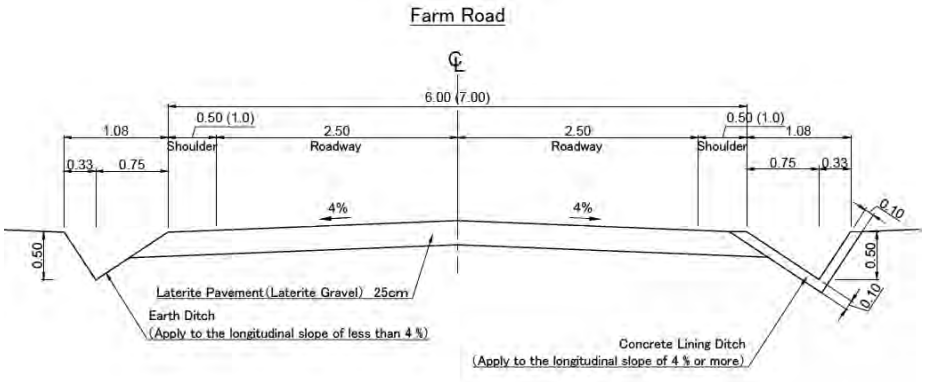
① NW1 (D72): Asphalt Pavement



② C1 (Some Sections) & S2: DBST Pavement



③ NW2 & C1 (Some Sections): Laterite Pavement



(6) Road Related Structures

In the target routes, road related structures such as culvert and bridge has been installed. Temporary facilities such as corrugated metal pipes and wooden bridges and deteriorated facilities are the main object of rehabilitation work on the road related structures in this project. The installation location of these structures was confirmed through the field investigation on the target roads. General information

of these existing road related structures is as shown in the table below.

Table 6.3.8 List of Existing Road Related Structures on Target Routes

Route	Station	Existing Condition			Plan
		Type of Structure		Size of structure	
NW1					
	0+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	0+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	0+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	0+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	0+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	2+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	2+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	2+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	2+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+350	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+450	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+550	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+650	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+750	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe：Diameter 800mm Length 9.0m
	3+800	Bridge	Super structure: With stone masonry, Sub structure: Stone masonry	Length 22.0m Width 4.5m Height: 8,5m	Bridge：Length 32.0m (2 span) Width 9.4m Height: 8.5m
	4+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
NW1	4+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 1000mm Length 6.0m	Concrete Pipe: Diameter 1000mm Length 9.0m
	4+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m

Route	Station	Existing Condition			Plan
		Type of Structure		Size of structure	
NW1	4+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	4+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	5+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	5+100	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	5+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	6+100	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 1000mm Length 6.0m	Concrete Pipe: Diameter 1000mm Length 9.0m
	6+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	6+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 1500mm Length 6.0m	Box culvert: W1.5m x H1.5m Length 9.0m
	6+950	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	6+950		New construction		Concrete Pipe: Diameter 800mm Length 9.0m
	7+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+420	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+480	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+580	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+840	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	7+980	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	8+130	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	8+260	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	8+400	Bridge to Box Culvert	Super structure: With stone masonry, Sub structure: Stone masonry	Length 6.0m Width 3.5m Height: 3.5m	Box Culvert: W 3.5m × H 3.5m Length 9.0m
	9+250	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	9+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	9+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	10+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	11+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	11+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	12+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m

Route	Station	Existing Condition			Plan
		Type of Structure		Size of structure	
	12+050	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	12+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	13+100	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	13+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	13+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	14+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
	15+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 9.0m
					NW2
	0+100	Bridge to Box Culvert	Super structure: With stone masonry, Sub structure: Stone masonry	Length 6.0m Width 2.5m Height: 2.5m	Box culvert: W2.5m x H2.5m Length 6.0m
	0+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	0+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+350	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	3+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	4+100	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	5+920	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	6+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	8+100	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	9+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	9+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	10+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	12+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
NW2	13+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	13+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m

Route	Station	Existing Condition			Plan
		Type of Structure		Size of structure	
	14+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 6.0m	Concrete Pipe: Diameter 800mm Length 6.0m
C1A					
	0+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	0+020		Gate	-	Rain gate (new construction)
	0+270	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	0+650	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Box culvert: W2.0m x H1.0m Length 6.0m
	0+970	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+150	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+460	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	3+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	4+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	6+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	6+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	7+850	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	8+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	9+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	9+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	11+000	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	11+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	11+700	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	12+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
C1B					
	1+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	1+950	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
C1C					
	1+150	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
C1C	2+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	3+500	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m

Route	Station	Existing Condition			Plan
		Type of Structure		Size of structure	
	3+900	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
C1D					
	0+170	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+400	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+800	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 4.0m	Concrete Pipe: Diameter 800mm Length 6.0m
S2					
	0+150		New construction	-	Concrete Pipe: Diameter 800mm Length 6.0m
	0+770		New construction	-	Concrete Pipe: Diameter 800mm Length 6.0m
	1+600	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 7.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	2+300		New construction	-	Concrete Pipe: Diameter 800mm Length 6.0m
	3+200	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 7.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	3+330	Bridge	Super structure: I Beam, with Wooden slab, Sub structure: Stone masonry	Length12.0m Width 3.5m Height: 4.0m	Bridge: Length 12.0m (1 span), Width 6.0m
	5 +300	Pipe culvert	Pipe: Iron pipe Inlet Outlet: Stone masonry	Diameter 800mm Length 7.0m	Concrete Pipe: Diameter 800mm Length 6.0m
	7+900		New construction	-	Concrete Pipe: Diameter 800mm Length 6.0m

1) Road Crossing Structures

Pipe culvert and box culvert is the main road crossing structures and must be rehabilitated in this project. The rehabilitation of existing structure would be conducted at original position basically. On the other hand, the position of newly installed structure would be decided by the result of field investigation.

i) Scale

The installation of road crossing structures aims to flow rain water safely. The scale of road crossing structures must be decided by the result of hydraulic calculation considering the catchment area , estimated high-water level, cross section of the target river and so on. With consideration of easy maintenance of the structure, the least cross sectional diameter of pipe culvert must be more than 800mm which is the most popular size of the pipe culvert in Cameroon. The structure of pipe must be made by reinforced concrete.

ii) Freeboard

The freeboard is calculated by considering a margin of 20% or more to the design high water level obtained by calculation.

2) Cross-River Structure

As a cross-river structure, bridge and box culvert must be installed. From a viewpoint of economical efficiency, box culvert might be applied as much as possible at the river closing point where possible to install box culvert in terms of terrain conditions.

i) Selection of Cross-River Structure

The chart below shows the basis of criteria for the selection of cross-river structure.

	Bridge	Box Culvert
Terrain	Deep River Bed	Shallow River Bed
Features	The difference between the surrounding ground level and the bed height is large.	The difference between the surrounding ground level and the bed height is small.
Schematic Cross-section		

ii) Proposed Height

The proposed height of the bridge is set as follows:

Proposed Height of the Bridge = Design High Water Level + Bridge Freeboard

The Bridge Freeboard is set as follows:

Table 6.3.9 Bridge Freeboard

Design Flood Discharge (m^3/s)	Bridge Freeboard (m)
Drainage Cannel	0.3
- 200	0.6
200 - 500	1.0
500 – 2,000	1.2

Source: Design Criteria for Agricultural Land Improvement Project: Rural Road

iii) Scale

The width of the bridge and box culvert installed as river crossing work shall ensure planned width and shall not be reduced.

iv) Bridge

Because the length of bridge is over 20m, the following investigation to the bridge crossing the Mekuene River was carried out for examinig preliminary design of the bridge.

· Detailed topographic survey around the bridge
· Standard penetration test and boring survey on embankment of left bank and right bank
· Hydrological survey

a) Examination of Foundation

Based on the results of the boring survey, as shown in the table below, the granite on the left bank (EL = 1150.64 m) and the right bank (EL = 1155.60 m) was selected to the foundation ground of the abutments. Concerning the bridge piers, due to the rise in the river level during the rainy season, confirmation of the foundation ground by the boring survey has not been carried out. It is necessary to conduct a boring survey at the time of detailed investigation.

Table 6.3.10 Boring Survey of Foundation Ground

Investigation Point	Sampling Depth	Foundation Ground*		Unconfined Compression Strength
		Rock Classification	Ground Elevation	
Abutment (Left Bank)	11.8 m – 12.4 m	Granite (Hard Rock Ground) (Less Crack : RQD 62%)	1150.64 m	60.6 MPa
Abutment (Right Bank)	5.55 m – 6.33 m	Granite (Hard Rock Ground) (Less Crack : RQD 85%)	1155.60 m	60.0 MPa

*Hard Rock Ground: Unconfined Compression Strength (qu) ≧ 25MN/m2 (Japanese Geotechnical Society)
**RQD: Percentage of the total length of cores of 10 cm or more per 1 m collection core.

b) Examination of Cross Section

1. Calculation of Planned Flood Volume

As for the calculation of the planned flood volume, the following Auvray-Rodier formula is applied as well as "6.2.2 Irrigation Improvement Plan (2) Drainage Plan".

Runoff Discharge (Qmax) = k × Kr × (C × P × S / 3.6) × Tb = 162m^3/s

where

k: Peak coefficient = 2.4 (gentle slope)

C: Reduction Coefficient = 1 - {(161-0.042*Pan)/1000}*logs = 0.783

P : Daily probable rainfall (20 yrs) = 119.3mm/d

Tb: Flood basic time = 1430min

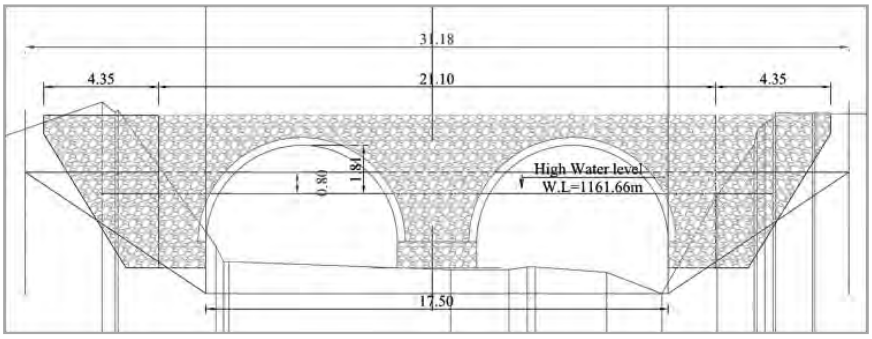
Kr: Runoff coefficient = 18.36 (based on geographical features of the site)

Pan: Average annual rainfall = 1,594mm/yr

S: Catchment area = 202km2

2. Calculation of Discharge Capacity

The cross section of the existing stone bridge is as shown in the figure below. In this project, set it without narrowing the current river width. Therefore, the bottom width shall be 17.5 m. In addition, the elevation of the bottom of the beam also secures the current elevation of it.



From the above, the discharge capacity of the point is calculated by Manning Formula as follows.

Quantity of Flow (Q) = A × V
Velocity of a flow (V) = 1/n × R2/3 × I1/2

where

A: Cross-sectional area (bottom width = 17.5m, Slope gradient = 1 : 1.5, Water depth = 3.1m, 4.1m)
n: Coefficient of roughness = 0.03
I: Gradient of river bottom = 1/1500
V: Average velocity
R: Hydraulic mean depth

Calculate the discharge capacity with the cross section considering the past highest depth of water by the interview survey, current elevation of the bottom of the beam, and 0.8m bridge freeboard. The result of calculation is as follows.

· Water depth 3.1 m: V = 1.54 m/s, Q = 106 m^3 / s
· Water depth 4.1 m: V = 1.79 m/s, Q = 174 m^3 / s

Thus, by setting elevation of the bottom of the beam to the current elevation of the bottom the beam, the discharge capacity (174 m^3/s) become larger than the flood volume (162 m^3/s).

3) Other Related Facilities

As other road related facilities, install safety signs and gates as necessary. Excluding D72 (NW1), the project target roads are the roads for accessing the main road from the villages, and the traffic volume of such roads are limited. However, the passage of heavy vehicles in the rainy season has caused the development of ruts, and in some cases subsequent vehicles cannot pass. Therefore, a gate for restricting the vehicle at the time of rain is installed on the starting point side or the end point side of the road as necessary.

6.3.3 Related Drawings for the Road Improvement

See Annex.

6.3.4 Construction Cost of Access Road Improvement

Major construction works and their construction costs are shown in Table below.

Table 6.3.11 Major Construction Works and Construction Costs of Rural Road Improvement[29]

Region	District	Symbol	Route	Length (km)	Class	Construction cost (million FCFA)
North west	NDOP, BALIKUMBAT	NW1	Bamali (N11) - Bamali 3 Corners – Balikumbat	15.5	District	5,648
		NW2	Ndop (N11) - Lower Bamunka Irrigation Rice – Bambalang - Bamali 3 Corners (D72)	14.5	Rural	1,164
Central	OBALA	C1	1) Mboua I (N4) - Mbele II J.C.1 - Mbele II J.C.2 -Mengama - Mban 2) Mbele II J.C.1 - Edokasi 3) Nkoledouma (N4) - Mbele II J.C.2 4) Mengama – Ntsaekang (P13)	24.9	Rural	2,660
South	BIWONG BULU	S2	Nkoetye – Nkolbitye (D39)	8.8	Rural	1,445
					Total	10,917

[29] The construction cost is estimated based on the unit price of labor service, materials, equip ownership cost and their quantity per unit. The quantity is calculated based on the design drawing. The unit price of labor service, materials and equip ownership cost is estimated based on the minimum price of the quotation collected from the 3 local contractors. The quantity per unit is calculated based on the estimation standard of land improvement works published by Ministry of Agriculture, Forestry and Fisheries, Japan. The unit price of each works is validated by referring the results of quantity survey of Batchenga-Lena Road Project conducted in 2016. The equipments cost (Stabilizer) is estimated based on the quotation collected from 2 makers.

6.3.5 Construction Plan

(1) Basic Policy of Construction and Procurement

The basic policy on construction and procurement concerning the road improvement of this project is as follows:

- Select construction materials and labor procurement as much as possible that can be procured domestically.
- Maintenance by general construction method. However, with regard to the construction method that secures the strength of laterite roadbed with additives such as cement, almost no construction machines to use are found in the country. Transferring technology through the training for O&M of the construction machine is required.
- When planning the construction method and construction process, formulation of appropriate plans with consideration of appropriate weather conditions, topographical conditions and geographical conditions is required.
- Because the project will be renovation of existing roads, grasp the usage of roads and make plans that the residents can use the roads even during the construction period.

(2) Considerations on Construction and Procurement

Points to be noted in formulating the construction plan concerning the road development of this project are as follows. Especially, because all target routes are existing roads, consideration shall be given to residents using it.

① Because the target road is also used as a community road of the local residents, it is not possible to completely block the passage even during the construction period. Also, as residents use the roads during construction, it is necessary to secure safety at the construction site as well as consideration from the environmental aspects for dust etc. as shown below.

- Safety consideration for residents: Construction yards should be clarified by fencing etc. and restricted access other than related. Also, to ensure that vehicles carrying equipment and materials will not have an accident, security guards etc. shall be placed to ensure safety.

- Environmental consideration for residents: No work that causes noise occurs at night and early in the morning. Take measures such as sprinkling water so that dust does not occur when the construction vehicle is in operation.

② In the road improvement which is mainly based on earth work, the work progress will be restricted by rain. The seasons of the country is roughly divided into dry season and rainy season. The rainfall of the North-West region is larger than that of Central region in this point. There are also routes passing through valleys, and the topography conditions are also different. Construction of the main body of the road becomes difficult when raining. Make careful consideration of the rainy season and prepare a construction plan.

(3) Construction method

1) Preparatory works

Prior to the construction work, the contractor shall confirm an alignment of the road, location of the appurtenant structures in the presence of government officials (MINADER ,UNDVA). It is also necessary to review traffic volume and temporary works such as detours, site office, stock yards for the construction to the beneficiaries.

2) Temporary works

Detours and drainage works are installed for the bridges and culverts construction.

3) Earth works

Road construction works are all for the repair works of the existing roads. Surface soil, grass, shrubs and unsuitable soil shall be first removed and disposed. Well graded laterite material is available at the quarry site near the road construction sites. It is preferable to collect laterite materials with small gravel particles.

4) Asphalt pavement

Asphalt pavement materials are composed of hot asphalt mixture, and the asphalt mixture is placed and compacted by heavy construction machineries i.e., asphalt finisher, macadam roller and tire roller. Strait asphalt is spread below and on the asphalt pavement.

5) DBST

After spreading the size-adjusted ballast (gravel) with strait asphalt, the layer is to be compacted with macadam roller and tire roller. Particle side is 3 to 5 mm, and thickness of the DBST layer is 2 cm. Strait asphalt is spread with fine aggregate below and on the pavement. Fig. B.1 shows standard section of the various road sections.

6) Concrete works

Job-mixed concrete is poured for small scale structures. Fine and course aggregates for concrete is obtained at the crushing plant in the vicinity. Concrete of the proposed bridges and culverts is also obtained from the concrete mixing plant to secure the required quality of the concrete. Design mixture of the concrete will be examined by concrete mixture test with actual aggregates, water and cement. Crane bucket is used for concrete casting, and shoot type casting is for small structures and leveling concrete.

7) Drainage works

Earth lining drainage is susceptible to an erosion, thus plain concrete (18 N/mm^2) produced at site is placed in the drainage ditch to prevent local erosion, especially along the steep slope portion.

(4) Construction Management Plan

Consultants conduct construction supervision mainly on the following items for construction work performed by contractors according to construction contracts and construction plans.

· Review and approve the construction plan
· Inspection and approval of construction survey
·Quality management
· Process management
·Safety management
· Mobility management, etc.

The target route can be divided into two broadly as follows geographically.
- North West
- Southern Region · Central Region
Therefore, the project plans to arrange at least two Japanese consultants for the supervision of the construction sites.

(5) Quality Control Plan

In order to complete the construction work by the contractor within the deadline, the project arranges Japanese engineers appropriately for the teaching of local engineers, and the supervision of construction work. The points for promoting smooth construction are shown below.

Japanese engineers prepare a manual showing the points of construction supervision. Local engineers need to understand this manual precisely and conduct construction management. Japanese engineers will guide local engineers on how to use the manual.

① Before Construction Starts
Japanese engineers will review the overall construction management plan prepared by the contractor for detailed construction process, placement of skill workers, procurement of inventory of construction materials and inventory management, guidance on improvement and effective use of the plan .

② Construction Period
Japanese engineers and local engineers will supervise and give guidance especially on the following points.

1) Monitor management skills and technical abilities of the foreman who manages several construction sites and instruct practical improvement measures on site management.

2) Confirm the technical capacity of the quality control capability (materials storage method, slump test, concrete preparation, mortar formulation, water cement ratio, etc.) concerning the material of the contractor, and technical capacity related to the work type of the type of work and instruct improvement measures.

3) Check inventory control of construction materials and instruct improvement measures.

4) Establish regular meetings with contractors to facilitate early problem discovery and resolution through smooth communication.
Items of quality control of earthwork and pavement are as shown in the table below.

Table 6.3.12 Quality Control of Earthmoving and Paving Works

Item	Test items	Application (reference)
Concrete construction		
Cement	Physical property test of cement	1 time before test kneading, once after every 500 m^3 casting.
Fine aggregate	Physical properties test of fine aggregate	1 time before test kneading, once after every 500 m^3 casting.
Coarse aggregate	Physical property test of coarse aggregate	1 time before test kneading, once after every 500 m^3 casting.
Concrete	Slump test	2 times / day
	Compressive Strength Test	Specimen for each casting (7 day strength, 28 day strength)
	Temperature	twice / day
Earthwork and paving		
Embankment	Compaction test	Before test construction and when the material is changed
	In situ density test	Every 500 m^2
Subgrade and base course	Compaction test	Before test construction and when the material is changed
	CBR test	Before test construction and when the material is changed
	In situ density test	Every 500 m^2
	Additive (for improvement of roadbed)	Before test construction and when the material is changed
Asphalt Pavement	Sieve analysis for aggregate	Before test construction and when the material is changed
	Abrasion resistance test for aggregate	Before test construction and when the material is changed
	density test	Every 500 m^2

(6) Construction schedule

Construction schedule is shown in Table below. Construction is scheduled from January 2020 at the same period of the irrigation development and agricultural machineries/ equipment installation.

Rural road construction work is mainly composed of removal of surface soil, grass and shrub, replacement of unsuitable soil, road surface leveling, road sub base embankment and compaction, asphalt pavement, appurtenant structure like drainage culverts and bridges.

Site office, warehouses, steel processing place, machinery parking lot is installed within two months from the beginning. Earth work is discontinued in July to September to avoid unsatisfied compaction work for the road sub base and laterite pavement due to high moisture contents of the earth materials.

Table 6.3.13 Proposed Construction Schedule (Access Road Development Component)1/2

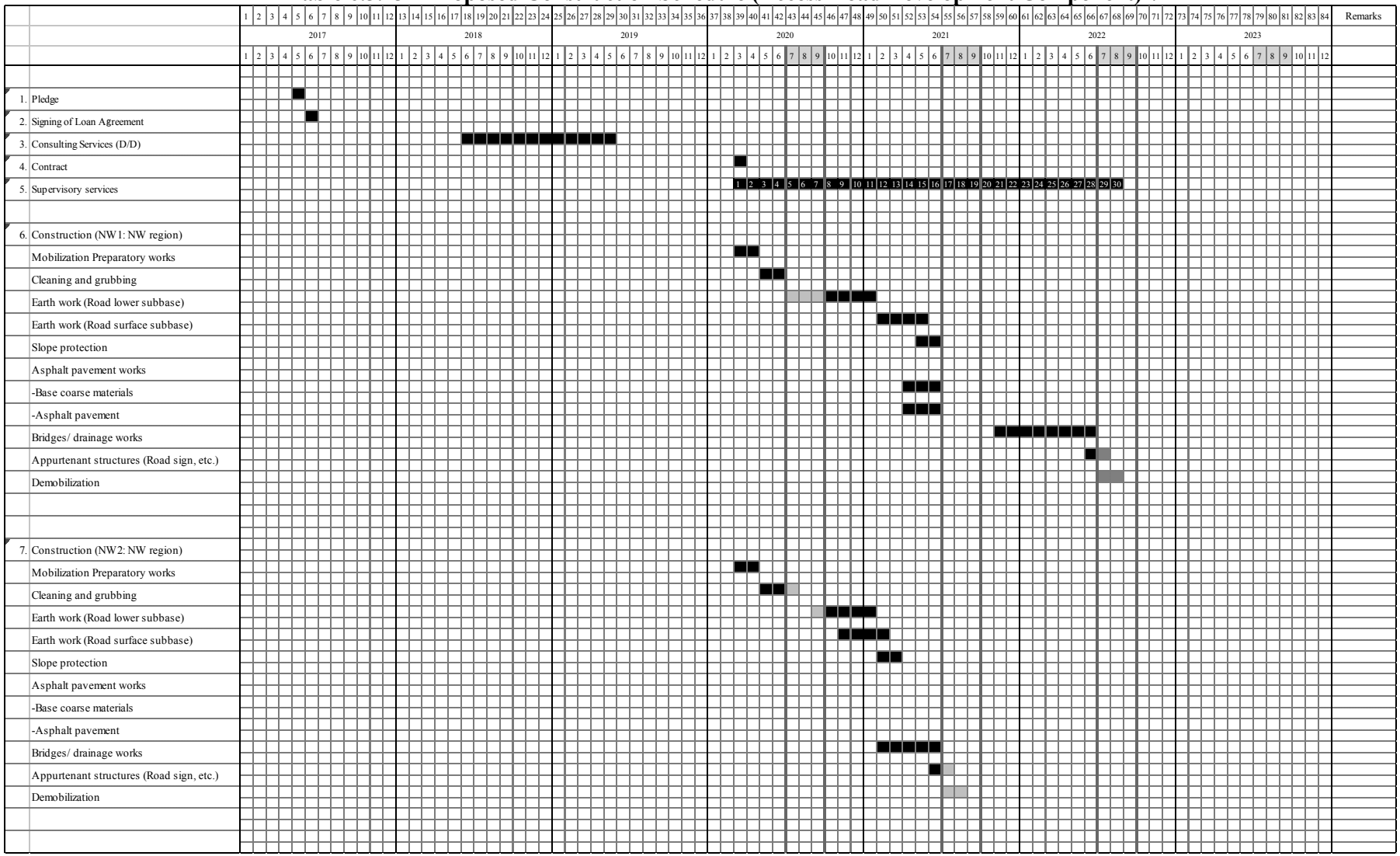
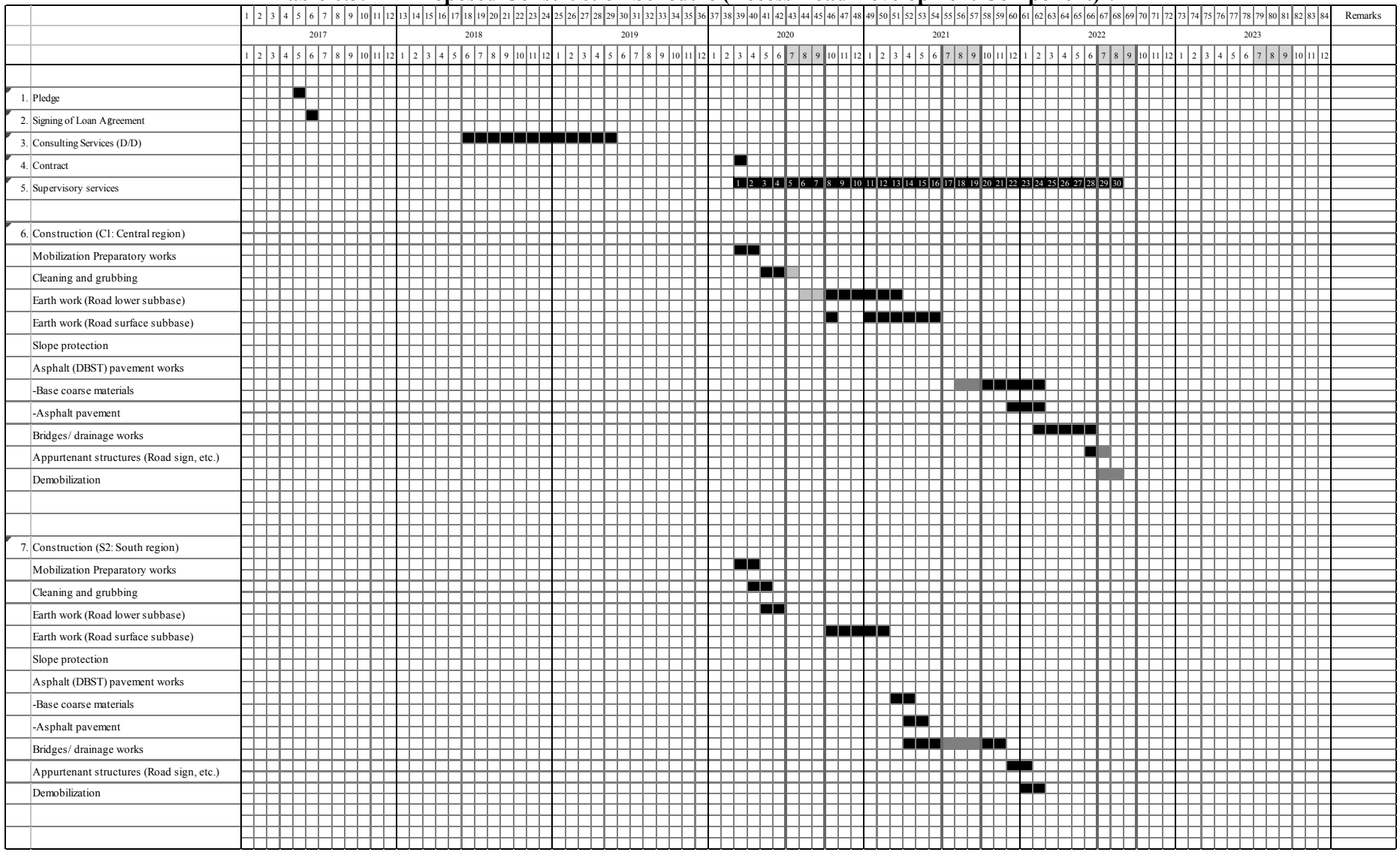


Table 6.3.14 Proposed Construction Schedule (Access Road Development Component)2/2



6.3.6 Plan of Operation and Maintenance of the Target Roads

(1) O&M Body of the Target Roads

As MINTP controls jurisdiction of all roads in Cameroon, MINTP will also be responsible for the O&M of the departmental road and the rural roads to be maintained in this project. However, as described in "3.3.4 Overview of Rural Road Sector", O&M of rural road is being transferred to communes along with budget in recent years. Therefore, although the MINTP is the main body of O&M, Municipalities in the central and southern states and UNVDA in the North West region will also be responsible for O&M work, respectively. If MINTP does not directly carry out O&M work, technical assistance must be given to Municipalities and UNVDA. If it is necessary to repair using a large construction machine, the Municipality and UNVDA will do it on its own or consign construction contractors. In case of shortage of necessary construction machinery and operators, borrow from MATGENIE. Regarding the road O&M budget of the municipality and UNVDA, the study team confirmed that a certain amount of O&M budget is secured every year.

The O&M system of the target four routes (NW1, NW2, C1, and S2) to be maintained by this project is mainly the following institutions.

Table 6.3.15 O&M Body of the Target Roads

Region	Route	Classification	O&M Body
North West	NW1	Departmental Road（D72）	MINTP Ngo-Ketunjia Office
	NW2	Rural Road	UNVDA
Central	C1	Rural Road	MINTP Lekiké Office, Obala Commune, Sa'a Commune
South	S2	Rural Road	MINTP Mvila Office, Biwong-Bulu Commune,

Source: JICA Study Team

However, since NW1 (D72) is a departmental road, it cooperates with the Ngo-Ketunjia division office and the MINTP Northwest provincial office for O&M. Regarding O&M budget, we consider utilization of related budget from MINTP, Road Fund, Northwest region, and Ngo-Ketunjia Division. On the other hand, other rural roads will receive technical and budgetary support from MINADER and MINTP regional offices.

(2) Routine O&M Work by Local Community

Routine O&M activities such as mowing along roads, removing sediments accumulating in drainage facilities, and cleaning pavement surfaces by residents living along the target routes are generally inactive especially in the section between villages.

6.3.7 Plan of Operation and Maintenance of Construction Machinery

(1) Procurement Circumstances Survey

Construction machinery to be procured in this project is a road stabilizer for roadbed improvement. Currently, road stabilizers are rarely seen in Cameroon. MATGENIE does not own this type of machinery at this moment. The results of comparative survey on Japanese made road stabilizer (A company) and European made road stabilizer (company B) with the possibility of procurement which are shown in the table below. As shown in the table, Company B dominates the price, but Company A is superior in terms of operability. In introducing road stabilizer, the project may select the machine by checking the road condition to be improved using this machine.

Table 6.3.16 Comparison Table of Road Stabilizer

Items		Company A	Company B
Basic Specifications			
Machine Mass	Total Mass (kg)	22,500	26,300
Total Length × Total Width × Total Height (mm)		9,280×2,650×2,915	9,160×2,550×3,000
Engine	Type	KOMATSU	MERCEDES BENZ
		SAA6D140E-5	OM460LA
	Output (kW(PS)/min-1)	370(503)/1,800	305(415)/2,000
	Exhaust Emission Standard	Tier3 / Non-EGR	Tier4 / Tier3
Speed	Forward Speed (km/h)	0-14	0–12.6
	Working Speed (m/min)	0-48	0-210
Tire Size × Number of Tier		20.5-25 20PR×4	620/75 R26
Fuel Tank Capacity (L)		700	830
Operability		◎	○
		➢ The rotor hood is shifted by 500 mm to the left and right, it is possible to work construct near the facility such as the road edge and utility pole. ➢ It operates even with poor local fuel. ➢ Driving is possible by one person. ➢ Self-propelled (14km/h) ➢ Light weight ➢ Possible to check operation by direct visual inspection.	➢ By moving the cabin, you can visually check the operation. ➢ The camera and monitor compensate for the vision that the operator needs. ➢ The over steering function enables work in a narrow place. ➢ 3 types of switching steering mode ➢ The drum moves up and down automatically at the start and the end of work.
O&M		△	△
Accessibility of Spare Parts		In the future, there is a plan to be able to purchase parts from Komatsu agent. At present, it does not handle the machine itself, it is necessary to obtain the machine from the head office.	There is an agency in Yaoundé, but it does not function at the present time. It is necessary to obtain the machine from the head office.
Price (JPY)		○	◎
Base Price		70,000,000 JPY / unit	65,000,000 JPY / unit
Supplies Expense *Assuming an operation time of 3000 hours		13,900,000 JPY / unit	11,000,000 JPY / unit
Comprehensive Evaluation		○	◎
➢ Product of company B dominates at price. ➢ For operability, product of company A dominates. ➢ Product of company A is originally suitable for the improvement of Earth Road including laterite pavement. ➢ The product of company B is suitable for improving asphalt pavement. ➢ From the above, when the project aims for Earth Road refurbishment, the product of company A might be recommended. ➢ When aiming at repair of asphalt pavement, the product of Company B might be recommended. ➢ However, with regard to the products of company B, trial operation is required by using local fuel in advance.			

Evaluation: ◎ Good, ○ Faire, △ Poor

(2) O&M of the Construction Machine

The construction machine will be introduced to MINTP which is MATGENIE's administrative and supervisory ministry. Although MATGENIE has introduced and possessed motor graders, bulldozers, etc. so far, and has long experience of maintaining construction machineries by themselves, there is no

proven track record with regard to the road stabilizer. Therefore, it is necessary to improve the capacity of staff in charge of construction machineries in MINTP and MATGENIE through OJT regarding the following matters.

① O&M Skills

In introducing the road stabilizer, it is necessary to provide adequate training not only for driving method but also the maintenance method. The trainings will be conducted with the aim of enabling technicians in these institutions to maintain and manage the machine by themselves.
In addition, regarding the issue of obtaining spare parts, during the OJT period, attendants actually try to make orders for spare parts while making contact with construction machine makers. After completion of the project, the soft component aims to make it possible for MINTP or MATGENIE to implement the O&M of the road stabilizer on our own.

② Survey and Test Skill of Appropriate Additive Materials

At the present time, it is assumed that 5% of cement is added as an additive for roadbed improvement. However, in addition to cement, lime can also be used as an additive. The type and amount of additives depend on the amount of roadbed material (laterite etc.) and the natural conditions such as groundwater level.
Therefore, it is necessary to conduct the test for each target route and check the type and amount of the additive material again. In this project, as with the above operation method and maintenance, we plan to conduct survey methods on additives and method for arranging test results through soft components with MINTP and MATGENIE staffs.

6.4 Installation of Agricultural Equipments Component

6.4.1 Basic Concept of the Component of Installation of Agricultural Equipments

(1) Country Elevator and Rice milling plant

Current situation:

- Storage of the husked rice: Although the country elevator is not currently installed in UNVDA, the UNVDA purchases the husked rice from the local farmers and stores those into the storage of headquarter and 18 rice purchasing centres. The storage capacity of headquarter is 4,500 tonnes at maximum while the stocks of rice in February 2016 is 2,753 tonnes. The rice purchasing centres are classified into small storage capacity (300 tons at maximum), medium storage capacity (500 tonnes at maximum) and large storage capacity (1,000 tonnes at maximum) depending on the situation of rice cultivation around the centres.

- Rice Milling Plant: the rice milling plant with the capacity of 3.5 tonnes per hour were installed in 1981. This plant is operated based on the production by order. The annual volume of milled rice is 2,954 tonnes in 2014 and 2,804 tonnes in 2015. The milling process is as follows.

Husked Rice Storage⇒ Receiving Hopper ⇒ Selector ⇒ Rice Husker ⇒ Air Sorter ⇒ Selector ⇒ Polishers ⇒ Broken Rice Siever (small size) ⇒ Broken Rice Siever (medium size) ⇒ Milled Rice Tank ⇒ Bagging

Challenges:

- Rice Storage: Since the rice is harvested after the rainy season, it is observed that the husked rice in the bag purchased by UNVDA contains the rice with high moisture content. The rice bags are piled on the pallets in the storage of headquarter. However, the storage does not have aeration facilities. Consequently, the rice becomes yellow and moldy due to the heat by fermentation. Furthermore, the long term conservation of rice in the storage results in the lower rice moisture content which causes the nuisances for the processing of rice.

- The existed milling plant was installed in 35 years ago. Thus, the performance of the equipments is low due to the deterioration of the equipments.

- The rice husking rate of the two calliper hullers is low. The existed milling machine is supposed to have sufficient pressure to attain the whiteness of the rice in a single passage. However, the pressure on each grain is so high that the grain is easily broken resulting in the higher rate of broken rice. Moreover, it is very difficult to maintain the performances of the machines.

Procurement policy to be considered:

- The management of the moisture content in the grain is the key issue. Thus, it is necessary to control the moisture content of the grain at the rice receiving stage in country elevator and the rice drying stage to avoid the occurrence of broken rice.
- To reduce the rate of broken rice by the introduction of proper rice husker which can gives adequate pressure to each grain during rice husking stage.
- To reduce the rate of broken rice by the introduction of proper milling machines which can gives adequate pressure to each unpolished grain during rice milling stage.
- To eliminate the broken rice before the packaging to improve the quality of sales products.

Based on the issues mentioned above, it is planned to introduce the country elevator and milling plant that can overcome those issues, thereby satisfies the needs of the consumers and improves the quality of rice.

(2) Tractors with Implements (Rotary Tiller)

Current situation:

The numbers and types of the agricultural machineries owned by UNVDA are stated above. The plowing service is available through the end of May to early September. The covering area of this service in 2014 and 2015 is 579 ha and 456 ha respectively while the number of farmers applied this service are 1,593 persons and 1,212 persons respectively.

Challenges:

Some of the machines owned by UNVDA cause failure frequently. In particular, the ones from India cause not only many failures but also incapability of repairment due to the lack of spare parts. Besides, although UNVDA owns the Turkish implements for their tractors, those implements are unsized towards the tractors which may result in the failure of universal joint.

Procurement policy to be considered:

- To introduce the equipments with high durability for the long term operation under the severe condition to avoid the frequent failure.
- To establish the supplement system of spare parts from the makers.
- To introduce the proper implement for the tractors to improve the work efficiency.

Based on the issues stated above, it is planned to introduce the tractors and implements which can perform sufficiently under the limited plowing period.

(3) Combine harvesters

Current situation:

Although UNVDA owns a large combine harvester, the machines is not in use due to the undeveloped rice fields. UNVDA also owns the two Italian reapers. However, it is necessary to examine whether those machines can utilize for the harvesting of rice.

Challenges:

The drainage condition at harvesting stage is the key issue. The irrigated water in rice fields should be well drained at harvesting stage, from the middle of November to the end of December for the utilization of combine harvester.

Procurement policy to be considered:

- While achieving the proper time harvesting thorough, to introduce the proper combine harvesters to reduce the work force for the harvesting
- To introduce the proper combine harvesters to reduce the harvesting loss compared to manual harvesting.

Based on the issues stated above, it is planned to introduce the combine harvesters which can perform sufficiently under the limited harvesting period.

6.4.2 Selection of agricultural machinery

The possibilities of introducing Japan-made agricultural equipments are considered based on the results of the survey. As a result, it is concluded that there are several superiorities in Japan-made equipments such as country elevator, milling plant, tractor, implement of tractor and combine harvester compared to other countries products in terms of those capacities and durability. The table below shows the results of procurement plan based on the results of the survey.

Table 6.4.1 Farm equipment selection proposal

	Equipments	Location to be installed	Quantities
1	Country elevator and milling plant (including the quality analysing tools and spare parts)	Headquarter of UNVDA (Babungo)	1 unit
2	Tractors	UNVDA-Ndop equipment centre	10
3	Implement (rotary tiller) of tractors	UNVDA-Ndop equipment centre	10
4	Combine harvesters	UNVDA-Ndop equipment centre	10

Source: JICA Study Team

(1) Procurement plan for the country elevator and milling plant

While installing the country elevator and milling plant, the proper collection plan, controlled shipping and transportation system are also newly developed not only to strengthen the capacity of UNVDA and farmer's group but also to increase the profit by the improvement of rice distribution and by the reduction of rice stocks.

The table below shows the required condition for the procurement of country elevator and milling plant.

Table 6.4.2 Required Condition for the procurement of country elevator and milling plant

Description	Specification
Target crop	Lowland rice
Moisture content of harvested rice	26 %
Moisture content of rice after drying	14 %
Receiving duration	60 days per year
Number of receiving line	2 lines
Capacity of receiving line	15 ton/hr × 2 Lines
Receiving time	8 hours per day
Annual processing capacity	15,000 tonnes per year

Source; JICA Study Team

The annual receiving capacity of country elevator is set as 15,000 tonnes per year based on the potential of rice productivity which is estimated at 5 tonnes per ha × 3,000 ha in the rice fields managed by UNVDA. Moreover, UNVDA aims to expand the rice fields up to 15,000 ha. The table

below shows the specification of the equipments regarding country elevator and milling plant. After setting annual receiving capacity of rice, the annual operation period of each equipment including the dryer, rice husker and milling machine is estimated. Based on this estimation, the equipment is selected so as to meet the requirement of the capacity.

UNVDA owns two trucks of 20 tones class, several pickup trucks and one tractor trailer. The 15,000 tons of rice will be collected by utilizing those vehicles efficiently.

Ⅱ. DESIGN CONDITION

Design Conditions of Rice Processing Plant for Cameroun

November 8, 2016

1. General & Operating Conditions

DESCRIPTION		SPECIFICATION
1) Number of Harvest Season		One crops per Year
2) Annual Processing Capacity		15,000 Tons per Year on Receiving Paddy(Input)
3) Yearly Operation	1) Receiving	90 Days per Year
	2) Drying	90 Days per Year
	3) Husking	150 Days per Year
	4) Milling	150 Days per Year
4) Daily Operation	1) Receiving	8 Hours per Day
	2) Drying	24 Hours per Day
	3) Husking	12 Hours per Day
	4) Milling	12 Hours per Day

2. Receiving Conditions

1) Daily Raw Paddy Receiving	15,000 T/Y ÷ 90 Days = 167 Tons per Day on 26% M.C.
2) Receiving Period	90 Days per Years
3) Amount of Raw Paddy Received	167 T/D x 90 D/Y = 15,030 T/Crop on 26% M.C.
4) Receiving Time	8 Hours per Day
5) Required Receiving Capacity	167 T/D ÷ 8 H/D = 20.9 T/H (≒ 30 T/H)
6) Recommened Number of Receiving Line	2 lines
7) Capacity of Receiving Line	15 T/H × 2 Lines

3. Drying Conditions

1) Moisture Content of Wet Paddy		Ave. 26%
2) Drying Target		Down to 14%
3) Moisture Conversion Ratio		(100% - 26%) ÷ (100% - 14%) = 0.860
4) Drying Rate		0.6% (Ave.)
5) Drying Time		(26% - 14%) ÷ 0.6%/H = 20 H 00M
6) Feeding & Discharging Time of NSDR30B	1) Feeding	2 Hour 00 Min.
	2) Discharging	1 Hour 00 Min.
	3) Total	Approx. 3 Hours 00 Min in Total
7) Total Drying Time		20 H 00M + 3 H 00M = 23 H 00 M
		Each Dryer operates at 1 batch per day.
8) Required Number of Dryer		167 Tons ÷ 30 Tons /Unit = 5.6 (6 Units of Dryer)
9) Number of Dryer		6 units of 30T Dryer
10) Amount of Dried Paddy per Day		167 T/D x 0.860 = 143.7 T/D
11) Drying Period per Year		90 Days per Years
12) Amount of Dried Paddy per Year		143.7 T/D x 90 Days = 12,933 Tons per Crop on 14% M.C.

November 8, 2016

4. Paddy Husking Condition

1) Amount of Dried Paddy per Year	12,933 Tons per Year on 14% M.C.
2) Required Husking Capacity per Day	12,933 T/Y ÷ 150 Days = 86.2 T/D
3) Daily Operating Hours	12 Hours per Day
4) Required Husking Capacity	86.2 T/D ÷ 12 H/D = 7.2 T/H
5) Recommened Number of Husking Line	2 lines
6) Capacity of Husking Line	3.6 T/H × 2 Lines

5. Paddy Storage Silo Conditions

1) Amount of Dried Paddy per Day	167 T/D x 0.860 = 143.7 T/D
2) Capacity of Husking Line	3.6 T/H × 2 Lines = 7.2 T/H
3) Daily Paddy Husking Capacity	7.2 T/H × 12 Hours = 86.4 Tons per Day
4) Daily Operating Hours of Husking Line	12 Hours per Day
5) Required Storage Capacity per Day	143.7 T/D − 86.4 T/D = 57.3 T/D
6) Receiving Period per Crop	90 Days per Crop
7) Required Storage Capacity per Crop	57.3 T/D × 90 Days = 5,157 Tons per Crop
8) Silo Holding Capacity per Unit	500 Tons per Unit
9) Required Quantity of Paddy Storage Silo	5,157 T/C ÷ 500 Tons = 10.4 (≒ 11 Units)
10) Quantity of Paddy Storage Silo	12 Units (11+1 for Silo Rotation)

6. Rice Milling Condition

1) Amount of Dried Paddy per Year	12,933 Tons per Year on 14% M.C.
2) Amount of Brown Rice per Year	12,933 T/Y × 0.8 = 10,347 Tons per Year
3) Milling Period per Year	150 Days per Years
4) Required Rice Milling Capacity	10,347 T/C ÷ 150 Days = 69.0 T/D
5) Daily Operating Hours	12 Hours per Day
6) Required Milling Capacity	69.0 T/D ÷ 12 H/D = 5.8 T/H
7) Recommened Number of Milling Line	2 lines
8) Capacity of Rice Milling Line	2.9 T/H × 2 Lines

The table below shows the processing capacity of the major equipments.

Table 6.4.4 Processing capacity of major equipments

#	Description	Specification
1	Receiving conditions	● Receiving Hopper: 2 Capacity of receiving_15 ton/hr × 2 Lines, 60 days per year, 8 hours per day ● Rice Cleaner: 2
2	Drying conditions	● Dryer (Husk Furnace type) : 30 ton × 6 60 days per year, 24 hours per day
3	Rice storage silo conditions	● 500 ton × 12 units (11 + 1 for Silo rotation) ● Mill day bin: 60 ton × 4 units
4	Rice husking conditions	● Rice Cleaner: 2 ● Rice Husker: 3.6 ton/hr × 2 150 days per year, 8 hours per day ● Stone extracting machine: 2 ● Rice Separator: 2
5	Rice milling conditions	● Rice Whitening Machine: 3.0 ton/hr × 2 150 days per year, 8 hours per day ● Rice Polishing Machine: 4 ● Optical Sorter: 2
6	Packing conditions	● Semi-auto Packer (5~20kg type) : 2 ● Semi-auto Packer (10~60kg type) : 2 ● Sewing Machine: 2 ● Heat Sealer: 2
7	Electrical conditions	● Control Panel (for Main) ● Control Panel (for Receiving) ● Control Panel (for Blending)
8	Dust conditions	● Bag filter with air lock & scraper ● Husk Storage: 1
9	Laboratory equipment	1 lot

Source; JICA Study Team

Considering that UNVDA covers the rice collection of 15,000 tons per year, the private rice millers may suffer due to the expansion of the business of UNVDA. However, if the area of rice fields increases as UNVDA expected to do so, the oppression of private demand would not be caused due to the increase of total rice production in entire area.

Besides, most of the private rice millers sell the par-boiled rice to Nigerian middle man, which is the contradictory situation for the increase of rice self sufficiency rate in Cameroon of which NRDS targets for. It is rational for UNVDA to cover the rice collection of 15,000 tons per year and to sell them for domestic market in terms of respecting the NRDS goal. The local farmers still have verities of choices how they sell their crops even after the installation of country elevator and milling plant. Thus, UNVDA should have good relationship with local farmers by providing not only the rice milling service but also plowing and harvesting service in order to secure the collection volume of harvested rice from the local farmers.

(2) Superiority of Japan-made Equipments for Country Elevator and Milling Plant

The superiority of Japan-made equipments for country elevator and milling plant is described below. The table below shows the superiority of those equipments summarized based on the hearing from the Japanese maker. As shown in the table, the Japan-made equipments cover all the required technology. This indicates that those Japan-made equipments has superiority and can be procured through the application of STEP scheme.

Table 6.4.5 Superiority of Japan-made country elevator and milling plant[*1]

Facilities	Item	Applied Technology	Japan	Korea	China	India	Europe
Country Elevator	Drying Facility	Automatic rice circulating dryer with moisture measuring system*2	○	○	○	○	○
		Rice drying system by using rice husk	○	×	○	×	×
	Silo	Silo with temperature measuring system	○	○	○	○	○
		Silo with hopper bottom type	○	○	○	○	○
Milling Plant	Rice Husking Facility	Double drive system*3	○	×	×	×	×
		Automatic husked rice sorter*4	○	○	○	○	○
	Rice Milling Facility	Imprecated rice milling system*5	○	○	○	○	○
		Automatic weight system by the current value *6	○	×	×	×	×
		Return function of unmilled rice *7	○	×	×	×	×
	Sorting Facility	Color Sorter (most advanced full color camera)	○	×	○	×	×
	Electrical Facility	Check system for the operation condition in the central operation room and control panels established in each facilities	○	○	○	×	○
	Dust Collection Facility	Dust collection system to avoid the blow down of dusts*8	○	○	○	×	○

Source：JICA Study Team

*1 Superiority of the equipments of Japanese maker A

*2 The inspection doors are installed in the bottom side of the dryer's lift and screw where rice husk or other contaminants are accumulated for the easy cleaning of those facilities.

*3 The conventional system requires the periodical replacement of secondary role due to the rubbing by the fast spinning of primary role. The introduced husking equipments have the Double-Drive system which automatically controls the spinning speed of the primary and secondary rolls based on the friction degree. Thus, it is not necessary to replace the rolls until both primary and secondary rolls become worn. Moreover, it simplifies the maintenance of those equipments due to the needlessness of roll rotation works.

*4 The introduced sorter applies the automatic sorting system which is able to sort the husked rice based on the several factors such as friction coefficient, size and the difference of specific weight between husked and unhusked rice by the libration of rice sorting board with dimples.

*5 Imprecated rice milling system can improve the yielding percentage of milled rice. In addition, applied diamond roll of the milling machine can be splitable which makes operators exchange the roll easily.

*6 To measure the whiteness of milled rice to control the pressure to rice (although it is required to arrange the setting of this equipments at initial operation, the following works will be stably conducted in spite of the operator's skill)

*7 The application of returning line can reduce the loss of unmilled rice.

*8 The application of the facilities can improve the work environment of the plant due to its dust collection system.

(3) Superiority of Engineering Service Regarding the Installation Work and Test Operation for the Country Elevator and Milling Plant

The engineering service regarding the installation work and test operation for the country elevator and milling plant is also required for this project. The reason is as follows.

Installation Work

The equipments to be procured through this project include the dryer, silo and elevating machine which requires the installation work in Cameroon. These equipments are originated and produced by the makers. Thus, the makers are familiar with the installation work of those equipments. Besides, installing the pipework for the connection of each equipment should be conducted by the maker's technicians in order to make the equipment's performance sufficiently effective.

Test Operation

The Japanese makers have their own know-how for the operation training of their products based on the experience selling their products in abroad. As an example, before the initiation of actual operation of equipments, some Japanese makers conduct "Empty Operation" of which the operators runs the

equipments without applying the rice for the training of local operators. After getting sufficient skills by the implementation of empty operation, the local operators will apply the rice into the equipments and operate them under the supervision of the technicians from Japanese makers. Through the training process described above, it is possible to reduce the risks of accidents and equipment's failures in the stage of test operation as well as to train the local operators effectively. Therefore, the engineering service conducted by the maker's technicians is indispensable.

(4) Procurement Plan of Tractor

Considering the current and future situation of rice fields, 10 units of tractors (40 HP) are planned to be procured. The workload area of each tractor is estimated as 44.6 ha for 1 rice cultivation season. Therefore, totally 446 ha of rice fields can be plowed by the procured tractors. This will enable not only to acquire the additional demand from the local farmers but also conduct the plowing service covering for 1,000 ha of rice fields per cultivation season by the utilization of existed tractors for the plowing service.

(5) Superiority of Japan-made Tractor

The table below shows the superiority of tractor summarized based on the hearing from the Japanese maker. Japan-made tractor has superiority especially for the plowing in the wet land since it provides long term durability, low failure rate, low fuel consumption, easy operability, water proof at the bottom of vehicle and the mobility including four quarter and rotation as well as it has original engines made by the same makers to fit the vehicle system. Besides, the introduction of the implement adopting the horse power of tractor will enable to improve the work efficiency and decrease the fuel consumption. These facts indicate that the Japan-made tractor and implement has superiority and can be procured through the application of STEP scheme.

Table 6.4.6 Superiority of Japan-made tractor *1

	Japan	China	Korea	India	Europe	America
low fuel consumption *2	○	△	△	△	△	△
Engine capacity*3	○	×	△	×	△	○
long-term durability	○	×	△	×	△	○
low breakdown rate	low	High	Intermediate	High	Intermediate	Intermediate
Easy operability	○	△	△	×	△	△
Easy maintenance	○	×	△	×	△	△
Water proof *4	○	×	△	×	?	△
rotation mobility	○	△	△	×	×	×
Light weight*5	○	△	△	×	×	×
Marketing situation of small-middle size tractors	○	△	○	○	△	△

Source : JICA Study Team

*1 Superiority of the equipments of Japanese maker B

*2 Since, the weight of engine per HP is lighter than that of other makers, it would improve the operability in rice field resulting in the good valuation in Southeast Asia.

*3 To avoid the stress of water and mud by the application of front axle structure and special sealing device of the shaft.

*4 The weight of Japan-made tractors are lighter than products from oversea since those are designed to be utilized in the rice field of Japan. It can also reduce the frequency of stuck in the rice field.

(6) Combine harvesters

Considering the current and future situation of rice fields, 10 units of combine harvesters with the processing capacity of 0.2-0.6 ha per hour are planned to be procured. The workload area of each

combine harvester is estimated as 46.0 ha for 1 rice cultivation season. Therefore, totally 460 ha of rice fields can be harvested by the procured combine harvesters. This will enable to acquire the additional demand from the local farmers since UNVDA has never conducted the harvesting service.

(7) Superiority of Japan-made Combine Harvester

The table below shows the superiority of combine harvester summarized based on the hearing from the Japanese maker. Japan-made combine harvester has superiority in terms of the low wastage factor, low failure rate, low fuel consumption and easy operability as well as it has original engines made by the same makers to fit the vehicle system. In particular, the application of reversing gear enable to clear the stuffing in feeder house or platform auger by reversing the driving shaft of feeder house which results in low failure rate of the equipment. Besides, the application of side opening system in threshing device enable to improve the operability of switching the cone cave which results in the improvement of workability of the maintenance. These facts indicate that the Japan-made combine harvester has superiority and can be procured through the application of STEP scheme.

Table 6.4.7 Superiority of Japan-made combine[*1]

	Japan	China	Korea	India	Europe	America
low fuel consumption	○	×	Not existed	?	?	?
Engine capacity	○	×		?	?	○
long-term durability	○	×		△	○	○
low breakdown rate	Low	High		High	Intermediate	Intermediate
Easy operability *2,3	○	○		×	△	△
Easy maintenance *4	○	△		×	△	△
Water proof	○	△		△	△	△
Light weight	○	○		×	×	×
Patent	○	?		?	?	?

Source：JICA Study Team

*1 Superiority of the equipments of Japanese maker B

*2 Application of large front rotor：The large front rotor with the size of Φ400 is equipped in the entrance of feeder house and thrashing part. It leads to the uniform transportation of the threshed rice to the threshed drum.

*3Application of reversing gear of the harvesting：The reversing gear is equipped in the driving shaft of feeder house. Thus, it can clear the stuffing in feeder house or platform auger by reversing the driving shaft of feeder house.

*4 Application of side opening system in threshing device：The flame structure is equipped in the side face of threshing device, which improve the operability of switching the cone cave.

(8) Other Points to Be Noted for the Superiority of Japan-made Equipments

Hence, it should be noted that the after sales service of Japanese makers of those equipments has also superiority compared to other makers. Other makers who sell cheaper equipments than Japanese maker usually do not focus on the after sales services to the consumers, which results in the lack of spare parts supply for those equipments. On the other hand, since Japanese makers usually regard those services as important, they establish the local agency to provide necessary services for the consumers. Thus, even the cost of the procurement of Japan-made equipments is higher than those of other countries, the consumers would be able to utilize those equipments for the longer period indicating that Japan-made equipments has also superiority in cost for the middle and long term utilization basis.

6.4.3 Drawings

Outline design drawings are attached in the Annex.

6.4.4 Construction Cost for the Installation of Agricultural Equipments

Major works and their construction costs including the procurement of equipments are shown in the table below.

Table 6.4.8 Major Works and of Costs for the Installation of Agricultural Equipments[30]

	Facilities, machineries/ equipment	Construction cost (million FCFA)
Components	1) Buildings (Silo (Storage capacity: 5,500m^3), rice drying, rice milling, rice storage, parts storage, hush storage bin, hush (ash) storage, administration office (office, meeting room, document storage, seminar room, canteen, etc.), generator room, toilet (outside), security room, etc.)	7,802
	2) Country elevator, rice drying, rice milling, hush storage bin	17,274
	3) Tractor: 10 units (40 HP), Attachment: Rotary tiller (10 sets) Combine: 5 units (Capacity: 0.2～0.6 ha/hr)	699
	4) Associated machineries: Fork lift (4 units), wheel loader (1 unit), cargo truck (3 units)	
	5) Transportation cost (Total of 2)-3)above)	1,227
	6) Primary and secondary electrical connection works, generator, water supply system (deep well, plumbing works)	436
	Total	27,438

Source: JICA Study Team

6.4.5 Construction Plan

(1) Construction method

1) Preparatory works

The contractor shall confirm location and structural design of the proposed buildings in the presence of government officials (UNDVA). High tension wire connection from existing electricity grid, installation of transformers (cubicles) shall be confirmed between two parties. Temporary work plan such as temporary roads, site office, stock yards are further reviewed.

2) Preparatory works

Site office, material test laboratory, warehouse and material processing yards are installed.

3) Earth works

Construction site shall be developed to install various buildings and facilities together with cut and bank works along the present inclined terrain. Surplus earth materials shall be properly disposed in the UNDVA property.

4) Concrete works

Concrete for the shed foundation and floor slab is to be delivered from Bamenda city (50km distance from the proposed construction site, Ndop). Job-mixed concrete is poured for small scale structures. Fine and course aggregates for concrete is obtained at the crushing plant in the vicinity. Deep well is installed in the construction site for the construction works Design mixture of the concrete will be examined by concrete mixture test with actual aggregates, water and cement.

5) Wall works

Concrete block is available for the wall structure. Two or one concrete block is installed in one layer

[30] The building work cost is estimated based on the unit price of each works collected from the Cameroonian local contractor and their quantity calculated based on the design drawing. For the cost estimation of country elevator and milling plant, only 1 Japanese enterprise submit the equipment's quotation though 4 Japanese enterprises are asked to do so. Thus, the quotation submitted from 1 Japanese enterprise is examined carefully, and then the price of those equipments are estimated. On the other hand, the procurement cost of tractors and combines are estimated based on the quotation collected from 2 enterprises.

according to the wall thickness.

6) Structural steel works

Sheds of the drying, milling facilities, storage warehouse is sustained by a truss structure. Truss beam is assembled with bolts at the site. Main beams and columns will be processed in the factory in Douala and transported to the site for installation. Steel pipe scaffolding is used for the roof and wall installation. Fixed type crane (Weight capacity: 20 ton) is installed for beam raising of sheds and silo installation and truck crane is for the use in the sheds.

7) Finishing works

Galvalume plate (t=53 mm) or aluminum plate (t=1.0 mm) is available for the durable roofing material. Aluminum product is also selected for outside doors, windows form a view point of strengthen and ease of maintenance. Wooden materials are also available for the fitting except the metallic door frame.

8) Equipment works

i) Electric equipment

- Electricity is provided from adjoining 36 kV grid by aerial wire. Diesel operated generators (Total capacity: 1.7 kVA) are installed in the generator room.
- Lighting equipment: The number of the light device is estimated to satisfy required illuminance of each facility.
- Lightning protection: Lightning protection system is installed to prevent lightning strike o the facilities.

ii) Plumbing sanitary:

- Water supply system: Deep well is install in the compound of the rice center.
- Drainage equipment: Drainage system consists of domestic effluent and sanitary sewage treatments. Both systems have septic tanks and seepage wells. Sewage water from the septic tank is delivered to the seepage well through gravel and sand filter layers.
- Fire extinguishing equipment: Fire extinguishers are equipped depending on the floor area and other factors.

9) Other works

i) Exterior works

- Existing terrain is excavated and shaped terrace-like floor from road side towards mountainous side.
- Concrete is paved in front of each facility and building. Gravel pavement is also available for the remaining area.
- Drainage ditches and drainage canal are installed around the facilities to drain rain water. Cross drainage canals are also installed across the roads and concrete pavement.

ii) Plumbing works

- Electric cables are installed in the cable duct. Maintenance pits (hand holes) are also placed for the maintenance purpose.
- Domestic and sewage water is drained to the septic tank though PVC (polyvinyl chloride) pipe.

(2) Construction schedule

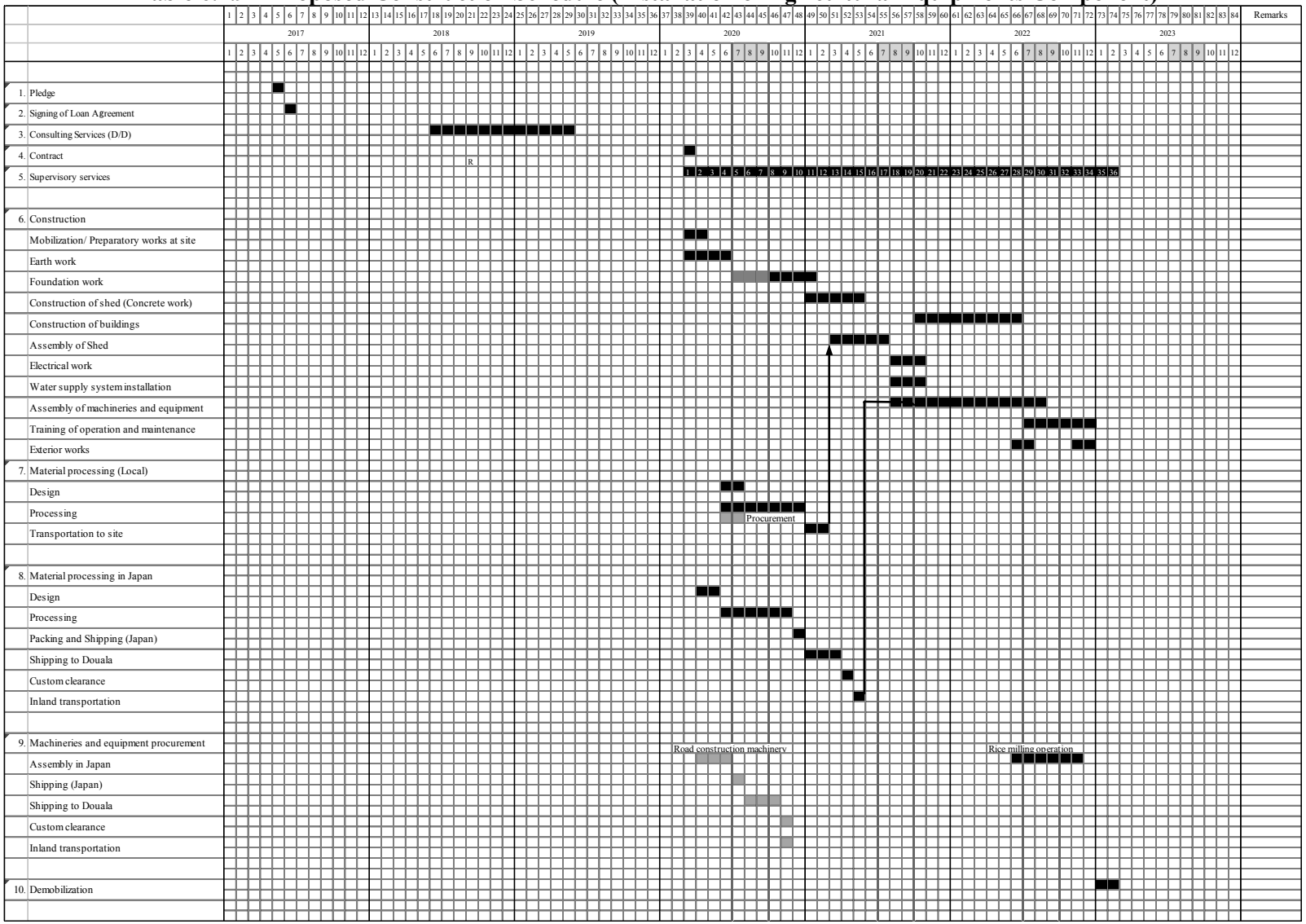
Construction schedule is shown in Table below by construction items. Earth work (Terrace work), electric connection work are commenced to secure temporary yard and electric supply for the

construction works in the first dry season.

Structural steel will be processed in Douala (or Yaoundé) city and delivered to the construction site. It takes 2 and 5 months for design and processing, respectively. Steel materials will be procured and shipped from other Africa and European countries. About 2 and 2 months are necessary for shipping and custom clearance at Douala port. All steel materials for the shed construction will delivered to the site after 16 months from the contract. Roof work may take for 5 months after material delivery to the site. Wall construction, waterproofing work, fitting work will be started after raising the roof. Electric and water supply works are commenced at the same schedule as the concrete works of the building and sheds construction. Painting work is carried out after the plastering and fitting work. Interior work is commenced immediately after the plastering work completes.

Machineries and equipment for the silo, rice drying and rice milling are to be delivered to the site from October 2021. Inspection of these machineries and equipment is scheduled in April 2023. Outstanding work can be completed by the end of June 2023.

Table 6.4.9 Proposed Construction Schedule (Installation of Agricultural Equipments Component)



6.4.6 Maintenance and Management Plan for the Agricultural Equipments

(1) Maintenance and Management Plan for the Agricultural Equipments Including Gender Approach

1) Selection of person in charge of maintenance and management of agricultural equipments

The joint use of the equipments tends to lead the careless utilization of equipments. Thus, it is indispensable to appoint at least 1 person to be the responsible manager for the maintenance and management of the equipments. The role of this manager is to maintain the equipments so as to utilize it safely and efficiently as necessary. Besides, the continuous training for the local operators and mechanics is necessary to improve their skills including the periodical maintenance and inspection, fault diagnosis, and repairment for the development of the sustainable maintenance and management system.

2) Procurement of Spare Parts and Inventory Management

It is crucial to establish the inventory management system for the on-time supplement of spare parts of the equipments. Thus, while securing the suppliers of the spare parts, the quantity of spare parts that is heavily exhausted or frequently failed should be paid more attention. Besides, there are many failed equipments in the center of agricultural equipments in UNVDA. Therefore, it is necessary to remove those equipments for securing the management space for new equipments. The introduction of 5S-KAIZEN scheme will enable to improve the condition of workshop in UNVDA where the spare parts and other tools are scattered and unsettled.

The main spare parts of the Japan-made equipments will be delivered on the same timing of the delivery of those equipments. It should be noted that UNVDA should secure the local agency to establish the supplement system of spare parts between UNVDA and Japanese makers. According to the Japanese maker of agricultural equipment, 80 % of the parts will be delivered within 7 days and other 20 % will be delivered within 30 days by air cargo while it depends on the stock status.

3) Gender and Agricultural Mechanization

As a pioneering case of gender consideration, UNVDA has conducted the training of tractor operation for their 6 field staffs and 1 staff of marketing division for agricultural materials before the international women's day. After this training, UNVDA will arrange the demonstration of the tractor operation operated by these staffs to change the recognition that the agricultural equipments are supposed to be operated by men.

The approach of gender mainstream does not mean the facilitation of women's participation in the operation training of agricultural equipments. If the beneficial community shows the negative response for the women's operation of agricultural equipments, UNVDA should clearly indicate the merits of women's participation for the operation of agricultural equipments. The words of gender mainstream may lead to the inflexible measures such as the providing equal opportunities to male and female for the training. Thus, it is necessary to respect the community's way of thinking for the gender issues. Therefore, the women's participation of the training should be conducted only for the knowledge sharing and UNVDA should respect the responses from the communities after the training. The division of labour works and access of the services between men and women should also be considered carefully to promote the agricultural mechanization for the contribution of the reduction of women's surplus labour.

(2) Human Resources Required for the Operation of Equipments

1) Country Elevator and Milling Plant

After the installation of country elevator and milling plant, the training courses in operation, maintenance and management methods of the equipments will be conducted for UNVDA operators and maintenance personnel. Once the equipment is installed, the technical staff from the maker will

conduct audits and adjustments on equipment and verify proper running. Then the UNVDA staff will conduct the test operation of those equipments and finally, the actual operation will be started. At the beginning stage of operation, the UNVDA operators will use small amounts of rice to observe the machine status and learn regarding the safety operation, trouble avoidance and solution and repairing methods and to avoid the breakdowns. After the improvement of operator's skill, the operation speed of the machines will reach the normal speed.

Besides, UNVDA employs 4 staffs of operation and maintenance and 8 workers for the operation of existed milling plant. In order to operate the country elevator and new milling plant, UNVDA should dispatch the personnel as stated in the table below.

Table 6.4.10 Dispatching Plan of the Operators for the Operation of Country Elevator and Milling Plant

	Position	No. of staffs
Country elevator	Rice receiving section	4
	Control room	2
	Rice dryer section	2
Milling plant	Rice receiving section	2
	Rice husking section	1
	Rice milling section	1
	Rice polishing section	1
	Grading section	1
	Sorting & Packing section	4
	Dust & Bran collecting section	1
	Control room	1
	Laboratory room	1

Source: JICA Study Team

2) Tractors and combine harvesters

The technical trainings will be conducted for the staffs in charge of operation, maintenance and management of the equipments as follows.

Seminar for the machine operation
Classroom lecture:
Structure and function of agricultural equipments and handling method, Efficient utilization of agricultural equipments, Safety operation of agricultural equipments, Method of operation recording
* DVD text book will be supplementary provided for the training mentioned above.

Practical training:
Method of pre-operation checks for each equipments, Operation training.

Seminar for the machine maintenance
Classroom lecture:
Maintenance and Repairment of Agricultural Equipments, Method of inspection and maintenance recording.

Practical training:
Tractor: Maintenance of oil pressure controller, rotating parts and security devices.
Combine harvester: Maintenance of harvester and conveyer, shelling and sorting parts, grain tank, and discharged straw disposal device
Common items for tractor and combine harvester: Maintenance of engine (oil, oil filter, fan belt, radiator, oil separator, air filter element), battery (charging battery, charger, removing battery), operation of electrical devices, automatic devices, travelling parts (tires, track rollers).
Method of fault diagnosis and repairment (especially for the electrical devices)

6.5 Consulting Service

6.5.1 Engineering Service

Since the executing organization for this project is MINADER, the consultant will support MINADER for the supervision and inspection of the construction works conducted by the contractors. Thus, the consultant will conclude the contract with MINADER in terms of the works regarding the D/D and S/V for this project. While the role of consultants at D/D stage is to conduct necessary survey for designing and prepare the tender document for the international competitive bidding to select the contractor, the consultants will conduct the supervision of the construction works at S/V stage. The table below shows the contents of the activities for consulting service.

Table 6.5.1 Contents of Consulting Service

Stage	Contents
D/D stage	・Initial discussion with executing organization for the commencement of the project ・Preparation of the detailed design and quantity survey ・Preparation of design specification and tender documents ・Preparation of construction plan and estimated project cost ・Acquisition of the derailed design and tender documents from the executing organization ・Revision of the EIA and RAP based on the result of D/D ・Support the implementation of the plan regarding land acquisition
Tendering Stage	・Preparation of the standard of screening for tender and the draft of public notification ・Implementation of P/Q and the notification ・Explanation and distribution of tender documents ・Implementation of bidding. Preparation of the report regarding the bidding result ・Selection of the successful bidder and facilitate the contract negotiation ・Facilitation of the approval of the contract
S/V stage	・Supervision of the construction works in terms of schedule, quality and progress control ・Inspection of the construction works ・Preparation of monthly report regarding the construction works.

Source：JICA Study Team

The following is the contents of detailed design and supervision of the building facilities.

(1) Plan of D/D

The contents of the activities regarding D/D stage are as follows.

D/D

- ✓ To decide the location and height of the facilities Based on the supplemental survey.
- ✓ To implement structure calculation and detailed design of the facilities.
- ✓ To prepare the layout of location, horizontal plan, detail plan (horizon, front face, side-view) and structure plan.
- ✓ To prepare the document for the quantity calculation for the construction.
- ✓ To evaluate the design contents based on the re-confirmation of basic condition, validation of design plan, consistency between the quantity and drawing and close inspection of the quantity calculation.
- ✓ To prepare the tender documents.
- ✓ To support the execution organization to select the contractor.
- ✓ To revise the EMP, EMoP, Environmental monitoring form and RAP based on the result of D/D
- ✓ To support the implementation of the plan regarding land acquisition

Table 6.5.2 Manning Plan of the Consultant at D/D stage

Work Contents	International Consultant	M/M	Local Consultant	M/M
Survey at the field	Team leader	11	Sub-Team leader	11
	Co-Team leader / Irrigation Engineer	11	Irrigation Engineer	11
	Road Engineer 1	11	Road Engineer 1	11
	Road Engineer 2	8	Road Engineer 2	11
	Architect and Facilities Engineer	11	Architect and Facilities	11
	Construction Engineer	8	Engineer	11
	Agro-Mechanical Engineer	2	Construction Engineer	6
	Design Engineer (Plant)	4	Agro-Mechanical Engineer	6
	Environmentalist	5	Hydrogist	3
	Procurement Specialist	2	Agronomist	6
			Agro-Economist	11
			Geodetic Engineer	11
			Design Engineer	6
			Quantity Engineer	11
			Socio-Environmentalist	
Tendering	Team Leader	8	Sub-Team leader	8
	Procurement Specialist	4		
Total		85		134

Source：JICA Study Team

(2) Plan of S/V

The contents of the activities regarding S/V stage are as follows.

- ✓ To supervise the construction works including building works, equipment works and other works.
- ✓ To arrange the procurement of equipments
- ✓ To supervise and arrange the entire activities of the project
- ✓ To supervise the schedule, quality control, progress control, inspection and report to the related organization.
- ✓ To support PMU for the implementation of plans regarding EMP, EmoP and RAP.

Table 6.5.3 Manning Plan of the Consultant at S/V stage

Work Contents	International Consultant	M/M	Local Consultant	M/M
Survey at the field	Team leader	38	Sub-Team leader	33
	Co-Team leader / Irrigation Engineer	21	Irrigation Engineer	33
	Road Engineer 1	27	Road Engineer 1	26
	Architect and Facilities Engineer	23	Architect and Facilities Engineer	22
	Environmentalist	6	Agronomist	6
			Quantity Engineer	9
			Socio-Environmentalist	8
Total		115		107

Source：JICA Study Team

6.5.2 Soft Components

(1) Soft Component for Irrigation Development

1) Background of Soft Component

Overall goal of this project is to increase self sufficiency rate of rice in Cameroon. To achieve this goal, it is requested not only to construct irrigation facilities but also to adopt comprehensive approach including soft component about operation and maintenance (O&M) of the facilities. Current issues on soft aspects for irrigation development are summarized as followings.

i) Knowledge and awareness of UNVDA staff and farmers on water management, O&M can be improved;

In the UNVDA area, water users associations named “Farm” have been established by UNVDA effort. However, there are no officers with specialty of water management, O&M in UNVDA although they try to do their best in their work based on field experience. As a result, awareness and activities of “Farm” can be still improved. These situation leads to improper water management, O&M, and finally gives negative effect to agricultural productivities and life span of irrigation facilities.

ii) Knowledge of UNVDA staff on agricultural engineering can be improved;

UNVDA engineers have academic background for civil engineering. However, there are no officers with specialty of agricultural engineering or irrigation design. As a result, agricultural engineering aspects can be improved for irrigation planning or design.

iii) Institution on water management, O&M can be improved;

As described ①, water users associations have been established in UNVDA area. However, guidelines, strategy or legislative system on water management, O&M have not been prepared in Cameroon central government. Therefore, institution on water management, O&M can be improved.

iv) Institution on agricultural engineering can be improved;

Design standard or design guidelines for irrigation facilities have not been prepared in Cameroon. And reports including water requirement, design drainage discharge or basic design have not been prepared for implementation of irrigation projects. Therefore, it is difficult to judge whether irrigation project is implemented properly or not.

v) Observation system on water resource and climate can be improved;

Discharges in river have not been observed for irrigation projects in Cameroon. And there are some deficiencies in climate data although basic climate data have been observed. Therefore, it is

difficult to collect necessary data for irrigation projects.

2) Objective of Soft Component

To solve 5 issues above mentioned, necessary measures are not only capacity development of related staff or farmers but also wide spreading approach including institutional development with long time.

In this project, irrigation facilities constructed in the target area will be positioned as a starting point to solve 5 issues, and following objective will be adopted.

Objective of the soft component is that "through the activities in the Upper Bamunka area (Target area), capacity of UNVDA staff is strengthened 1) to conduct proper water management, O&M, and 2) to conduct proper planning, design and construction management for irrigation projects to secure stable production of rice". Moreover, training materials prepared in the soft component will contain proposals for institutional development on water management, O&M and irrigation development in Cameroon.

3) Outcome of Soft Component

Corresponding to the objective mentioned above, expected outcome of the soft component is that "1) water management, O&M is conducted properly in the Upper Bamunka area, and 2) daily-work practice for planning, design and construction management is improved".

4) Confirmation Method for Achievement of Outcome

Achievement of outcome will be confirmed by 1) monitoring sheet for water management, O&M managed by UNVDA staff and 2) understanding tests.

5) Activity of Soft Component

Items of activities are corresponding to each issue (The chart below). Planned activities are summarized as shown in the following table.

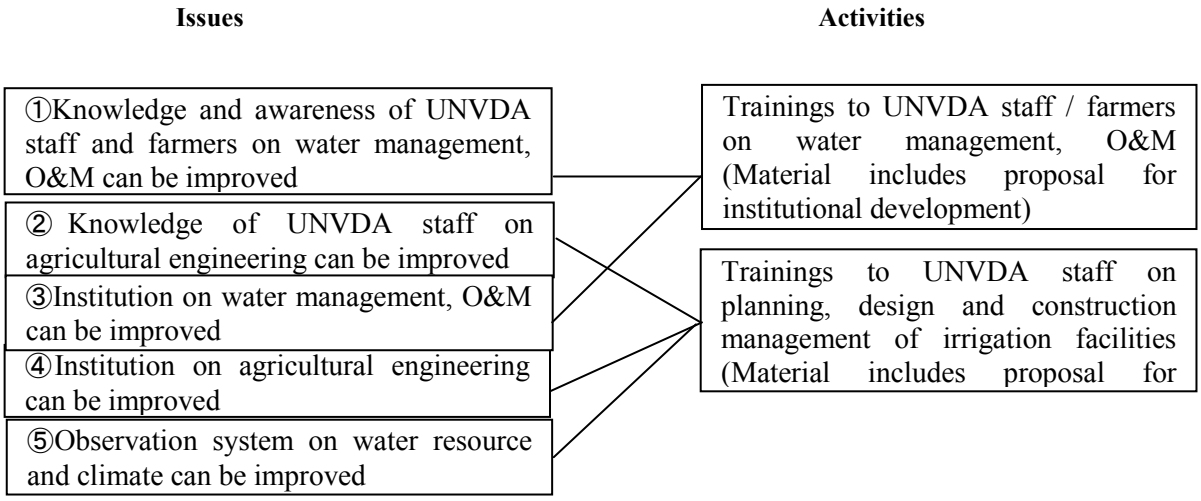


Figure 6.5.1 Issues and Activities

Table 6.5.4 Activities of Soft Component

Item	Activities	Participants
1. Training on Water Management, O&M	(1) Management of water users association and record keeping (2) Water distribution and operation of facilities (including water tariff and way of use of standard plots) (3) Maintenance of canals (including small repair) (4) Maintenance of farmroads (including small repair) ✓ Trainings will be provided by consultants to UNVDA staff. After that, trainings will be provided by UNVDA staff to "Farm" members. ✓ Materials prepared by the training will include 1) lessons learned of this project and 2) proposal for institutional development for water management, O&M in Cameroon.	(Trainer) Consultant (Target) UNVDA, Farmers
2. Training on planning, design and construction management of irrigation facilities	(1) Survey (Field survey for irrigation projects, data observation, traficability and others) (2) Planning (Layout of irrigation facilities, design drainage discharge, water requirement, land consolidation and others) (3) Design (Design of canal-cross sections and others) (4) Construction management (Construction management of irrigation projects) ✓ Based on drawings and specifications of the irrigation improvement project in Upper Bamunka area (target area), not the aspects of civil engineering but the aspects of agricultural engineering will be discussed. ✓ Materials prepared by this training will include 1) lessons learned of this project and 2) proposal for institutional development for planning, design and construction management of irrigation facilities in Cameroon.	(Trainer) Lecturer / Consultant (Target) UNVDA

6) Procurement of Implementation Resources for Soft Component

Regarding the training on water management, O&M, a consultant from Japan will become a lecturer because it is difficult to find the resource person in Cameroon. And UNVDA staff after getting the training will provide similar trainings to farmers. Regarding the training on planning, design and construction management, University professor in civil engineering or retired person from MINADER or UNVDA will be regarded as a lecturer based on the support of consultant and he will provide trainings.

7) Implementation Schedule

Implementation schedule of the soft component is as follows. In the early stage, trainings on planning, design and construction management will be conducted. And in the latter stage, trainings on water management will be conducted in the rice cropping season. On the other hand, trainings on O&M will be conducted after the rice cropping season.

Table 6.5.5 Implementation Schedule of Soft Component and Assignment Schedule (Irrigation Development)

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	2020												2021												2022											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Construction schedule Construction period																																				
1.Training on water management, O&M																																				
2.Training on planning, design and construction management																																				
Assignment schedule Expert (Japanese) 1 Expert (Japanese) 2 Expert (Local) 1 Expert (Local) 2																																				

Note1: ▬ is rainy season.
Note2: Experts are assumed as follows.
Consultant1: Water management, O&M
Consultant2: Design of irrigation facilities
Local Consultant1: Water management, O&M
Local Consultant2: Design of irrigation facilities

8) Submission of the Result

After the completion of the soft component, soft component completion report (including monitoring results for the target area) and training materials for water management, O&M and planning, design and construction management will be submitted. Regarding preparation of these documents, officers in UNVDA and MINADER will be actively involved in, and thus ownership will be enhanced.

9) Obligation of Recipient Country

MINADER should disseminate the output of the project to the other regions using the training materials which is prepared in the soft component.

(2) Soft Component for Access Road Development

1) Background of Soft Component

At the present time, all of national roads, provincial roads, departmental roads and rural roads in Cameroon have been placed under the jurisdiction of the MINTP. In recent years, although paving rate of national road has been continuously improved, pavement maintenance and renovation of the lower class roads such as departmental roads and rural roads have not been fully implemented.

Many of the departmental and rural roads are paved with laterite and other soil materials. The roads have only minimum road related structures. The application of temporary construction materials is recognized in such road related structures in departmental and rural roads. These roads tend to have less tolerance to soil erosion due to the lack of enough soil compaction during construction period. In addition, the lack of professional knowledge and experience among both clients and local contractors for quality control of road rehabilitation work caused the uncertain quality of rural road paving. NW1 (D72) has been suffering from serious partial deterioration of the road surface in every rainy season due to the unreasonable passing of mid-size and large-size vehicles. It becomes a major obstacle to the provincial agricultural products distribution in the North West region.

On the other hand, the government has been preparing the gradual transfer of the jurisdiction over the rural road O&M to Communes from a few years ago. Although administrative and technical officers in Commune are now recognized as the prospect O&M body under the decentralization process, their technical skills, knowledge and experience for performing tasks in the whole process of road rehabilitation and construction are not enough. With the help from MINTP, intensive training on O&M of rural road, renovation planning and budgeting, and quality control of road construction and rehabilitation work must be necessary for these officers. In addition, it must be noted that an awareness of co-management for the rural road among people living along the road has not been enough fostering in Cameroon. Awareness of local community members to join the part of O&M work is also required.

From the above, the project targets a departmental road (D72) and rural roads directly linked to the main roads including national roads. In addition to road rehabilitation, the project aims to the improvement of road related structures such as bridges, culverts and other drainage facilities to eliminate rainwater from road structure. The rehabilitation method in this project must be divided into two with consideration of the nature of target roads; 1) combination of in-place stabilizing method for subbase course molding by the use of road stabilizer and asphalt paving (or DBST paving), and 2) laterite paving. In the first method, nodular laterite as a base course material and certain amount of cement are stirred at the current position on the road surface. In-place stabilizing method by the use of road stabilizer might be unfamiliar method among contractor in Cameroon.

The challenges in the access road development component are summarized as follows.

i) Administrative capacity for O&M of rural road in Communes is vulnerable.
ii) Technical standards for rural road construction and rehabilitation are not prevailing among officials in Communes.
iii) Work experience, professional knowledge and technical skills related to road construction and maintenance among technical officers in Communes are insufficient.
iv) Work experience, professional knowledge and technical skills among small or medium-sized local contractors carried out the renovation of rural roads are varied.
v) In-place stabilization method for subbase course modeling with the application of road stabilizer is unfamiliar among related officers and technician in Government and Communes.
vi) Awareness among residents along the target rural road to road maintenance is limited.

To overcome these problems described above, in parallel with the rural roads rehabilitation work, the project also carries out the soft components for the purpose of followings.

i) To improve the capacity for O&M of rural road among Communes and related corporations.
ii) To improve the capacity for O&M of load stabilizer of MINTP and MATGENIE.

2) Goal of the Soft Component

The contents of soft component was designed with consideration of building up the sustainable O&M system of the target routes including departmental and rural road, and road stabilizer among related organization including Communes, MINTP Departmental Office, UNVDA, and so on. It is realized with sustainable contribution to the improvement of O&M work on rural road from the Government after the completion of construction work. An acquisition of proper professional knowledge and technical skills for O&M by technical officers in Communes, MINTP Departmental Office, and UNVDA is also the key to realize better O&M of rural road in the future.

3) Outcome of the Soft Component

In order to achieve the goal described above, MINTP, MINADER, Communes, and related public corporation such as MATGENIE and UNVDA must understand and execute their own original roles in accordance with the organization structure in the administration system in Cameroon. Then, the O&M of target routes by soft component target organization including Communes, UNVDA and MINTP Departmental Office must be improved.

4) Confirmation of the Achievement of the Soft Component

Confirmation of the achievement of the soft component is carried out as follows.

Table 6.5.6 Confirmation of the Achievement

Soft Component	Confirmation Topics
To improve road operation and maintenance capacity of municipalities (commune) and related companies	① Confirmation of agreements (Memorandum of Agreement) of work that has been described is the operation and maintenance items of the jurisdiction road ② Confirmation of implementation status of development and maintenance and learning situation development and maintenance content by questionnaire after training ③ Confirmation of the activities of develop and maintenance organization
To build operation and maintenance system of load stabilizer. To improve technical capabilities of field engineers and operators	① Confirmation of agreements (Memorandum of Agreement) of work that has been described is the operation and maintenance items of the provided equipment ② Confirmation of implementation status of development and maintenance and learning situation development and maintenance content by questionnaire after training ③ Confirmation of the activities of management and maintenance organization

Source: JICA Study Team

5) Contents of Soft Component

Specific activities correspond to current conditions, as shown in the figure below. The activities and subject for each activity are summarized in the table below.

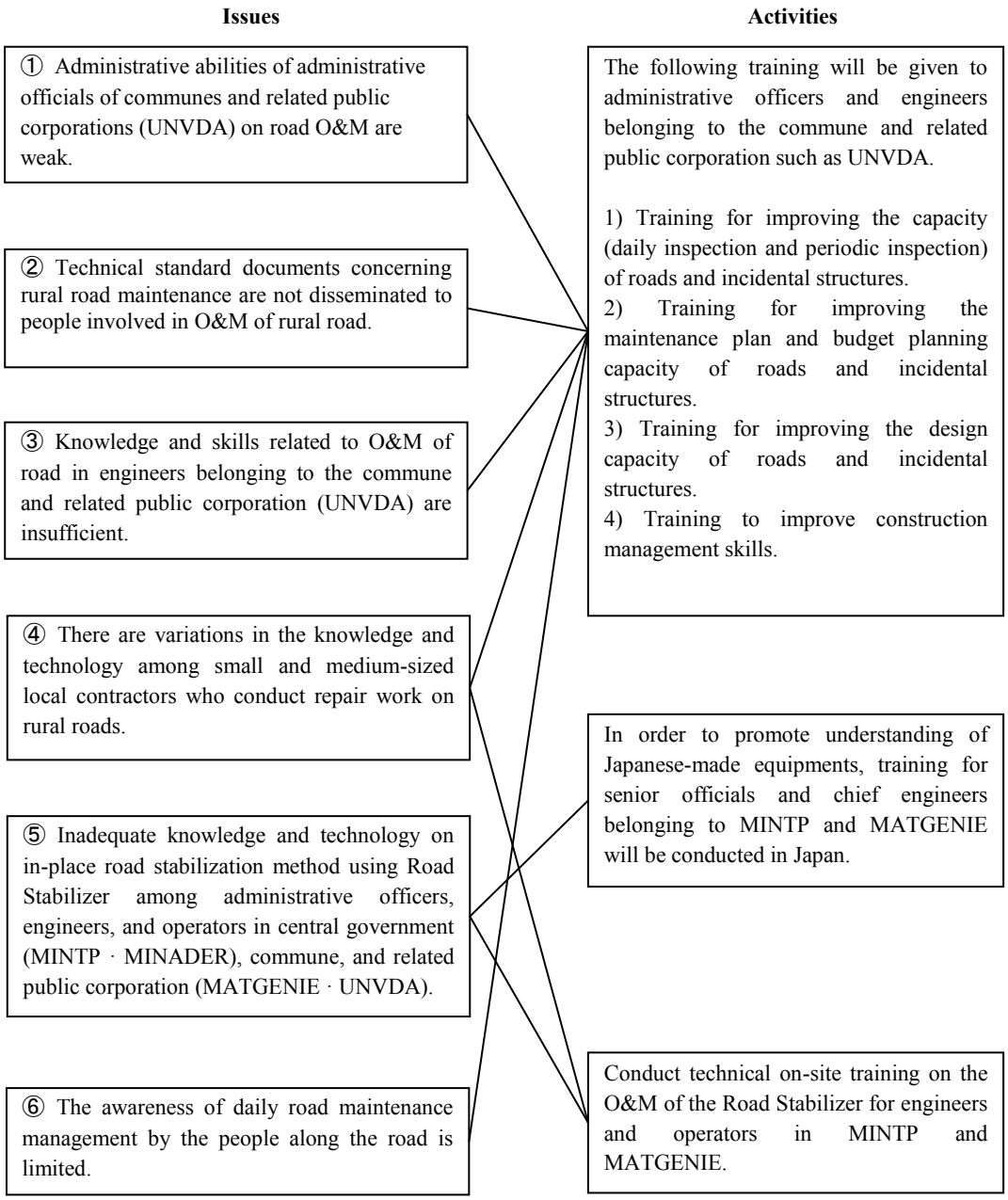


Figure 6.5.2 Issues and Activities

Table 6.5.7 Contents of Soft Component

Subject	Activities	Target
1. Improve O&M capacity of roads among communes and related public corporations	【Expected Achievement】 1.1 Design and construction capacity among commune and related public corporations such as UNVDA will be improved. 【Activities】 Through the implementation of the construction, the following activities are carried out.	【Target】 (20 people *) Administrative officers, engineers, and operators belonging to Commune and related public corporations such as UNVDA 【Practitioner】

Subject	Activities	Target
	(1) To grasp the current state of work related to design, order placement, construction and construction management. (2) Collect technical drawings and standard related to road design and introduce these materials to commune and related public corporations such as UNVDA. (3) With the target person, designing the road and road related structure. (4) Implementing construction work with the target person. (5) To develop a design and construction management manual.	Japanese consultants, MINTP related department, MINTP regional office, local consultant and so on * Two participants are supposed to participate from a total of 10 regional administrative agencies (nine communes + one public corporation (UNVDA))
	【Expected Achievement】 1.2 Road maintenance planning and budgeting capacity of commune and related public corporations such as UNVDA improves. 【Activities】 Do the following activities through implementation of the workshop. (1) Understanding the implementation status of periodic road inspections and the status of road registration book. (2) Reviewing the implementation system of periodic road inspections and the contents of road registration book. (3) Establishing the procedures for periodic road inspection and preparation of road registration book, and the periodic road inspection work through practice by OJT to the target person. (4) With the target person, establishing annual road maintenance plan and budget plan based on the improved road registration book.	
2. Improvement of O&M capacity related to road stabilizers by MINTP and MATGENIE	【Expected Achievement】 2.1 Deepen the understanding of the load stabilizer (herein below referred to as 'stabilizer') among administrator and chief engineer 【Activities】 (1) Lecture on the significance of in-place stabilization method by utilizing stabilizer. (2) Lecture to understand basic structure of stabilizer, tour of manufacturing factory, and tour of road construction site. (3) Lecture on related technologies necessary for implementation of in-place stabilization method such as cement mixing test. (4) Practical training to master the basic operation method of stabilizer. (5) Conduct lectures and tours on concrete management considerations and failure cases directly linked to the actual O&M work of stabilizer.	【Target】 (5 people) Administrative officers and chief engineers of MINTP, MINADER, commune, related public corporation such as MATGENIE and UNVDA, and civil engineering educational institution 【Practitioner】 Japanese consultant, person in charge of construction equipment maker etc.
	【Expected Achievement】 2.2 Engineers and operators who operate and maintain stabilizer in the actual site acquire related techniques and knowledge. 【Activities】 (1) Lecture on significance of in-place stabilization method by utilizing stabilizer. (2) To understand the basic structure of the stabilizer, observe the actual machine and give a lecture.	【Target】 (10 people) Engineers and operator in MINTP and MATGENIE 【Practitioner】 Japanese consultant, Japanese specialist in charge of construction equipment manufacturing company, chief engineer who

Subject	Activities	Target
	(3) Lecture on related technologies necessary for implementation of in-place stabilization method such as cement mixing test. (4) Perform a practical skill to master the basic operation method of the stabilizer. (5) Conduct lectures and tours on concrete management considerations and failure cases directly linked to the actual O&M work of stabilizer in site. (6) Case study construction will be carried out on the maintenance target route of the main project. (7) In addition to preparing the O&M manual of the stabilizer, clarify the responsibility range of MINTP and MATGENIE which are the main administrator.	participated in training in Japan (Activity 2.1)

Source: JICA Study Team

6) Resources for Soft Component Implementation

For the sustainable use of departmental roads and rural roads developed by this project, the followings are indispensable:

- Improvement of O&M capacity among rural road management agency after decentralization, namely communes and related public corporation such as UNVDA.
- Improvement of O&M ability of the road stabilizer by MINTP and MATGENIE.

In carrying out training aimed at improving the capacity of O&M by the commune and related public corporations such as UNVDA, not only Japanese consultants, but also administrators and engineers in MINTP, local consultants, road contractors, and geotechnical survey companies must be utilized.

Meanwhile, concerning the implementation of training on improving O&M capacity of the road stabilizer, it is a new technology that can hardly find examples of utilization in the country. For this reason, the soft component mainly utilizes the resources of Japan in conducting the training. Specifically, the engineer belonging to the equipment maker acts as the lecturer of the training.

7) Implementation Process of Soft Component

Regarding "Improve O&M capacity of roads among communes and related public corporations", a series of components were implemented in Obala Commune in the first year and the same components were implemented for other target communes and related public corporations in Obala. In the course of two years, the component plans to improve O&M capacity of 9 municipalities and 1 public corporation such as UNVDA.

As for "Improvement of O&M capacity related to road stabilizers by MINTP and MATGENIE", training in the Japanese country and in-site local training will be held only for the first year. (See table below).

Table 6.5.8 Implementation Schedule of Soft Component and Assignment Schedule (Access Road Development)

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	2020												2021												2022											
Items	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Construction schedule																																				
Construction period																																				
Road																																				
1. Improvement of O&M capacity of roads among communes and related public corporations																																				
1.1 Improvement of design and construction capacity																																				
1.2 Improvement of Road maintenance planning and budgeting capacity																																				
2. Improvement of O&M capacity related to road stabilizers by MINTP and MATGENIE																																				
2.1 Deepen the understanding of the load stabilizer among administrator and chief engineer																																				
2.2 Engineers and operators who operate and maintain stabilizer in the actual site acquire related techniques and knowledge.																																				
3.Monitoring																																				
Assignment schedule																																				
Expert (Japanese) 1																																				
Expert (Japanese) 2																																				
Expert (Japanese) 3																																				
Expert (Local) 1																																				
Expert (Local) 2																																				
Expert (Local) 3																																				

Note 1 : Heavy Rainy Season Small Rainy Season (Central Region)

Note 2: Experts are as assumed as follows:

Consultant 1: O&M of Road / Design / Construction Management
Consultant 2: Construction Technique (O&M of Road Stabilizer) 1
Consultant 3: Construction Technique (O&M of Road Stabilizer) 2
Local Consultant 1: O&M of Road / Design / Construction Management
Local Consultant 2: Construction Technique (O&M of Road Stabilizer) 1
Local Consultant 3: Construction Technique (O&M of Road Stabilizer) 3

8) Product of soft component

As a result of the product, there are a soft component completion report, a farm road design and construction management manual, a daily inspection manual, and an O&M manual of road stabilizer. MINTP, MINADER, commune, UNVDA, and MATGENIE need to participate actively in the work of preparing manuals and cultivate their ownership.

9) Responsibility of the partner country

Upon completion of construction of the target route, MINTP, MINADER, Communes, and UNVDA, utilize the road registration book and manuals created through the implementation of this soft component, and continue activities related to the O&M of roads and road stabilizer. In addition, under the support of MINTP and MINADER, it is necessary to periodically update the road registration book and manuals. MINTP and MINADER also provide knowledge gained from this soft component to stakeholders involved in road condition improvement work in Cameroon.

(3) Soft Component for Installation of Agricultural Equipments

1) Background of Soft Component

Cameroon has formulated the "agricultural mechanization strategy paper", it has been promoting the modernization and agricultural mechanization of agriculture. Main actors of agricultural mechanization in the country are DOPA of MINADER,CENNEMA, UNVDA, and private firms who owns tractors. It is rare that general small-scale farmers own agricultural machinery. These farmers are usually utilizing hiring service of agricultural machineries provided by government agencies and private suppliers.

This project includes the promotion of agricultural machinery as one of the project components which aim to the expansion of rice production and rice distribution network. Introduction of Japanese made agricultural machineries such as country elevator (CE), rice milling plant, tractor and combine has been planned as the Japanese ODA loans (STEP).

UNVDA has a long experience of operating a rice milling plant over a period of 35 years, and also owns an agricultural machinery center that stores the agricultural machinery such as tractors. However, the equipment of existing rice milling plants has become obsolete, and rice milling rate and machine operation rate tends to decline. Tractors owned by the agricultural machinery center also tend to break down. Since the supply of spare parts from makers is unstable, some machines have not been repaired.

Based on the above, the problems of agricultural machinery managed by UNVDA are summarized as follows.

- Inappropriate rice of moisture management (rice of over-drying by the purchase of high rice moisture content and long-term storage) Lowering of
- Degradation of operation efficiency and rice polishing efficiency due to aging of existing equipments in the plant
- Maintenance management system and technical force is insufficient
- Required spare parts have not been procured
- Insufficient storage, inventory management and the management of agricultural machinery depot of parts

Prior to this project, PRODERIP has been implemented as a technical cooperation project in target area. In PRODERIP, “training and rice milling expert” and "post-harvest processing expert" have been dispatched, and technology transfer and capacity strengthening related to post-harvest processing have been implemented. Therefore, it is necessary to examine the impact of

PRODERIP's activity on the target area, and to implement the soft components. This soft component will promote technical skills already established by PRODERIP to UNVDA and will provide necessary technical assistance such as O&M of newly introduced agricultural machineries.

2) Objective of Soft Component

This project is based on the premise that UNVDA will continue to operate and maintain the rice milling plant and agricultural machinery center efficiently and continuously even after completion of this project. In formulating the soft component plan, the goal is to acquire knowledge necessary for proper O&M of rice milling business, plowing service and harvesting service utilizing newly introduced agricultural machineries, and to develop O&M system of these machineries.

Implementation of this soft component is not merely aimed at strengthening stakeholder's O&M capacity of newly introduced rice milling plants and agricultural machinery center in the Northwest Region.

This soft component is also considered as a model case of the following activities included in the item "agricultural mechanization strategy" formulated by the government, and supports to utilize the outcome from the project: "Promotion of agricultural mechanization in large-scale production areas"; "Human resource development for agricultural mechanization", "Support program for introducing agricultural machinery".

3) Output of the Soft Component

In order to achieve the objective above, it is necessary for stakeholders concerned with O&M of agricultural machineries to recognize their roles and to carry out their own activities. Therefore, the outcome of this soft component is:
- Proper O&M system for newly introduced agricultural machinery is developed.
- Enhance the O&M capacity of stakeholders.

4) Confirmation of the Achievement

Confirmation of the achievement of soft component is performed by the following.

① Confirmation of the implementation status of O&M (machine operation record, work record, etc),
② Confirmation of technical acquisition status after training (implementation of comprehension test)

5) Activities of the Soft Component

As shown in the following table, concrete activity items correspond to each task.
For each activity item, the contents of the activities and the subjects are summarized in the following table.

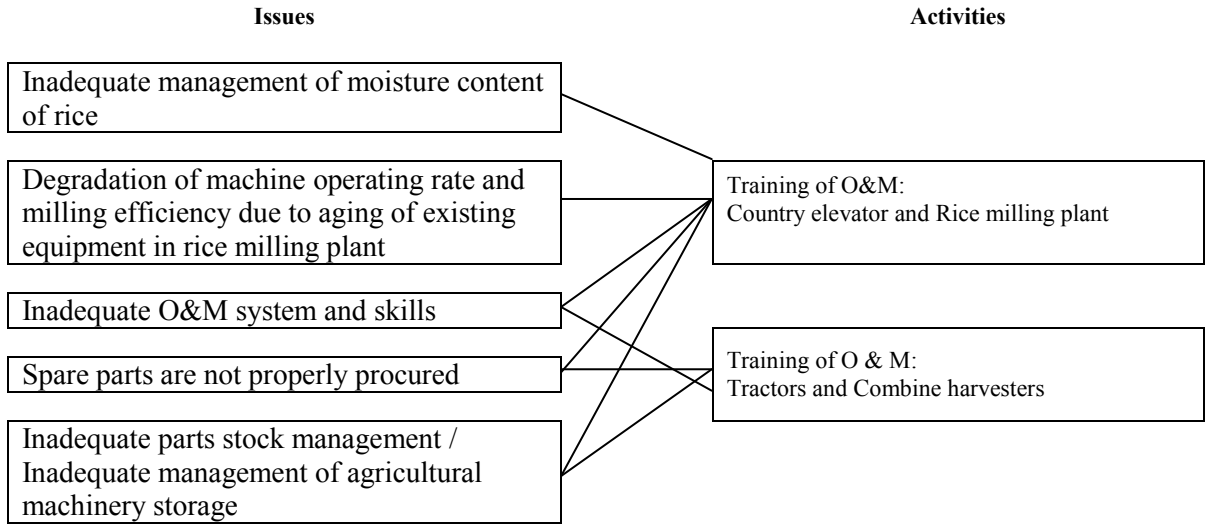


Figure 6.5.3 Issues and Activities

Table 6.5.9 Contents of Activities

Items	Activities	Targets
1. Explanation of soft component Plan and drawing up of implementing schedule	(1) Briefing on contents of the soft component (2) Coordination with PRODERIP activities (3) Clarification of roles (4) Formulation of implementing schedule	(Implementing bodies) Consultant (Targets) UNVDA
2. Training of O&M: Country elevator and Rice milling plant	【Training in Japan】 ● Lectures at the maker's training facilities and factories (drying and hulling, rice milling technology, optical sorting machine, health and safety) / 5 days ● Driving operation (optical sorting machine, etc.) and tours (grain elevator and rice milling plant, etc.) / 5 days.	(Implementing bodies) Machine maker (Targets) UNVDA
	【Rice Buying】 ● Harvesting time: handling of reaping activities at the appropriate time, handling of received rice, moisture measurement of rice (moisture control), collection of rice drying fee based on the moisture content of rice, the way of proper rice transfer to silo.	(Implementing bodies) Consultant (Targets) UNVDA
	【Country elevator and Rice milling plant】 ● Receiving: Setting of rice drying fee based on the moisture content of rice ● General operation: the way to avoid troubles during operation and how to deal with problems / How to arrange and replace parts during operation / Method of proper rotation of rice stored in the silo.	
	【General Issues】 ● Establish timely spare parts procurement method (Procurement procedure, Way of payment) ● Preparation of O&M manual.	
	【5S-KAIZEN】 ● Introduce the concept of "5S-KAIZEN" activities. Teaching the proper method of stock rice management and the way of formulating well-organized rice storage room.	(Implementing bodies) Consultant (Targets) UNVDA
3. Training of O&M: Tractor and Combine harvester	【Training in Japan】 ● At the maker's training facilities and factories and the like donating equipment, lectures _ five days, carried out in the overhaul (overhaul) and operating training _ 5 days. ● Lectures at the maker's training facilities and factories / 5 days ● Driving operation & Overhaul / 5 days.	(Implementing bodies) Machine maker (Targets) UNVDA

Items	Activities	Targets
	【Tractor】 ● Implementation of effective tractor hiring services, setting of an appropriate fee for tractor hiring.	(Implementing bodies) Consultant (Targets) UNVDA
	【Combine harvester】 ● Combine: transporting combine harvester to the field at harvest time, the measurement of rice weight at each field, transporting and receiving rice to/at CE, appropriate fee setting for hiring combine harvester ● Adjustment between farmers who own adjacent field when bringing combine into field	
	【General Issues】 ● Promoting the establishment of proper procurement method of spare parts. (Procurement procedures, Way of payment, etc.) ● Creating the O&M manual.	
	【5S-KAIZEN】 Introduce the concept of "5S-KAIZEN" activities. Teaching the proper method of stock rice management and the way of formulating well-organized rice storage room.	

Source: JICA Study Team

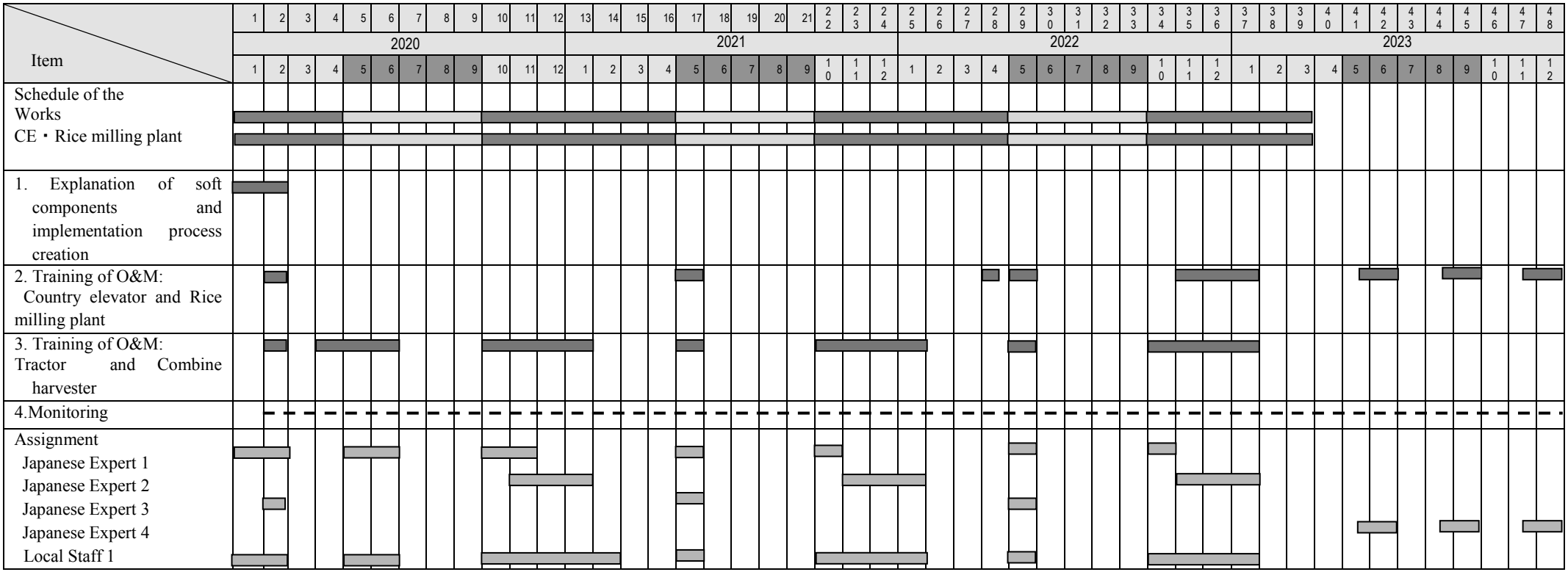
6) Procurement of Resources for Soft Component

In order for sustainable utilization of agricultural machinery introduced in this project, it is essential that O&M of newly introduced equipments is carried out properly. The main body of O&M activities is UNVDA. It has already operated rice milling factory, and also owns agricultural machinery center which providing tractor rental service. In this sense, it should be said that UNVDA has basic skills of O&M of agricultural machineries. Therefore, although Japanese experts will transfer technology at the initial stage mainly, as time goes on, persons having good experience of subject in UNVDA should also be required to contribute to the training as a part of training executing body.

7) Implementing Schedule for Soft Component

In this soft component, it is necessary to properly and efficiently use newly introduced agricultural machinery. For this reason, Japanese agricultural machine makers conduct training on maintenance and operation of machines. Based on this training, field training in Cameroon will be carried out. The implementation period is the period from the beginning to the completion of the construction period.

Table 6.5.10 Schedule for Soft Component Activities and Assignment (Installation of Agricultural Equipments)



Japanese Expert 1：Agricultural Machinery
Japanese Expert 2：Post-harvest
Japanese Expert 3：5S－KAIZEN
Japanese Expert4：Milling Plant Maintenance and Management
Local Staff 1：Agricultural Machinery

8) Items of documents etc. as the part of Outputs

As an output of the soft component, the Project teams will organize soft component completion report, O&M manuals and monitoring report. In formulating the manuals, the team will include UNVDA stakeholders for fostering UNVDA's independence.

9) Approximate Cost for the Soft Component

Cost for the soft component is estimated as 123,222,246 yen.

Table 6.5.11 Approximate Cost for the Soft Component

(Unit: Japanese Yen)

Items	Expected Cost in Japan
Manpower Cost	100,705,498
Direct Cost	22,516,748
Total	123,222,246

Source: JICA Study Team

10) Responsibility of the Cameroon Side

To take advantage of the agricultural machinery to be introduced into the new in this project properly and sustainably, the operation and maintenance is important. In this soft component, intended for UNVDA the department is the introduction destination of new agricultural machinery, which is a plan to improve the operation and maintenance capabilities through a variety of training. In order to ensure the continuation of the operation and maintenance, but to create the operation and maintenance of the manual, it is necessary to perform the update after the busy season of work. In addition, MINADER_DOPA is, as a model case of the agricultural mechanization of UNVDA, to provide training opportunities of this soft component to the officials of the relevant agencies.

O&M is important for proper and sustainable use of newly introduced agricultural machinery in this project. In soft component, the project conducts various kinds of training for UNVDA, where agricultural machinery is installed. The aim of these training is for improvement of O&M ability in UNVDA. The O&M manuals should be prepared to ensure the sustainable O&M activities in UNVDA. The manual needs to periodically update the contents. In addition, DOPA of MINADER must offer training opportunities for this soft component to relevant stakeholders.

(4) Soft Component for Marketing

1) Background of Soft Component

The development of the project production bases and post-harvest processing facilities aim at improving the productivity of rice and increasing the volumes sold to countries in a bid to increase the self-sufficiency rate of this cereal. In 2013, whereas the annual consumption per person reached 33 kg (equivalent white rice), the national production did not cover more than 20 % of the needs, 80 % were therefore imported. Until now, UNVDA ensures the promotion of local rice with irrigated rice cultivated since more than 40 years in the Ndop plain in the North-West Region, an important rice region in Cameroon. However, local rice is widely overtaken by imported rice not only at the level of production volumes, but also at the level of the quality of price. Thus, to increase local rice distribution and meet the volumes, we will develop production facilities (production bases, rural roads, post-harvest developments, mechanization) and to produce and put on the market rice that corresponds to the taste of the consumers of the country at a competitive price, we will plan marketing campaigns.

In this regard, 5 issues were identified with UNVDA rice, which the project services (trainings) are proposing to deal with through technical assistance consistent and in line with PRODERIP achievements prior to them, in order to contribute to the increase in the distribution volumes of local

rice:

① Local rice is not well known by the population
Its distribution is limited in such a way that consumers of urban centres do not know it
② A new marketing strategy is necessary for UNVDA rice
UNVDA plays an essential role in seed production, the collection of rice, the sales but they now need a new marketing strategy to fight against the dominating position of the imported rice on the markets of the country, and then establish a label with high quality rice, and make it different from imported rice.
③ Need to improve UNVDA and farmers' notions on production and sales
Currently, farmers sell their rice to UNVDA at a fixed price or they sell to middlemen on the basis of UNVDA price. But if the ongoing precept is "that a farmer which produces can sell", it remains through that the improvements planned to sell quality rice are insufficient. It is essential to change the sales notion of UNVDA which is the main marketing body.
④ The rice milling activities management capacities of UNVDA are low
UNVDA has less experience in this field since they began this activity only in 2010. They also face problems of old rice storage. We must now plan its reconversion into a real milling professional. PRODERIP Project implements a pilot technical cooperation project on the production of improved seeds, irrigated rice cultivation techniques and the strengthening of mechanization. PRODERIP wishes to develop quality rice through a production approach by step. With the services component of the project, we will strengthen the bodies and human resources to develop marketing around UNVDA "produce to sell".

2) Objective of Soft Component

The work plan is this component is established with the objective of "creating a new marketing structure and teaching marketing knowledge" in the hypothesis that UNVDA will take care of the new milling factory and will manage it as well as they will sell rice, taking into account the current activities of PRODERIP and the management of rice milling activities carried out by UNVDA. In addition to the marketing strengthening of the rice produced in UNVDA sectors in the North-West Region, this component will help the Cameroonian Government to disseminate the lessons learnt from the project in all the major production sectors of the country.

3) Outcome of Soft Component

To meet the abovementioned goals, we must first define the role of each marketing actor (UNVDA, farmers, distribution) and adapt the activities to each of them. The result will be "the improvement of the marketing capacities of UNVDA Officials" in order to increase the volumes of rice sold on the national market.

4) Confirmation Method for Achievement of Outcome

The indicators which will define the achievement level of the objectives are ① the income statement report of the milling and the sales of UNVDA which is the main actor of these activities ② the implementation level of marketing activities ③ the interview with buyers (situation of sales and comments from consumers) ④ trainees' knowledge state and verification of the comments.

5) Activity of Soft Component

The concrete activities of this component are shown in the following figure for each working theme. Given that PRODERIP is committed on the themes ①,②,④, the project will lay an emphasis on the elements ③ and ④.

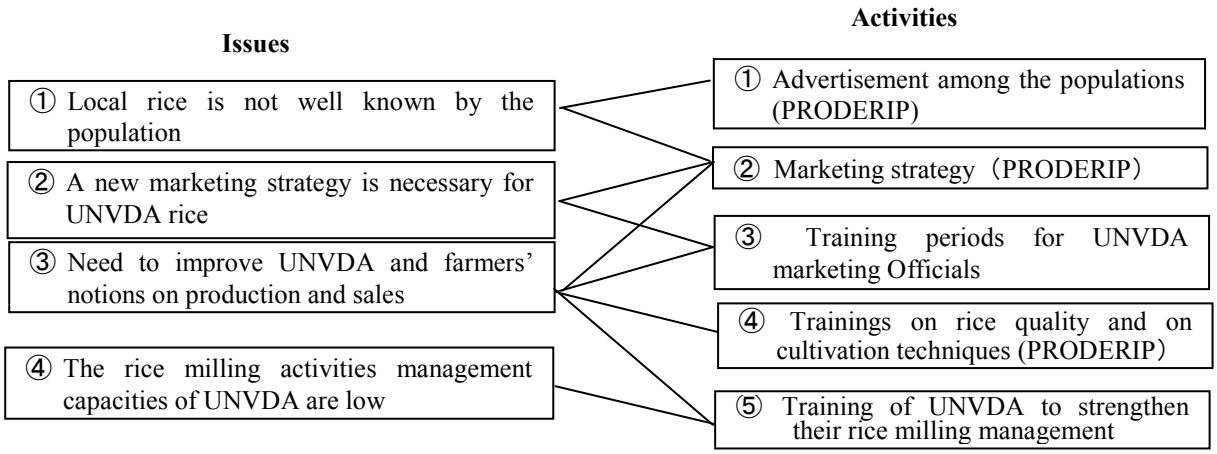


Figure 6.5.4 Issues and Activities

Table 6.5.12 Activities of Soft Component

Items	Activities	Participants
1. Pooling of the services Plan (training)	(1) Revision and pooling of the services component general plan (2) Checking of PRODERIP results and adaptation of the activities (3) Emphasis on the sharing of roles (4) Preparation of the implementation schedule	(Program Officer) ・Consultant (Beneficiaries) ・UNVDA, SEMRY, MINADER
2. Advertisement among the populations	Presentation of local rice in the media and through tasting. Presentation of the shops in which local rice is sold.	This activity being a duplication of PRODERIP activities, it will not be implemented
3. UNVDA marketing strategy	Study and development of commercial strategies for UNVDA rice including the sale of high quality rice	This activity being a duplication of PRODERIP activities, it will not be implemented
4. Strengthening of UNVDA human resources in marketing	(1) Verification of the strategy developed (2) Concept of agriculture dedicated to the market, presentation of SHEP (3) Rice market study by UNVDA employees and farmers (4) Support to the preparation of UNVDA rice production and sales plan, with as key activity high quality rice production (for 2 or 3 farms)	(Program Officer) ・Consultant, UNVDA (Beneficiaries) ・UNVDA Marketing Department, Production Department, extension workers
5. Training on rice quality and rice price	Training on high quality rice production principles and on cultivation and post-harvest processing techniques, training in the open field.	This activity being a duplication of PRODERIP activities, it will not be implemented
6. Capacities development of UNVDA in the administration of rice milling	(1) Analysis of current situation and clarification of problems (2) Work program (3) Analysis of financial results (end of season)	(Program Officer) ・Trainers, consultant (Beneficiary) ・UNVDA Managerial Staff

6) Procurement of Implementation Resources for Soft Component

The main objective of the trainings is to develop local rice sales in a market agriculture approach meeting UNVDA motto "I produce to sell". From this angle, trainings in marketing and management will be intended for UNVDA Marketing Department and extension workers, and trainings on farmers' marketing notions will address extension workers and leaders of farmers. These will be training of trainers which will be carried out by Japanese Experts in collaboration with their Cameroonian counterparts.

7) Implementation Schedule

The implementation of this component will begin 3 years after the initial phase (see table below) since PRODERIP results shall first be used and developed, Check improved seeds production and high quality rice production, study the marketing strategy developed, and have discussions on these issues with PRODERIP. It would be desirable to begin the activities in 2020, one year before the end of PRODERIP Project.

8) Submission of the Result

After the completion of the soft component, a completion report and a monitoring report will be produced. These reports will be prepared with the active participation of UNVDA. UNVDA will actively participate in their drafting in order to feed our own knowledge.

9) Obligation of Recipient Country

At the end of the works, the Government of Cameroon will use the results of the trainings on marketing for UNVDA rice milling works and will disseminate them to the officials of the rice production sectors.

Table 6.5.13 Implementation Schedule of Soft Component and Assignment Schedule (Marketing)

Month/day / Theme	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	2020												2021												2022											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Works schedule Duration																																				
1.. Presentation of training services and preparation of the schedule																																				
4. Preparation of UNVDA marketing strategy																																				
6. Capacities development of UNVDA in the management of rice milling																																				
7. Monitoring																																				
Staff Japanese Expert 1 Japanese Expert 2 Local 1 Local 2																																				

Note 1 : for the elements from 1 to 6 refer to table 6.5.2.5.1 Rainy season

Staff posting:
Japanese Consultant 1 : Marketing
Japanese Consultant 2 : Business Management
Local Consultant 1 : Marketing
Local Consultant 2 : Business Management

6.6 Project Cost

(1) Total Project Cost

The table below shows the total cost of this project.

Table 6.6.1 Project Cost

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (million JPY)			Total (million JPY)		
	Total	JICA Portion	Cameroon Portion	Total	JICA Portion	Cameroon Portion	Total	JICA Portion	Cameroon Portion
Irrigation Development	53	53	0	1,223	1,223	0	1,275	1,275	0
Access Road Development	84	84	0	1,962	1,962	0	2,047	2,047	0
Installation of Agricultural Equipment	3,205	3,205	0	1,514	1,514	0	4,719	4,719	0
Dispute Board	62	62	0	0	0	0	62	62	0
Price Escalation	291	291	0	707	707	0	998	998	0
Physical Contingency	369	369	0	541	541	0	910	910	0
Sub-total (Civil & Procurement)	4,064	4,064	0	5,947	5,947	0	10,011	10,011	0
Consulting Services	743	743	0	415	415	0	1,158	1,158	0
Soft Component	316	316	0	148	148	0	464	464	0
Sub-total (C/S and S/C)	1,059	1,059	0	563	563	0	1,622	1,622	0
Land Acquisition	0	0	0	31	0	31	31	0	31
Administration Cost	0	0	0	579	0	579	579	0	579
VAT	0	0	0	2,239	0	2,239	2,239	0	2,239
Import Tax	0	0	0	488	0	488	488	0	488
Income Tax	0	0	0	36	0	36	36	0	36
Special Income Tax	0	0	0	243	0	243	243	0	243
Contract Registration Fee	0	0	0	501	0	501	501	0	501
Interest during construction	52	0	52	0	0	0	52	0	52
Front End Fee	23	0	23	0	0	0	23	0	23
Total	5,199	5,123	76	10,626	6,510	4,116	15,825	11,633	4,192

Source：JICA Study Team

1. Exchange Rate: US$1= FCFA 589 =¥101.3 (FCFA 1=¥ 0.172)
2. Price Escalation: 1.6% per annum (Foreign Currency Portion), 2.8% per annum(Local Currency Portion)
3. Physical Contingency: 10% (Construction), 5% (Consulting Services)
4. Base Year for Cost Estimation: October 2016
5.Non Eligible Portion was calculated as follows :
- Administration Cost = 5% of the eligible portion
- VAT = 19.25%
- Import Tax = 12% of the expenditure in foreign currency of the eligible portion
- Income Tax = 2.2%
- Special Income Tax = 15.0%
- Contract Registration Fee = 5.0%
- Actual Non Eligible Portion will be adjusted according to Cameroon provision
6. The total amount may not be the same as the sum, due to the round off.

(2) Calculation Results of Ratio of the goods and services to be procured from Japan

As a result of survey, the necessity and validity of the application of Japanese techniques and equipments are confirmed in terms of the procurement of agricultural equipments such as country elevator and milling plant and the various engineering services such as installation work and test operation. Besides, the ratio of those goods and services to be procured from Japan will be 34.81 %. Therefore, the STEP scheme can be applied in this project.

Table 6.6.2 Calculation Results of Ratio of the Goods and Services to Be Procured from Japan

Items	Cost (Yen)
1. Engineering Cost[31]	190,000,000
2. Country Elevator and Milling Plant	2,478,050,000
3. Combine & Tractor	73,083,000
4. Stabilizer	190,000,000
5. Marine Transportation Cost of Machineries and Equipments	178,374,105
6. Inland Transportation Cost of Machineries and Equipments	13,689,603
7. Sub-Total (1+2+3+4+5+6)	3,123,196,708
8. Price Escalation	49,971,147
9. Physical Contingency	312,319,671
10. Total (7+8+9)	3,485,487,526
Total construction cost (total project cost without consulting services)	10,011,256,551
Ratio of the goods and services to be procured from Japan	34.81%

Source：JICA Study Team

[31] Engineering cost includes the services such as installation of facilities and test operation. This corresponds the “service” of application rule of STEP

Chapter 7 Project Implementation Plan

7.1 Organizations Related to the Project and Their Capacities

(1) MINADER

MINADER is the highest organization of agricultural administration in Cameroon and their missions are followings; 1) to guarantee the national food security, 2) to acquire the foreign currency by export of agricultural products, 3) to supply the food to neighboring countries, 4) to promote the employment of young people and 5) to enhance the peace and sustainability of Cameroon. In this project, MINADER is the executing agency and takes responsibility for all of the executed works; overall project coordination, procurement management, financial management, arrangement of audit, monitoring and evaluation of works, implementation and monitoring of environmental and social considerations, and preparation of reports. The organization chart is shown as below.

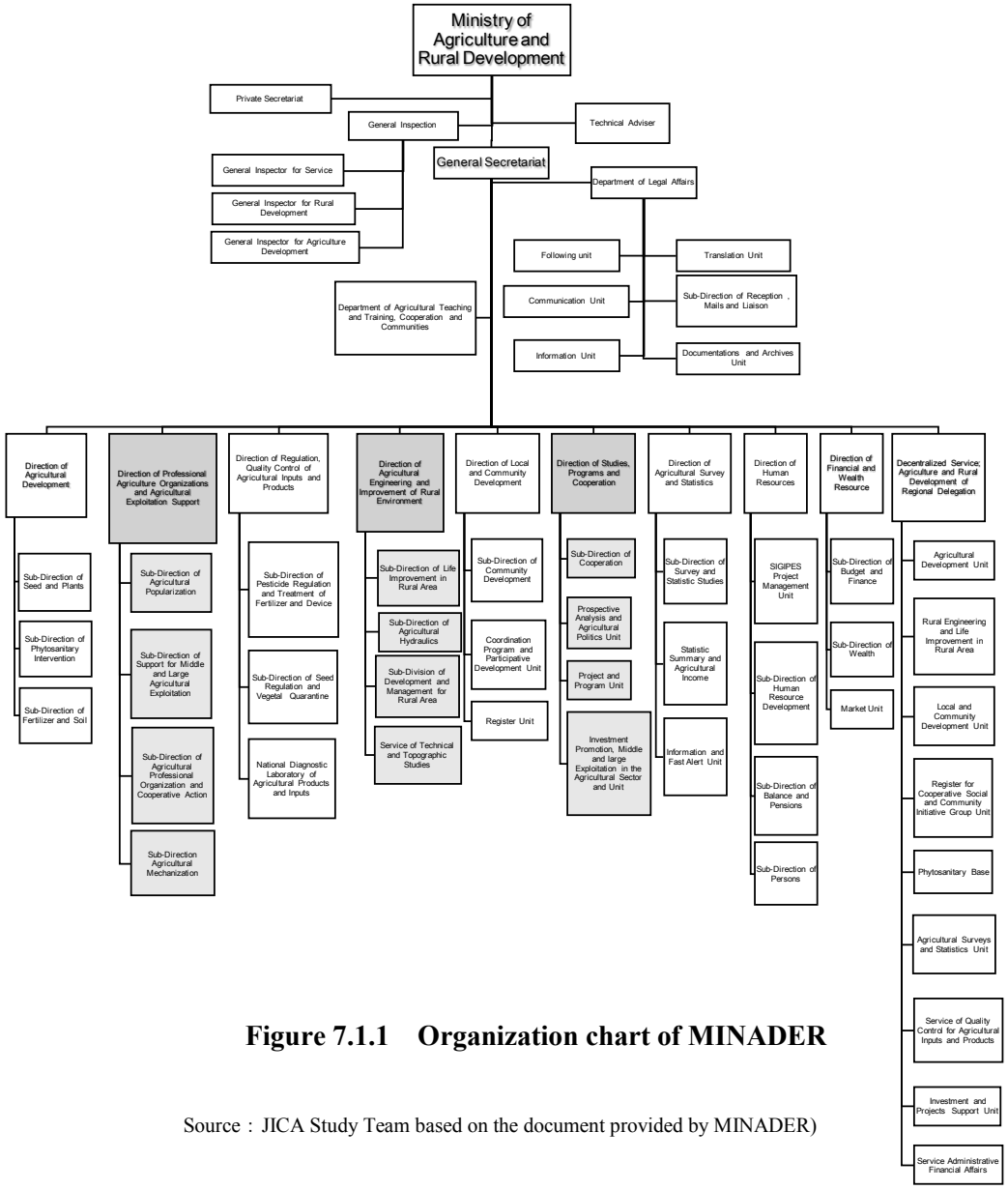


Figure 7.1.1 Organization chart of MINADER

Source：JICA Study Team based on the document provided by MINADER)

1) Technical Capacity of MINADER

In MINADER there are approximately 974 staffs as of May 2016. Three directions (DGRCV,

DOPA, DEPC) out of the ten directions existing in MINADER are related to this project. The number of staffs of each related direction is shown in the table below.

Table 7.1.1 Number of staffs in the directions related to this project in MINADER

Direction	Sub-Direction	Number of staffs			
		Sub-Director	Chief	Officer	Sub-total
Direction of Agricultural Engineering and Improvement of Rural Environment (DGRCV) :1 Director	Sub-Direction of Life Improvement in Rural Area	1	3	6	10
	Sub-Direction of Agricultural Hydraulics	1	3	6	10
	Sub-Division of Development and Management for Rural Area	1	3	6	10
	Service of Technical and Topographic Studies	0	1	2	3
DGRCV Total					34
Direction of Professional Agriculture Organizations and Agricultural Exploitation Support (DOPA) :1 Director	Sub-Direction of Agricultural Popularization	1	3	6	10
	Sub-Direction of Support for Middle and Large Agricultural Exploitation	1	3	6	10
	Sub-Direction of Agricultural Professional Organization and Cooperative Action	1	4	9	14
	Sub-Direction Agricultural Mechanization	1	3	6	10
DOPA Total					45
Direction of Studies, Programs and Cooperation (DEPC) :1 Director	Sub-Direction of Cooperation	1	3	0	4
	Prospective Analysis and Agricultural Politics Unit	0	1	5	6
	Project and Program Unit	0	1	5	6
	Investment Promotion, Middle and large Exploitation in the Agricultural Sector and Unit	0	1	5	6
DEPC Total					23

Source : JICA Study Team based on the document provided by MINADER

As mentioned below, since the main implementation body of this project will be the PMU composed of new staffs who will be employed under the leadership of MINADER, each direction will provide the technical support to PMU in response to their special field. In this project, DGRCV will be the technical assistance for irrigation component. DOPA will be for installation of agricultural equipments component. DEPC will take the responsibility to assist the coordination among the stakeholders. Although there are only a few staffs in these directions, the required works are also limited. Therefore there is almost no difficulty for MINADER to execute the works.

The following table shows the outline of the donner-financed loan project implemented by MINADER in the recent years. These projects are very similar to this project because they are all regarding agricultural development including the improvement of rural infrastructures, community development or strengthen the agricultural supply chain. The Implementation Framework of this project will be established by following these projects frameworks. In particular, the experience of the following agricultural projects can be made use of in the implementation of this project. Hence it is considered that MINADER has sufficient capability to execute the project.

Table 7.1.2 Outline of donner-financed loan Projects in MINADER

Project	Donner	Period	Outline	Amount of Loan
Grassfield, Rural Infrastructure and Participatory Development Support Project Phase 1	AfDB	2005-2011	・Community Development(including the improvement of rural roads.) ・Strengthen the organization related to agriculture	17.9 million USD
Agricultural Competitiveness Improvement Project	WB	2010-2015	・Rural infrastructure improvement (including rural road) ・Strengthen the organization related to agriculture	60 million USD
Grassfield, Rural Infrastructure and Participatory Development Support Project Phase 2	AfDB	2014-2019	・Community Development(including the improvement of rural roads.) ・Strengthen the organization related to agriculture	25.6 million USD
Agriculture Investment and Market Development Project	WB	2014-2019	・Rural infrastructure improvement (including rural road) ・Strengthen the agricultural supply chain ・Strengthen the organization related to agriculture	100 million USD

Source：JICA Study Team

2) Financial Capacity of MINADER

The following table shows the annual budget of MINADER in 2007 to 2014. Responding to the world food crisis occurred in 2007 to 2014, the total budget of MINADER is tending to increase year by year. The ratio of the investment budget to the total budget accounts for 33.4 to 48.2% in these years, and it shows that investment has been stably carried out every year. The investment budget has been increased year by year reflecting the increase of total budget. In addition, the investment budget is increasing by 226% from 2007 in proportion to the increase of total budget. On the other hand, the ratio of the operation budget accounts for 51.7 to 66.5 % to the total budget in these years. The operation budget also tends to increase as well as the investment budget however, since the increase range of operation budget is lower than its investment budget, it is tending to decrease as the ratio of total budget. The execution rate of these budgets has achieved almost 100%. Hence it is considered that MINADER has enough capacity to implement the project properly in terms of the financial capacity.

Table 7.1.3 Annual budget of MINADER（1,000 FCFA）

	Investment	Operation	Total	Investment Ratio (%)	Operation Ratio (%)
2007	16,500,000	25,429,000	41,929,000	39.4	60.6
2008	13,300,000	26,466,000	39,766,000	33.4	66.5
2009	25,711,000	29,480,000	55,251,000	46.5	53.3
2010	23,000,000	37,342,000	60,342,000	38.1	61.8
2011	28,583,000	32,390,000	60,973,000	46.9	53.1
2012	28,431,000	38,432,000	66,863,000	42.5	57.4
2013	37,629,000	40,391,000	78,020,000	48.2	51.7
2014	37,305,000	40,056,000	77,361,000	48.2	51.7

Source：JICA Study Team based on document « PROJET DE LOI DE FINANCES POUR L'EXERCICE 2014 CHAPITRE 30 »

(2) UNVDA

UNVDA was established in May, 1978 as the development authority under the jurisdiction of MINADER in accordance with UNVDA's act No. 78/157. Their missions are 1) to improve the living environment in Noun Valley area, 2) to departure from the poverty, 3) to contribute the food security, 4) to departure from dependence on imported-rice by producing the domestic rice in Cameroon. Their given authorities are 1) Providing the training to the farmers by extension workers, 2) Distribution of improved seeds and fertilizer to the rice farmers, 3) Improvement of rice production environment by

improving the irrigation system, 4) Maintenance of irrigation facilities and the machines or equipments, and 5) Promoting the rice post-harvest and selling. The organization chart of UNVDA is shown below.

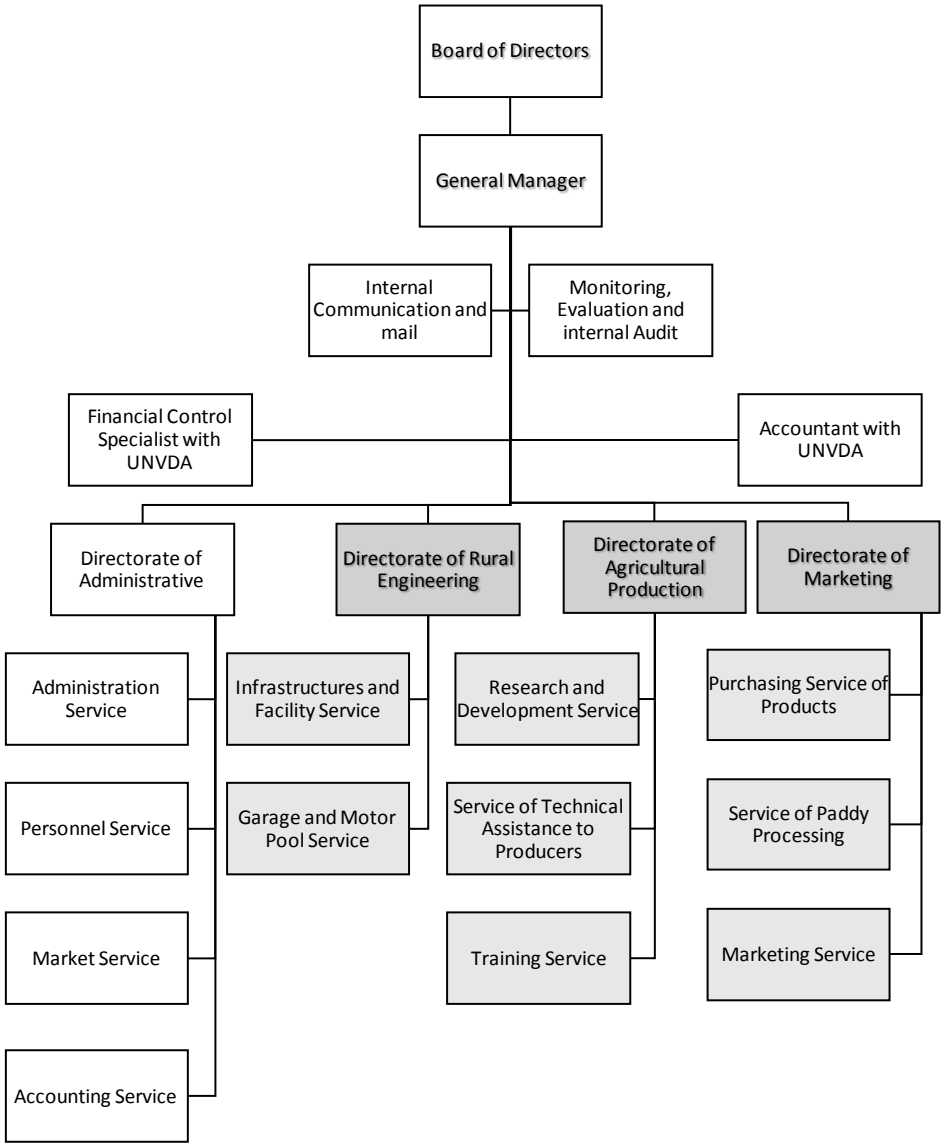


Figure 7.1.2 Organization Chart of UNVDA
Source：JICA Study Team based on document provided by UNVDA

1) Technical Capacity

In UNVDA there are approximately 144 staffs as of 2014. Two directions (DGR, DC,) directions in UNVDA are the main related directions for the project implementation. The number of staffs in each related direction is as shown in the following table.

Table 7.1.4 Number of staffs in the directions related to this project in UNVDA

Direction	Sub-Direction	Number of staffs		
		Sub-Direction	Officer	Sub total
Directorate of Rural Engineering (DGR) :1 Director	Infrastructures and Facility Service	1	6	7
	Garage and Motor Pool Service	1	50	51
DGR Total				59
Directorate of Marketing (DC) :1 Director	Purchasing Service of Products	1	1	2
	Service of Rice Processing	1	12	13
	Marketing Service	1	9	10
DC Total				26

Source：JICA Study Team based on the document provided by UNVDA

DGR is in charge of the improvement of rural infrastructure and the maintenance of machines. Since the establishment of UNVDA, DGR has developed rural infrastructures; 14 dams, 4.6km of irrigation canal, 5.2km drainage canal, 220 ring culverts, 406 box culverts, 280km of internal farm road, 90km of rural road and 25 bridges. They owned the 3 bulldozers, 2 motor graders, 1 compactor, 1 power shovel, 1 wheel loader and 2 dump trucks. The DGR garage staffs take the responsibility for the maintenance of these machines as well as the tractors and combine for rice cultivation. As mentioned above, it is difficult to procure the Japan-made spare parts and it is the main cause of the problem on the machine maintenance and management in UNVDA. To improve this problem, PRODERIP will provide UNVDA staffs the technical training to procure the spare parts from Japan appropriately. Hence in the future, at the timing of procurement in this project, UNVDA will acquire the sufficient capacity for the machine maintenance and management.

DC is in charge of the purchase of harvested rice, the post-harvest processing and sales of the products. The existing rice milling plant of UNVDA is managed by the service rice milling and they carry out the maintenance and management including weekly disassembly inspection and repair. In addition, since 1981, DC has managed properly the existing rice milling plant. For these reasons it is possible for UNVDA to maintain and manage the country elevator and rice milling plant properly with the provided technical training by this project to transfer the required techniques.

There are 13 staffs in the service rice milling and they will increase the staffs in this service in accordance with introducing the new equipments.

2) Financial Capacity

i) The balance sheet

The table below shows the balance sheet of UNVDA in 2013 to 2015. In this period, the capital adequacy ratio is high and it accounts for 86.3 to 90.5%.

Table 7.1.5 Balance sheet of UNVDA（2013-2015）（FCFA）

	Assets (FCFA)	Debt (Upper) and Net Assets(Lower) (FCFA)	Capital Adequacy Ratio (%)
2013/1/1-2013/12/31	12,125,656,546	1,155,802,044	90.5
		10,969,854,502	
2014/1/1-2014/12/31	12,126,816,932	1,664,635,402	86.3
		10,462,181,530	
2015/1/1-2015/14/31	11,958,108,739	1,565,259,322	86.9
		10,392,849,417	

Source：JICA Study Team based on the document provided by UNVDA

The table below describes the breakdown of net assets shown in the table above. According to the table, the capital of UNVDA is 1.38 billion FCFA which accounts for 13 % of net assets in 2015. The item showing highest occupancy rate in the net assets is the investment grants and subsidies allocated by Cameroon government, which accounts for 58 % of net assets in 2015. Thus, it is assumed that UNVDA depends more than half of management resource on the subsidies from the

government. The subsidies to UNVDA were allocated around 6 billion FCFA annually for past three years. Hence, those subsidies would be continuously allocated by the government based on the enhancement of awareness regarding the food security in Cameroon. Therefore, it can be evaluated that the management of UNVDA is sufficiently stable as the related agency of this project. On the other hand, although the total revenue was more than total expenditure in 2014, it marked deficit in 2013 and 2015. According to UNVDA, the main cause of this deficit was mostly derived from the expenses for granted works such as the rehabilitation of the school as the role of public agency. However, considering the fact that the retained earnings are still marked as deficit, it is pointed out that the improvement of the management of UNVDA is indispensable for the future stable management.

Table 7.1.6 Breakdown of Net Assets of UNVDA（2013-2015）（FCFA）

Year	Capital	Revaluation Surplus	Retained Earnings	Profit or Loss	Investment grants & subsidies	Others
2013	1,380,000,000	4,337,664,434	-1,116,618,240	-13,046,530	6,381,854,838	0
2014	1,380,000,000	4,337,664,434	-1,129,664,770	70,785,207	5,679,209,677	124,186,982
2015	1,380,000,000	4,337,664,434	-1,058,879,563	-285,503,195	6,019,567,741	0

Source：JICA Study Team based on document provided by UNVDA

ii) The budget for construction and O&M of irrigation facilities

The table below shows the annual budget for construction and O&M of irrigation facilities in UNVDA (2013-2016).

Table 7.1.7 Annual budget of UNVDA for construction and O&M of irrigation

	2013 (FCFA)	2014 (FCFA)	2015 (FCFA)	2016 (FCFA)
Irrigation	160,500,000	176,000,000	529,000,000	444,000,000

Source：JICA Study Team based on the document provided by UNVDA

The table below shows the O&M cost of targeted irrigation area.

Table 7.1.8 Annual O&M cost of target irrigation area

Item	Amount / spot	Cost / spot [FCFA]	Quantity / year	Cost / year [FCFA]
Maintenance and repair of drainage canal	Excavation: 1.8m^3 (W2m×D0.3m×L3m)	1.8*1,030	1spot / 20m Length of drainage canal (Bottom length: more than 1.2m): 7.11km	659,353 (=1.8*1,030*(7110/20))
	Banking: 1.8m^3 (W2m×D0.3m×L3m)	1.8*1,067	1spot / 20m Length of drainage canal: 7.11km	682,645 (=1.8*1,067*(7110/20))
Maintenance and repair of internal farm road	Banking: 0.6m^3 (W1m×D0.2m×L3m)	0.6*1,067	1spot / 20m Length of farm load: 28.02km	896,752 (=0.6*1,067*(28020/20))
	Compaction: 0.6m^3 (W1m×D0.2m×L3m)	0.6*802	1spot / 20m Length of farm load: 28.02km	674,329 (=0.6*802*(28020/20))
Repair of culvert	Construction quantity of a culvert	1*14,076	20spot / 935spots	281,512 (=14,076*20)
Repair of irrigation canal	Construction quantity of 1 meter of irrigation canal	1*92,347	1spot / 20m Length of irrigation canal: 8.07km	37,261,933 (=92,347*(8070/20))
Repair of inlet gate	Construction quantity of a gate	1*7,818	100 / 1644spots	781,760 (=7,818*100)
TOTAL				41,238,284

Source：JICA Study Team

The table below shows the annual budget of UNVDA for construction and O&M of irrigation facilities, and the maintenance cost of target irrigation area. The O&M cost accounts for 7.8 to 25.7% of the annual budget in 2013 to 2016. Considering that the UNVDA rice area UNVDA is 3,357 ha as of 2015, it is expected that UNVDA can sufficiently secure the O&M cost for target irrigation area. Moreover, UNVDA has plan to require monetary burden to the beneficiaries for

the cost of water use and maintenance of the irrigation facilities. UNVDA plans to collect 10,000 FCFA/ha annually from the beneficiaries of the project target site and they would collect annually 8,180,000 FCFA which reaches 20 % of the annual cost for the O&M of irrigation facilities as described above. However, it would require the certain period for the achievement of monetary burden from the beneficiaries since UNVDA has never requested those farmers to contribute such burden.

Table 7.1.9 Comparison of annual construction and O&M budget and O&M cost of irrigation facilities

	2013 (FCFA)	2014 (FCFA)	2015 (FCFA)	2016 (FCFA)
Annual budget	160,500,000	176,000,000	529,000,000	444,000,000
Maintenance	41,238,284	41,238,284	41,238,284	41,238,284
Ratio of maintenance cost per annual budget (%)	25.7%	23.4%	7.8%	9.3%

Source：JICA Study Team

iii) The budget for O&M cost of access road

The table below shows the annual O&M cost of the UNVDA access road. UNVDA will be the main management and maintenance agency for the rural road NW2 in North West region, and its annual maintenance cost is 3,755,000 FCFA. Since this cost accounts for only 1.6 to 4.2 % of the annual O&M budget of UNVDA, it is considered that UNVDA will hardly have any problems on the maintenance and management of NW2 in the future.

Table 7.1.10 Comparison of the annual budget and O&M cost for UNVDA access road

	2013 (FCFA)	2014 (FCFA)	2015 (FCFA)	2016 (FCFA)
Annual Budget for Access Road	89,000,000	114,000,000	230,000,000	100,000,000
Maintenance	3,755,000	3,755,000	3,755,000	3,755,000
Ratio of maintenance cost per annual budget (%)	4.2	3.3	1.6	3.8

Source：JICA Study Team

iv) The budget for O&M cost of country elevator and rice milling plant

The table below shows the annual O&M budget of the existing rice milling plant in UNVDA.

Table 7.1.11 Annual budget for construction and O&M of irrigation facilities

	2013 (FCFA)	2014 (FCFA)	2015 (FCFA)	2016 (FCFA)
Milling Plant	70,000,000	175,570,000	81,250,000	100,000,000

Source：JICA Study Team

The table below shows the estimated benefit of UNVDA on the assumption that UNVDA will carry out the rice milling business of 15,000t and selling all rice which they produce.

Table 7.1.12 Estimated benefit from the rice milling business with new equipments

	Qty.（kg）	Unit price（FCFA/kg）	Benefit	
White rice (standard)	4,500,000	330	1,485,000,000	FCFA
White rice (high quality)	3,000,000	700	2,100,000,000	FCFA
Unpolished rice	2,250,000	700	1,575,000,000	FCFA
Broken rice	1,500,000	250	375,000,000	FCFA
Rice bran	150,000	100	15,000,000	FCFA
Rice husk	3,000,000	50	150,000,000	FCFA
Total			5,700,000,000	FCFA

Source：JICA Study Team

The table below show the annual O&M cost for the country elevator and rice milling plant. This

annual O&M cost is calculated on the assumption that UNVDA will carry out the rice milling business of 15,000t and the price of the rice is set as 140 FCFA/kg. According to this trial calculation, the estimated benefit that UNVDA will get by this project is much more than O&M costs. For these reasons, it is expected that the maintenance and management of new equipment introduced in this project will be carried out appropriately as long as the rice milling business by UNVDA is running. Besides, the budget of purchasing rice at initial stage of equipments operation will be secured by the subsidy from MINADER.

Table 7.1.13 Estimated annual O&M cost for the new equipments

Item		Unit Price (FCFA/kg)	Total（FCFA）
Primary Cost	Purchases Cost of Rice	140	2,100,000,000
	Labor Cost Extension Worker	2.0	30,000,000
	Labor Cost Buying Center Staff	1.0	15,000,000
	Transport Cost	1.5	22,500,000
	Rice Bag	3.0	45,000,000
Rice milling plant	Electrical Power rate	4.0	60,000,000
	Labor Cost	1.0	15,000,000
	O & M (Spare parts)	37.8	567,000,000
	Amortization Expense	25.2	378,000,000
	Administration and Technical Cost	6.0	90,000,000
Packaging	Bag	39.0	585,000,000
	Bagging and Carrying	9.0	135,000,000
Total		270	4,042,500,000

Source：JICA Study Team

v) O&M cost for tractor and combine

The table below shows the annual O&M budget for existing tractors and combines in UNVDA.

Table 7.1.14 Annual O&M budget for existing tractors and combines

	2013 (FCFA)	2014 (FCFA)	2015 (FCFA)	2016 (FCFA)
Tractors and Combine	37,000,000	45,000,000	103,000,000	70,000,000

Source：JICA Study Team

The table blow shows the estimated benefit from the rental service of tractors and combines.

Table 7.1.15 Estimated benefit from the rental service of tractors and combines

	Unit Price (FCFA/ha)	Target Area (ha)	Assumed Benefit (FCFA)
Tractor	86,400	1,082	93,484,800
Combine	136,800	624	85,363,200

Source：JICA Study Team

The table below shows the annual O&M cost of tractor. O&M cost of the tractor rental service is 8,795FCFA/hour. It takes approximately 4.8 hours to cultivate 1ha with one tractor. 10 tractors procured by this project can work totally 1,082ha/year. To summarize the above, annual O&M cost of tractor is

8,795 FCFA/hr × 4.8 hr/ha × 1082 ha = 45,677,712 FCFA.

Since the estimated benefit will be more than annual O&M cost, it expected that maintenance and management of tractors procured in this project will be carried out appropriately as long the equipment rental service is stably running by UNVDA.

Table 7.1.16 Tractor O&M cost per hour

Item	Unit	Unit Price (FCFA)	Qty.	Total (FCFA)
Labor Cost Operator	hr	380	1	380
Labor Cost Mechanic	hr	320	1	320
Labor Cost Demonstrator	hr	500	1	500
Spare parts	hr	1,065	1	1,065
Amortization Expense	hr	2,130	1	2,130
Fuel	ℓ	500	4	2,000
Oil	ℓ	2,200	1	2,200
Other	lot	200	1	200
Total				8,795

Source：JICA Study Team

The table below shows the annual O&M cost of combine. O&M cost of the combine rental service is 14,007 FCFA/hour. It takes approximately 8 hours to harvest 1ha with one combine. 10 combines procured by this project can work totally 624 ha/year. To summarize the above, annual O&M cost of combine is

14,007 FCFA/hr×8 hr/ha×624 ha = 69,922,944 FCFA.

Since the estimated benefit will be more than annual O&M cost, it expected that maintenance and management of combine procured in this project will be carried out appropriately as long the equipment rental service is stably running by UNVDA.

Table 7.1.17 Combine O&M cost per hour

Item	Unit	Unit Price (FCFA)	Qty.	Total (FCFA)
Labor Cost Operator	hr	380	1	380
Labor Cost Mechanic	hr	320	1	320
Labor Cost Demonstrator	hr	500	1	500
Spare parts	hr	2,969	1	2,969
Amortization Expense	hr	5,938	1	5,938
Fuel	ℓ	500	3	1,500
Oil	ℓ	2,200	1	2,200
Other	lot	200	1	200
Total				14,007

Source：JICA Study Team

(3) MINTP

MINTP is the governmental organization responsible for the entire road running in Cameroon. Their missions are followings; 1) to formulate national policies on infrastructure development, maintenance and public facilities development, 2) to conduct the surveys to realize infrastructure and public facility improvement in suitable manners for the natural environment in places, 3) to Promote the development of infrastructure and public facilities, 4) to manage the construction of infrastructures and public facilities based on the standards, 5) construction and maintenance of road including the urban road, 6) monitoring of construction work by experts of civil engineering and 7) to arrange the staffs for the public works. The organization chart of MINTP is shown as below.

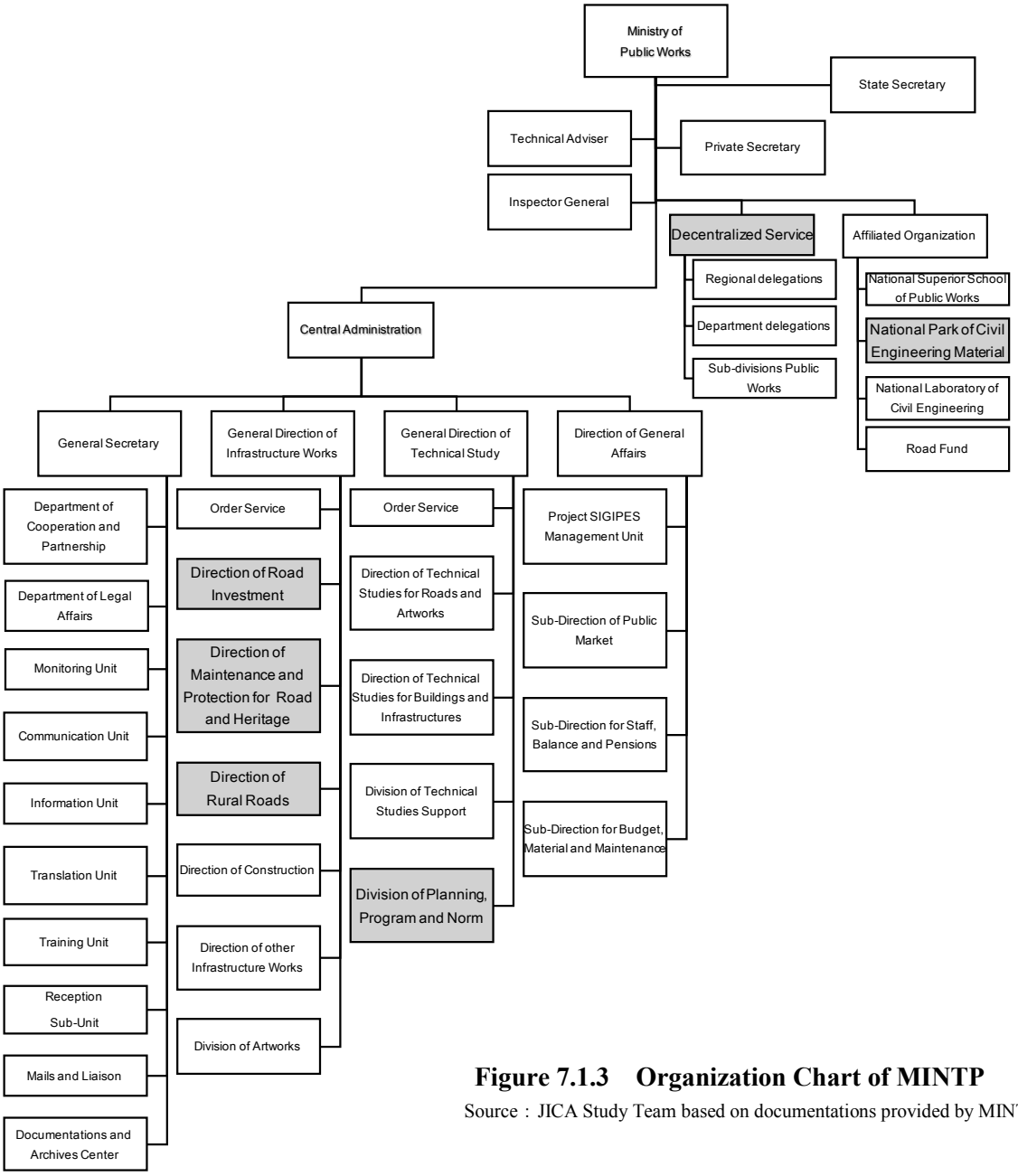


Figure 7.1.3 Organization Chart of MINTP

Source：JICA Study Team based on documentations provided by MINTP)

1) Technical Capacity

There are 1,784 staffs working in MINTP as of January 2016. The directions related to this project are DIR, DEPRR, DRR, DPPN and local office in North-West, Central and South regions. The number of staffs in these directions is shown as below.

Table 7.1.18 Number of the staffs in the directions related to this project in MINTP

Direction	Sub-Direction	Number of staffs			
		Sub-Director	Chief	Officer	Sub-Total
Direction of Road Investment (DIR) :1 Director	Sub-Direction of New Works	1	3	16	20
	AFDB and WB project office	1	0	10	11
	Sub-Direction of Rehabilitation	1	2	8	11
DIR Total					42
Direction of Maintenance and Protection for Road and Heritage (DEPRR) :1 Director	Heritage Protection Office	1	3	12	16
	Sub-Direction of Maintenance for Road Network of North	1	2	10	13
	Sub-Direction of Maintenance for Road Network of East	1	2	9	12
	Sub-Direction of Maintenance for Road Network of South	1	3	12	16
DEPRR Total					58
Direction of Rural Roads (DRR) :1 Director	Sub-Direction of Maintenance for Rural Road Network of North	1	2	13	16
	Sub-Direction of Maintenance for Rural Road Network of East	1	2	12	15
	Sub-Direction of Maintenance for Rural Road Network of South	1	2	13	16
DRR Total					48
Division of Planning, Program and Norm (DPPN) :1 Director	Monitoring Office of Construction and Building Conducted by Enterprise	1	3	6	10
	Program Office	1	4	6	11
	Planning Office	1	4	8	13
	GIS Office	1	3	5	9
	Price and Cost Control Office	1	3	6	10
	Technical Standard Office	1	4	4	9
DPPN Total					63
Regional Direction of Central Region:1 Director		15	29	177	222
Regional Direction of South Region:1 Director		9	18	86	114
Regional Direction of North-West Region:1 Director		12	19	68	90

Source : JICA Study Team based on the documentation provided by MINTP

As described below, the focal point person in charge of technical support for PMU in the access road component will be arranged from MINTP staffs. Though this focal point the relevant directions will provide the technical support to PMU in response to their special field.

DIR will take responsibility for the O&M of heavy-duty machine (stabilizer) which will be procured through this project. However, since DIR does not have sufficient capacity for the O&M of construction equipments, its role will be consigned to MATGENIE. DEPRR is the principle direction taking responsibility for the maintenance of cultural heritage and national, regional and provincial road. DEPRR will take responsibility for the maintenance of NW1 route in North West region. In contrast, DRR is the principle direction for the maintenance of rural road in Cameroon and will be in charge of the maintenance of C1 and S2 routes rehabilitated by this project. DPPN will take responsibility for the technical advice regarding the design of provincial and rural road for that rehabilitation conducted by this project, while the regional offices of North West, central and south will be in charge of the monitoring of the rehabilitation works of the target roads.

The table below shows the summary of the donor projects conducted by MINTP as main executing organization or related organization. Since the components of those projects include the rural and provincial roads rehabilitation which is executed by MINADER or MINTP, it can be captured that those projects are quite similar with this project. In particular, the project implementation organization including the cooperative system between MINADER and MINTP for this project is formulated based on that of PACA project. Thus, the experiences and lesson learnt obtained through those project could be used as reference for this project. As stated above, MINTP has sufficient knowledge and experiences regarding the road improvement in Cameroon, which can be concluded that MINTP could not only provide proper advices regarding the design of various roads at D/D and

construction stage but also conduct necessaries activities including the maintenance and management of the target road of this project.

Table 7.1.19 Outline of the Projects in MINADER

Project	Donner	Period	Outline	Amount of Loan
Agricultural Competitiveness Improvement Project (PACA)	WB	2010-2015	・Rural infrastructure improvement (including rural road) ・Strengthen the organization related to agriculture	60 million USD
Investment and Development of Agricultural Market Project (PIDMA)	WB	2015-2019	・Rural infrastructure improvement (including rural road) ・Strengthen the agricultural supply chain ・Strengthen the organization related to agriculture	100 million USD
Construction of Kumba-Mamfe road (115 km) from Kumba-Nfaitock and 42 km from Nfaitock-Batchuo-Akagbe.	AfDB, BDEAC	2015-2017	・Improvement of the road targeted by the project	82 million USD
Corridor Road Improvement Project connecting Djoum-Mintom to the Congolese Borders (121 km)	AfDB	2015- on going	・Improvement of the road targeted by the project	67 million USD
Project for Rehabilitation of Batchenga-Ntui- Yoko-Lena	AfDB, African Development Fund (AFD), BDEAC, Africa Growing Together Fund (AGTF), AFD, JICA	2015-on going	・Improvement of the road targeted by the project	352 million USD

Source：JICA Study Team

2) Financial Capacity

The table below shows the budget of MINTP in 2013-2016. MINTP has the road fund budget apart from the investment budget for public works. The source of road fund budget is the gasoline taxes, toll fees and etc. This fund mainly used for domestic road maintenance and management. The investment budget accounts for 75% of total budget except for 2016 when the three-year emergency plan budget was set up. In this period 44.4 to 48.8 billion FCFA is allocated for the road development and it shows that the maintenance and management of road is stably carried out.

Table 7.1.20 Annual budget of MINTP（billion FCFA）

	Operation	Investment	Road Fund	PLANUT*	Total
2013	22.4	216.2	46.3	0	284.9
2014	21.6	196.7	44.3	0	262.6
2015	22.9	254.0	48.8	11.0	336.7
2016	21.5	236.7	47.8	97.0	403.9

Source：JICA Study Team based on the document provided by MINTP　* Plan d'urgence triennal

The table below shows the budget regarding the maintenance and management of rural road and its actual expenditure in MINTP during 2014 - 2015. According to the table below, the budget of maintenance and management for the rural road was allocated 31.8 % in 2014 and 46.9% in 2015 within the total budget for its entire roads in Cameroon. In addition, the ratio of budget execution in these terms was 100 % and 94 % respectively. Therefore, it can be assumed that MINTP has sufficient capacity not only to secure the budget for the maintenance and management of rural road but also to execute the budget for it properly, which proofs the appropriateness of MINTP as the main organization in charge of maintenance and management of the roads rehabilitated by this project.

Table 7.1.21 Budget Regarding the Maintenance and Management of Rural Road and Actual Expenditure in MINTP（billion FCFA）

	Budget	Actual Expenditure:1	Road Fund:2	1/2 (%)	Ratio of budget execution (%)
2014	14.1	14.1	44.3	31.8	100
2015	24.4	22.9	48.8	46.9	94

Source：JICA Study Team based on document provided by MINTP

(4) MATGENIE

MATGENIE was established in 1967 based on the national law of N° 1967/DF/55 as the main agency who supplies the services regarding the leasing, maintenance and management of the construction equipments for the improvement of road running in Cameroon. Although it was operated based on the budget allocated from the country at the time of its formation, MATGENIE was reformed as financially independent agency from the year of 1970 based on the national law of N° 2015/183. The main mission of MATGENIE as public enterprise is as follows.

- Leasing of construction equipments to private company and / or the sales of the equipments and spare parts for the implementation of public works.
- Maintenance and management service for the construction equipments.
- Training service for the operation, maintenance and management of construction equipments.
- Authentification service for the proto type of construction equipment and vehicle in Cameroon.

The organization chart of MATGENIE is as shown below.

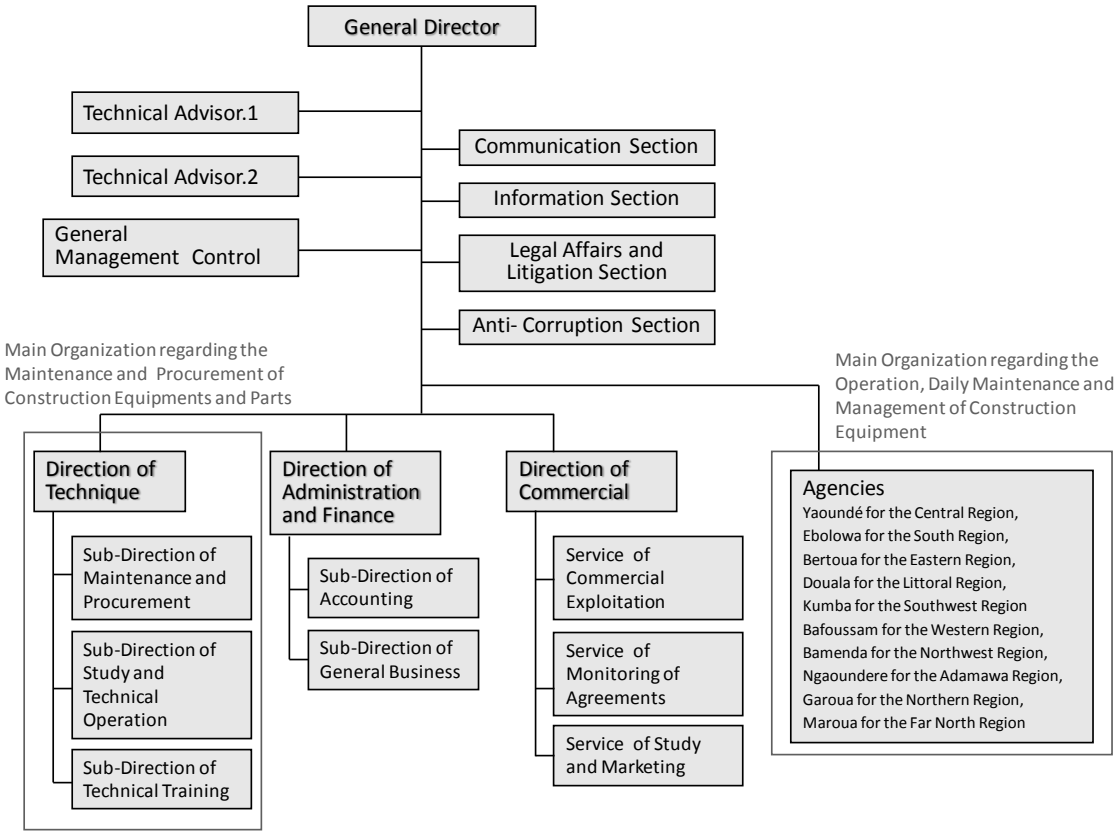


Figure 7.1.4 Organization Chart of MATGENIE
(Source：JICA Study Team based on document provided by MATGENIE)

1) Technical Capacity

The Direction of Technique (DT) is the principle direction regarding the service for leasing

construction equipments and those O&M and management in MATGENIE. The role of DT is 1) the procurement and maintenance of construction equipments, 2) the operation and management of the equipments and 3) the management of training service for the operation and maintenance of construction equipments. As for the procurement and maintenance of construction equipments owned by MATGENIE, DT is supposed to monitor the maintenance condition of those equipments and clarify the cause of malfunction if serious failure has happened in the equipments. Moreover, DT takes responsibility for the investigation of the condition of equipments allocated in each region and procurement of the necessary spare parts for repairing failed equipments based on the investigation results. Since there are regional offices of MATGENIE, the regional service such as leasing of equipments to private company are conducted by the staffs of those offices.

The number of staffs in MATGENIE is 279 persons at March 2016. The half of the staffs belongs to administration sector and another belongs to the technical sector. As for the technical staffs in MATGENIE, the car mechanic, electrical engineer and welding operator are dispatched at least 1 staff to regional staff. Additionally, the plumber and engine driver are also dispatched to several regional offices.

Table 7.1.22 Number of staffs in MATGENIE

	Total No. of Staffs	Administration Staffs	Technical Staffs
Headquarter	75	58	17
Yaoundé Regional Office	25	10	15
Ebolowa Regional Office	21	11	10
Douala Regional Office	28	12	16
Kumba Regional Office	15	7	8
Bertoua Regional Office	22	8	14
Bamenda Regional Office	16	6	10
Bafoussan Regional Office	18	6	12
Ngaoundere Regional Office	18	3	15
Garoua Regional Office	22	11	11
Maroua Regional Office	19	8	11
TOTAL	279	140	139

Source：JICA Study Team based on document provided by MATGENIE

MATGENIE has an experience to be the execution agency of commodity credit project of JBIC. The table below shows the summary of this project. According to the post fact report of the project, the operation rate of equipments procured through this project was 64 % at the year of 2000, which can be evaluated that the O&M and management of those equipments was well conducted by MATGENIE based on the fact that the long period has passed since those equipments was delivered to MATGENIE. Although the economical situation of MATGENIE deteriorated temporally due to the economic crisis, several equipments procured through this project are still in use in 2016 and thus, the capacity of O&M and management of equipments of MATGENIE is assumed to be high level.

Table 7.1.23 Summary of Commodity Credit Project of JBIC

Item	Contents
Name of Project	Road Development Project
Borrower	Government of the Republic of Cameroon
Executing Agency	MATGENIE
Loan Amount / Loan Disbursed Amount	3,588 million Yen / 1,709 million Yen
Exchange of Notes	January 1983
Loan Agreement	June 1984
Interest Rate	3.5%
Repayment Period (Grace Period)	30 Years (10 Years)
Finish Disbursement Date	January 1990
Summary of the Project	To procure the equipment and materials, including construction machinery, vehicles, and so on required for the maintenance and rehabilitation of roads, and to carry out related training, in order to elevate maintenance standards of the country's domestic road networks, improve road conditions, and revitalize domestic distribution.
Procured Equipments	200-CV bulldozers:8, 110-CV bulldozers:7, Motor graders:34, Wheel loaders:5, Tire rollers:8, 10-ton dump cars:28, Tank-equipped lorries (sprinkler trucks):16, Fuel lorries:18, Refueling vehicles:4, Trucks:10, 3.5-ton dump cars:64, 1.5-ton light trucks:20, Tractor trailers:2, Inspection vehicles:16, Tools (sets):50

Source：Report of Road Development Project

2) Financial Status

i) The balance sheet

The table below shows the summary of balance sheet of MATGENIE during 2012-2014. Although the capital adequacy ratio within this term tends to decrease, it is still in high level and thus, the economical management of MATGENIE is assumed to be stable. The reason of decreasing the capital adequacy rate may be the positive capital investment started in these years due to the deterioration of owned equipments. In fact, MATGENIE procured many China-made construction equipments recently by loaning from China.

Table 7.1.24 Balance sheet of MATGENIE（2012-2014）

	Assets (FCFA)	Debt (Upper) and Net Assets(Lower) (FCFA)	Capital Adequacy Ratio (%)
2012/1/1-2012/12/31	26,735,298,117	5,232,788,167	80.4
		21,502,509,950	
2013/1/1-2013/12/31	26,543,214,868	5,767,225,653	78.3
		20,775,989,215	
2014/1/1-2012/14/31	28,036,096,727	6,522,378,884	76.7
		21,513,717,843	

Source：JICA Study Team based on document provided by MATGENIE

ii) Settlement of Accounts

The table below shows the summary of settlement of accounts in MATGENIE during 2012 – 2014. Considering the fact that the total revenue within this term was more than that of total expenditure, the economical situation of MATGENIE is assumed to be stable.

Table 7.1.25 Settlement of Accounts of MATGENIE (2012-2014)

	Revenue (FCFA)	Expenditure (FCFA)	Balance (FCFA)
2012/1/1-2012/12/31	3,257,143,032	3,016,031,373	241,111,659
2013/1/1-2013/12/31	4,222,049,738	3,859,949,079	362,100,659
2014/1/1-2012/14/31	4,163,146,986	4,063,146,515	100,000,471

Source：JICA Study Team based on document provided by MATGENIE

iii) Budget for the O&M and Management of Construction Machinery

Although the road stabilizer procured through this project would be delivered to MINTP, MINTP would consign its O&M and management to MATGENIE since currently MINTP does not have sufficient capacity and experience for it. The table below shows the abstract of contract concluded between MINTP and MATGENIE in terms of the O&M and management of construction equipments owned by MINTP. In fact, MINTP has started to procure and dispose the construction equipments to its regional office since December 2015, and the consigning contract regarding the O&M and management of construction machineries were concluded for 2 times. According to the contract, the O&M and management cost was changed depending on the kinds and number of the equipments. Since MINTP procured new equipments in July 2016, the total contract cost after August 2018 was increased more than that of January to July 2016. In fact, the budget for this consigning contract was spent through the annual investment budget of MINTP. Since the annual investment budget of MINTP was secured in past 4 years as stated above, it is assumed that the O&M and management cost for the stabilizer would be secured certainly.

Table 7.1.26 Abstract of the contract concluded between MINTP and MATGENIE regarding the O&M and management of construction equipments

	Contract No. 220/2015	Contract No.147/2016
Period	January 2016 to July 2016（7 months）	August 2016 to December 2016（5 months）
Total amount	239,999,904 FCFA	390,458,080 FCFA
Contracted work	・Safety assurance for the equipments (arrangement of guardian, monitoring by GPS) ・O&M and management of equipments (periodical maintenance, procurement of spare parts) ・Arrangement of operator of equipments ・Technical transfer to technical staff of MINTP	
Managed machines	・Bulldozer：2 ・Motor grader：4 ・Shovel Loader：3 ・Backhoe：1 ・Vibration roller：2 ・Dump truck：4 ・Refueling truck：1 ・Water supply truck：2 ・Manual compactor：2	・Bulldozer：3 ・Motor grader：6 ・Shovel Loader：4 ・Backhoe：2 ・Vibration roller：4 ・Dump truck：5 ・Refueling truck：2 ・Water supply truck：3 ・Manual compactor：4

Source：JICA Study Team based on document provided by MATGENIE

7.2 Implementation Organization Plan for the Project

(1) Implementation Organization Plan

The executing organization of this project is MINADER. After the sighing of L/A, MINADER establishes Project Steering Committee (PSC) and Project Management Unit (PMU). The member of PSC is consisted of the representative of related ministries. In contrast, PMU consists of 1) National Coordinator, 2) Expert for Civil Engineer, 3) Expert for Agricultural Machinery, 4) Expert for Monitoring and Evaluation, 5) Expert for Socio-Environment and 6) Expert for Administration and Finance of which is selected by MINADER. Additionally, the 2 secretaries and several drivers are dispatched as supporting staff of PMU.

The principle body in regional level is differed depending on the target region. The table below shows the principle body for the regional project activities in each region.

Table 7.2.1 Project Activities and principle body of each region

Region	Project Activities	Principle Body
North west	Irrigation development, Access road development, Installation of agricultural equipments	UNVDA、Regional office of MINADER and MINTP
Central	Access road development	Regional office of MINTP
South	Access road development	Regional office of MINTP

Source：JICA Study Team

The selected consultants by the International Competitive Bidding (ICB) support the entire activities of the project as Project Management Consultant (PMC)

The table below shows the principle role of PSC, PMU, PMC and other regional offices of related ministries in this project. The figure below shows the organization chart of project implementation.

Table 7.2.2 Role of Each Organization in the Project

Organization	Proposed Member	No. of Member	Major Function
Project Steering Committee (PSC)	MINADER (Chairman), MINTP, MINEPAT, MINEPDED, MINFI, MINATD MINDCAF,MINEE ,CAA, UNVDA	9	・Decision making body at the state policy level ・Provide strategic direction and define enabling policy ・Approve the annual work plan and fund allocation proposed by PMU including the cost for EMP , EMoP and RAP ・Review the annual work progress including EMP and RAP ・Establish appropriate convergence platforms and institution arrangement
Project Management Unit (PMU)	National Coordinator, Expert for Civil Engineer, Agricultural Machinery, Monitoring & Evaluation, Scio-Environmentalist Administration and Finance and Support staff	6	・Management body at the state level ・Overall management body for the procurement of Consultant and Contractor ・Overall management body for the entire procedure regarding EMP, EMoP and RAP. ・Develop annual work plan, and monitor the work progress at the state level ・Facilitate convergence among the departments concerned at the state level ・Provide technical guidance ・Fund management
Focal Point of MINTP	Nominated by MINTP	2	・Validate the design and construction plan of access road ・Monitoring and inspection of access road in cooperation with PMU ・Provide technical guidance in terms of access road
Focal Point of UNVDA	UNVDA staff nominated by MINADER	1	・Validate the design and construction plan of irrigation facilities and agricultural equipments. ・Monitoring and inspection of irrigation facilities and agricultural equipments in cooperation with PMU ・Provide technical guidance in terms of irrigation facilities and agricultural equipments
Regional Office of related Ministries, Related Council	U NVDA, Regional office of each ministry and technical staffs of council	As requested by PMU	・Implementation body at the regional level ・Monitor and evaluate the work progress at the regional level ・Troubleshooting ・Facilitate convergence at the field level ・Implementation of monitoring based on the EMP, EMoP prepared by PMU
Project Management Consultant (PMC)	Selected by ICB	-	・Overall project monitoring and management ・Inter-departmental coordination and close communication ・Development and review of the annual work plan and monitor the work progress at the state level ・Facilitation of convergence among departments concerned at the state level ・Construction management, technical guidance, and monitoring ・Support the works regarding EMP, EMoP and RAP conducted by PMU ・Fund management ・Regular meetings on monthly basis ・Technical support (training and awareness program, etc.).

Source：JICA Study Team

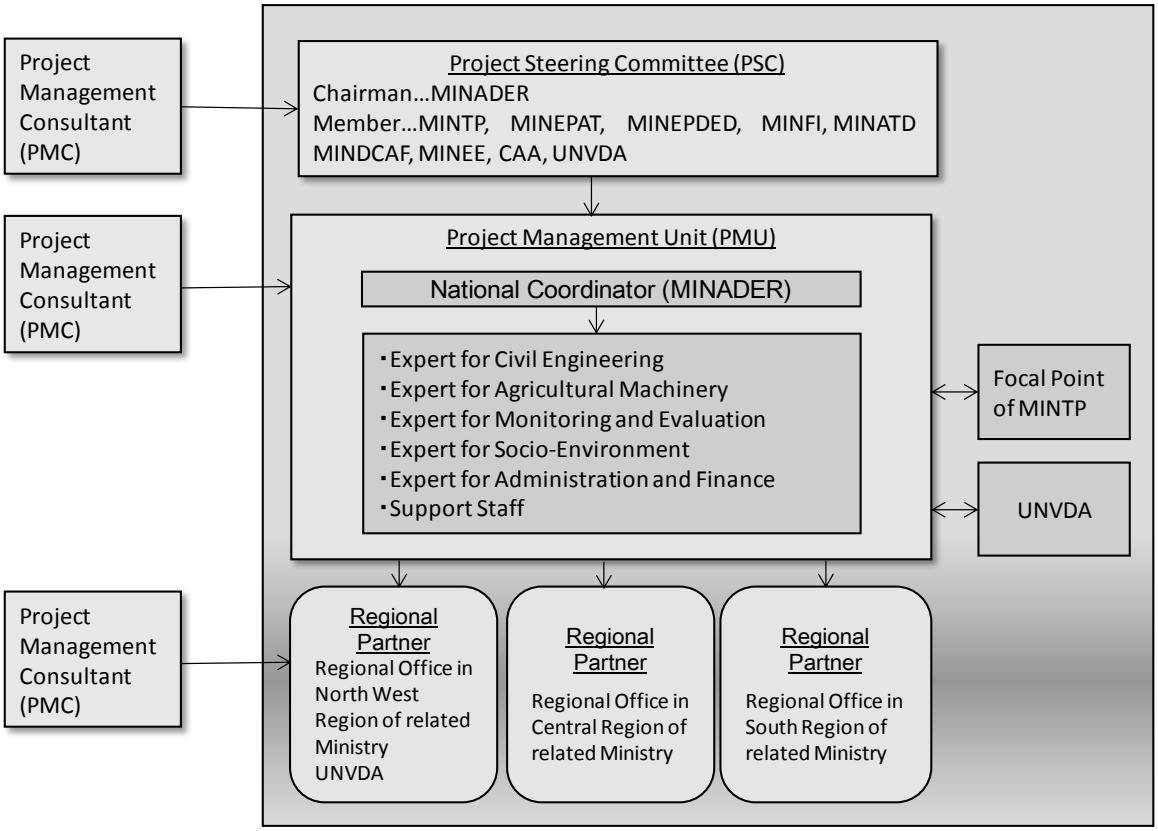


Figure 7.2.1 Organization Chart of the Project Implementation

Source：JICA Study Team

(2) Project Implementation Plan

1) D/D stage

PMU and PMC will conduct the D/D which includes the designing, quantity survey and construction planning of the project. The results of D/D will be approved by PSC. Moreover, based on the results of D/D, the revision of EMP, EmoP and RAP will be conducted as necessary. The budgetary measure for the RAP will be arranged by MINADER based on the request from PMU. The principle role of each organization at D/D stage is as shown in the table below.

Table 7.2.3 Role of Each Organization at D/D Stage

Organization	Major Function
Project Steering Committee (PSC)	・Selection of PMC by ICB ・Provide strategic direction and define enabling policy to PMU and PMC ・Review of D/D and revised EMP, EMoP, RAP prepared by PMU and PMC ・Approval of D/D
Project Management Unit (PMU)	・Preparation of ICB to select PMC ・Overall management body for the implementation of D/D ・Preparation and revision of D/D in cooperation with PMC ・Revision of EMP, EMoP and RAP based on the results of D/D ・Submission of D/D and revised EMP, EMoP and RAP to PSC ・Fund Management during D/D stage ・Facilitate convergence among the departments concerned at the state level
Regional Office of related Ministries, Related Commune	・Technical Assistance of D/D in cooperation with PMC ・Facilitate convergence at the field level
Project Management Consultant (PMC)	・Technical Support to prepare D/D ・Preparation and revision of D/D in cooperation with PMU ・Revision of EMP, EMoP and RAP based on the results of D/D in cooperation with PMU ・Inter-departmental coordination and close communication ・Facilitation of convergence among departments concerned at the state level ・Support of Fund management

Source：JICA Study Team

2) Tendering stage

PMU will prepare the tender documents regarding the construction of the facilities and the procurement of equipments under the supervision of PMU. After confirmation and approval of those documents conducted by PSC, PMU will implement the tendering for the selection of the contractor under the support of PMC. PMU will conduct the contract negotiation and conclusion after the selection of contractor. Based on the results of those procedures, PSC will approve the contract. The principle role of each organization at tendering stage is as shown in the table below.

Table 7.2.4 Role of Each Organization at Tendering Stage

Organization	Major Function
Project Steering Committee (PSC)	・Review of tender documents prepared by PMU and PMC ・Monitoring of overall project
Project Management Unit (PMU)	・Technical support for the preparation of tender documents prepared by PMC ・Review of tender documents prepared by PMC ・Submission of tender documents to PSC ・Overall management body for the Tender supported by PMC ・Selection of contractor by ICB ・Evaluation of the Tender documents submitted by the Contractor ・Facilitate the approval of contract agreement with contractor ・Fund management during tendering Stage ・Facilitate convergence among the departments concerned at the state level
Regional Office of related Ministries Related Commune	・Technical support if there are supplemental works for the preparation of tender documents.
Project Management Consultant (PMC)	・Overall Management Body to prepare the tender documents under the supervision of PMU ・Support for the selection of contractor by ICB ・Facilitate the approval of contract agreement with contractor ・Inter-departmental coordination and close communication ・Facilitation of convergence among departments concerned at the state level ・Support of Fund management

Source：JICA Study Team

3) Construction stage

PMC will supervise the selected contractors and construction works under the supervision of PMU at construction stage. Hence, PMU will be in charge of the monitoring activities based on the EMP and EMoP prepared by this study under the support of PMC. The principle role of each organization at construction stage is as shown in the table below.

Table 7.2.5 Role of Each Organization at Construction Stage

Organization	Major Function
Project Steering Committee (PSC)	・Review of progress report prepared by PMU and PMC ・Monitor and evaluate overall project
Project Management Unit (PMU)	・Supervision of contractor under the support of PMC ・Preparation of progress report in cooperation with PMC ・Submission of progress repot to PSC ・Overall management body for the conduction of EMP and EMoP under the support of PMC ・Fund management during construction stage ・Facilitate convergence among the departments concerned at the state level
Regional Office of related Ministries Related Commune	・Supervision of contractor at regional level under the support of PMC ・Monitor and evaluate the work progress at the regional level ・Implementation of monitoring based on the EMP and EMoP prepared by PMU ・Troubleshooting ・Facilitate convergence at the field level
Project Management Consultant (PMC)	・Supervision of contractor under the supervision of PMU ・Preparation of progress report in cooperation with PMU ・Support for the conduction of EMP and EMoP ・Inter-departmental coordination and close communication ・Facilitation of convergence among departments concerned at the state level ・Support of Fund management

Source：JICA Study Team

4) O&M and management stage

The principle body for the O&M and management of the facilities and equipments procured through the project is shown in the table below.

Table 7.2.6 Principle Body for the O&M and Management of the Facilities and Equipments

Region	Facilities	Organization
North West	Irrigation Facilities	UNVDA
	Route of NW1	MINTP
	Route of NW2	UNVDA
	Country Elevator and Milling Plant	UNVDA
	Tractors and Harvesters	UNVDA
Central	Route of C1	MINTP
South	Route of S2	MINTP
Others	Road Stabilizer	MINTP（Supported by MATGENIE）

Source：JICA Study Team

5) Schedule

The implementation schedule of the project is as follows.

Table 7.2.7 Project Implementation Schedule

Stage	Schedule
Pledge	May 2017
L/A signing	June 2017
Procurement of Consulting Services	June 2017 – May 2018
Consulting Service	June 2018 – February 2024
Detailed Design and Review	June 2018 – May 2019
PQ and Tender	March 2019 – February 2020
Construction Period	March 2020 - February 2024
Project Completion Date	March 2020 – February 2023
Defect Liability Period	February 2023

Source：JICA Study Team

7.3 Burden of Cameroon Government

The project cost for D/D, tendering and C/S will be covered by Yen-loan. In contrast, based on the JICA guideline, the administration cost, various tax and land acquisition cost will not be covered by yen-loan. The table below shows the burden of Cameroon government.

Table 7.3.1 Burden of Cameroon Government

Portion	Contents	Source
1.Consultant Fee	1) Consultant fee during Detailed Design (D/D) stage	Yen loan
	2) Consultant fee during Construction Supervision (C/S) stage	Yen loan
2.Soft Component	1) Soft component for irrigation development	Yen loan
	2) Soft component for access road development	Yen loan
	3) Soft component for agricultural machinery	Yen loan
	4) Soft component for marketing	Yen loan
2.Cost of Construction and Procurement Fee	1) Irrigation Development	Yen loan
	2) Access Road Development	Yen loan
	3) Installation of Agricultural Machinery	Yen loan
3.Price Escalation	1) Construction materials, fuel labor cost, etc.	Yen loan
4.Physical Contingency	1) Unpredictable Expenses such as natural disaster	Yen loan
5.General administration expenses	1) Wage of organization/agencies related to the Project implementation	Cameroon
6. Tax and duties	1) VAT, etc.	Cameroon
7. Compensation Fee	1) Land, Crop, etc	Cameroon

Source：JICA Study Team

Chapter 8 Project Evaluation

8.1 General

Aiming to justify the validity of the three components (irrigation, farm road and agricultural machinery) proposed by the preparatory survey on rural infrastructure improvement project in the Republic of Cameroon, the economic, financial, and socio-economic evaluations are to be carried out by referring to the proposed development plan as well as relevant information collected from the MINADER, UNVDA and other relevant departments. Economic evaluation is carried out through the calculation of the internal economic rate of return as a whole three components (EIRR), because it is only when combined the benefits can contribute to the achievement of project objectives. The financial evaluation is to be performed by analyzing the farm income for an average farm model and the cash flow of agricultural machinery business by UNVDA.

8.2 Economic Evaluation

8.2.1 Basic Assumption

The following basic assumptions are adopted for the economic evaluation:

- The economic project life is 25 years.
- The exchange rate is USD 1 = FCFA 589 = JPY 101.3 as of October 2016.
- All local prices such as good, services and materials are expressed in price level as of 2016.
- Transfer payments such as administration cost, land acquisition cost, tax, duty, subsidy, and interest are excluded from the economic analysis.
- The standard conversion factor is 0.90, the shadow wage rate for agriculture labor works is estimated at 0.80 for hired and 0.50 for family(refer to 8.2.2）

8.2.2 Economic Price

(1) Conversion factors for economic evaluation

The economic project cost comprises initial investment cost including direct construction cost, on-farm development cost, equipment procurement cost and consulting services cost as well as annual O&M cost. Financial cost of these items is to be converted into economic cost by applying economic conversion factors (ECF). In this evaluation, the applied ECF are as follows:

1) Standard conversion factor (SCF)

In order to evaluate the costs and benefits with respect to world market prices, an SCF of 0.90 is applied. This conversion factor is referred to similar projects[32] in Cameroon.

2) Shadow Wage Rate

The existence of unemployment and underemployment of unskilled workers in irrigation target site: Ndop area's economy means that the opportunity cost of unskilled labour can be considered to be lower than its wage rate. Shadow wage rate for agricultural labour is estimated as shown in Table 8.2.1 below. As shown in the table, the average wage for unskilled agricultural labour in the study area was estimated at FCFA 2,000 per day. The minimum wage rate for other industrial labour in Ndop was INR 2,500 per day. Based on this figure, the shadow wage conversion factor was estimated at 0.80 as shown in Table 8.2.1.

[32] Projet d'Appui aux Infrastructures et au Development Participatif dans lesRegions Septentronales(PIRDEP), 2011, FAO/Afican Development Bank

Table 8.2.1 Shadow wage rate

Casual agricultural labour wage	FCFA/day	2,000
Wage of unskilled labour in other industries	FCFA/day	2,500
Shadow wage rate		0.80

Source: JICA Study Team based on the results of interviews with UNVDA and the field observation in June 2016

(2) Project cost for evaluation

The project cost for evaluation broadly comprises irrigation development, farm road development and agricultural machinery, consulting services and physical contingency. The financial costs are converted into the economic costs by applying the SCF for each of components. As shown in Table 8.2.2, the project cost is estimated at FCFA. 55,389 million at economic prices.

Table 8.2.2 Project Cost in Financial and Economic Prices

	Foreign Currency Portion (FCFA Millions)		Local Currency Portion (FCFA Millions)		Total (FCFA Millions)	
	Financial Price	Economic Price	Financial Price	Economic Price	Financial Price	Economic Price
Irrigation Development	308	308	7,110	6,399	7,419	6,708
Access Road Development	488	488	11,407	10,266	11,895	10,755
Installation of Equipment	18,634	18,634	8,802	7,922	27,436	26,556
Dispute Board	360	360	0	0	360	360
Price Escalation	1,692	0	4,110	0	5,802	0
Physical Contingency	2,145	2,145	3,145	2,831	5,291	4,976
Consulting Services	3,881	3,881	2,083	1,875	5,964	5,756
Price Escalation	235	0	215	0	450	0
Physical Contingency	206	206	115	104	321	310
Soft Component	1,626	1,626	725	653	2,351	2,279
Price Escalation	122	0	95	0	217	0
Physical Contingency	87	87	41	37	128	124
Land Acquisition	0	0	150	135	150	135
Price Escalation	0	0	14	0	14	0
Physical Contingency	0	0	16	14	16	14
Administration Cost	0	0	3,366	0	3,366	0
VAT	0	0	13,017	0	13,017	0
Import Tax	0	0	2,837	0	2,837	0
Income Tax	0	0	209	0	209	0
Special Income Tax	0	0	1,413	0	1,413	0
Contract Registration Fee	0	0	2,913	0	2,913	0
Interest during construction	302	0	0	0	302	0
Front End Fee	134	0	0	0	134	0
Total	30,221	27,736	61,785	30,236	92,006	57,972

Source：JICA Study Team

(3) Economic Annual Operation and Maintenance Cost

The annual cost of operation and maintenance (O&M) was calculated by combining those three components. The economic annual O&M cost in full operation stage is estimated at FCFA. 156 million. However, in the installation of agricultural equipments component, the service fees such as milling and plowing by tractor include annual operation and maintenance expenses, so these expenses

are not included in the amount of FCFA 156 million.

8.3 Benefit Calculation for Each Component

8.3.1 Benefit Calculation in Irrigation Development Component

(1) Precondition for Benefit Calculation

Preconditions for benefit calculation are shown in the following items of 1) to 4).

1) Benefit of Drainage Canal

i) Increase of Cropping Area

In the middle and downstream area, some farmers cannot cultivate rice and wheat because of much water in the field (inundation). Therefore, increase of cropping area was calculated as benefit of drainage canal. In the benefit calculation, it is better to use net income, which is defined as "sales of products - farming cost". However, it was difficult to obtain such kind of credible data in Cameroon. Therefore, gross income (yield x sales price of crop) was alternatively adopted. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.1 Conditions for Benefit Calculation (Benefit of Drainage Canal; Increase of Cropping Area)

Uncultivated area due to inundation [ha]		Unit yield after improvement [t/ha]		Sales price after improvement [FCFA/kg]	
Rice	Maize	Rice	Maize	Rice	Maize
359	183	4.5	2.5	140	150

ii) Increase of Unit Yield

In the middle and downstream area, unit yield is not high because of much water in the field (inundation).Therefore, increase of unit yield of rice and wheat was calculated as benefit of drainage canal. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.2 Conditions for Benefit Calculation (Benefit of Drainage Canal; Increase of Unit Yield)

Low yield area due to inundation [ha]		Unit yield before improvement [t/ha]		Unit yield after improvement [t/ha]		Sales price before improvement [FCFA/kg]		Sales price after improvement [FCFA/kg]	
Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize
301	385	1.8	1.8	4.5	2.5	110	150	140	150

2) Benefit of Farmroad

i) Decrease of Travel Time to Farmlands

Farmers move from their houses to their farmlands by walking in their farming activities. However, farmers cannot help walking inefficiently on farmlands or ridges between farm lots because there are farmroads only in the small portion of the target area. Therefore, decrease of travel time to farmlands was calculated as benefit of farmroad. For benefit calculation, human-time value, namely, monetary value which can be obtained by working in created time was adopted as an original unit of decrease of travel time. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.3 Conditions for Benefit Calculation (Benefit of Farmroad; Decrease of Travel Time to Farmlands)

Beneficiaries [no.]	Traveling speed on farmlands or ridges [km/h]	Traveling speed on farmroad [km/h]	Traveling section of farmroad (Round trip) after improvement [km]
2,800	3.36	4.80	2.06

ii) Decrease of Transportation Time of Farm Production

Farmers transport farm products by motor cycles on access roads. On the other hand, farmers cannot help transporting them by man powers within the target area because there are farmroads only in the small portion of the target area. After improvement, farmers will transport farm products by motor cycles within the target area. Therefore, decrease of transportation time of farm production was calculated as benefit of farmroad. For benefit calculation, the human-time value was adopted as an original unit of decrease of travel time. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.4 Conditions for Benefit Calculation (Benefit of Farmroad; Decrease of Transportation Time)

Beneficiary area [ha]	Transportation days before improvement [day/ha]		Transportation days after improvement [day/ha]	
	Rice	Maize	Rice	Maize
850	25	20	1	1

iii) Reduction of Farming Time

Many farmers cannot use the tractor service provided by UNVDA because there are farmroads and drainage canals only in the small portion of the target area. After improvement, the tractor service will expand in the target area. Therefore, reduction of farming time was calculated as benefit of farmroad. For benefit calculation, the human-time value minus cost of the service for agricultural machineries was adopted as an original unit of decrease of travel time. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.5 Conditions for Benefit Calculation (Benefit of Farmroad; Reduction of Farming Time 1/2)

Plowing & leveling days before improvement [day/ha]	Harvest & threshing days before improvement [day/ha]	Plowing & leveling days after improvement [day/ha]	Harvest & threshing days after improvement [day/ha]
55	45	15	10

Table 8.3.6 Conditions for Benefit Calculation (Benefit of Farmroad; Reduction of Farming Time 2/2)

Plowing service fee (Tractor)*1 [FCFA/h]	Harvesting service fee (Combine harvester) [FCFA/h]	Plowing hour by tractor*2 [h/ha]	Harvesting hour by combine harvester [h/ha]	Tractor service dissemination area after improvement*3 [ha]	Combine service dissemination area after improvement [ha]
18,000	24,000	4.8	3.8	786	460

*1: UNVDA conducts plowing instead of farmers based by the payment of service fee. Harvesting service is also assumed as the same.
*2: Plowing hour by tractor is based on the interview. Harvesting hour by combine harvester is estimated as 80% of tractor (MAFF "Circumstances around agricultural machinery").
*3: Present dissemination area is removed from the table (459ha*7%=32ha).

iv) Reduction of Travel Time and Travel Cost for Living Transportation

Construction of farmroads will change not only farming activities but also living transportation. Therefore, reduction of travel time and travel cost for living transportation were calculated as benefit of farmroad. For benefit calculation, the human-time value and the vehicle-time value were adopted as original units of decrease of travel time. Regarding travel cost, vehicle depreciation cost (decrement of vehicle value by running unit distance) and fuel cost were adopted as original units of reduction of travel cost. Transportation means were assumed as walking, bicycle and motor cycle because of internal farmroads. Benefit items for reduction of travel time and travel cost for living transportation are shown in the following table.

Table 8.3.7 Benefit Items for Reduction of Travel Time and Travel Cost for Living Transportation

Transportation means	Reduction of travel time		Reduction of travel cost	
	Human-time value	Vehicle-time value	Vehicle depreciation cost	Fuel cost
Walking	○	-	-	-
Bicycle	○	○	○	-
Motor cycle	○	○	○	○

Before improvement, it takes 14.0km from the outside of the city to Ndop city using an existing road (D72) in the general route. However, it will be shortened to 7.4km from the same point to the Ndop city passing the internal farmroad after improvement. And the difference between both routes for travel time was used to calculate benefit of improvement. And traffic volume for living transportation was set up based on the traffic survey on the general route.

Table 8.3.8 Conditions for Benefit Calculation (Benefit of Farmroad; Reduction of Travel Time and Travel cost for Living Transportation)

Transportation means	Walking	Bicycle	Motorcycle
Moving speed [km/h]	4.8	15	30
Volume for living transportation*1 [Passing number/day]	214	34	170
Volume for living transportation [passing number/year]	78,110	12,410	62,050

*1: Traffic survey was conducted on the access road branching from D72 road located on the south of the target area.

By the way, the volume for living transportation will increase year by year with economic growth in Cameroon. Therefore, volume for living transportation for future will be calculated using GDP growth rate in Cameroon. Because the GDP growth rate was about 5 % on average from 2010 to 2015 (the table below), 5 % was used as the growth rate of volume for living transportation.

Table 8.3.9 GDP Growth Rate in Cameroon

Year	2010	2011	2012	2013	2014	2015	Ave.
GDP growth rate (%)	3.27	4.14	4.60	5.55	5.89	6.21	4.94

3) Benefit of Irrigation Canal

In the upstream area regarded as a model site, irrigation & drainage canals will be installed along all the standard plots in addition to integration of small plots with land leveling. Therefore, increase of unit yield of rice was calculated as benefit of improvement. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.10 Conditions for Benefit Calculation (Benefit of Irrigation Canal; Increase of Unit Yield)

Beneficiary area of irrigation*1 [ha]	Unit yield before improvement [t/ha]	Unit yield after improvement [t/ha]	Sales price before improvement [FCFA/kg]	Sales price after improvement [FCFA/kg]
129	3.1	6.0	110	140

1) Existing irrigation area (35ha) has been removed.

4) Benefit of Integration of Small Plots with Land Leveling

In the upstream area, integration of small plots with land leveling will be conducted. It will lead reduction of utilization time of farming machineries per ha because efficiency of farming machineries will be improved. Therefore, decrement of farmers cost for farming machinery service provide by UNVDA was calculated as benefit of improvement. Conditions required for benefit calculation are shown as follows based on the field survey.

Table 8.3.11 Conditions for Benefit Calculation (Benefit of Integration of Plots with Land Leveling; Decrease of Cost for Farming Machinery Service)

Plowing hour by tractor before improvement [h/ha]	Plowing hour by tractor after improvement*1 [h/ha]	Harvesting hour by combine harvester before improvement [h/ha]	Harvesting hour by combine harvester after improvement*1 [h/ha]	Beneficiary area [ha]
4.8	3.36	3.8	3.04	164

*1: Utilization time before integration of small plots with land leveling x coefficient 0.7. The coefficient was based on the interview to UNVDA staff.

(2) O&M Cost of Irrigation Development Component

Operation of irrigation facilities has been conducted by UNVDA officers in the UNVDA area. In this project, participation of "Farm (Water Users Association)" to operation is planned to be promoted under the guidance of UNVDA. However, payment such as salary to "Farm" members for operation of irrigation facilities is not assumed. Therefore, additional cost is not assumed for the operation.

Even in maintenance activities, participation of "Farm" will be promoted, and the maintenance cost will also be promoted to be borne by "Farm". However, it is a new for Cameroon that beneficiaries pay the maintenance cost of irrigation facilities. Therefore, it is better to include that cost in the UNVDA budget as of old. Estimated annual maintenance cost is shown in the following table.

Table 8.3.12 Item of Maintenance of Irrigation Facilities

Item	Frequency	Contents
Maintenance and repair of drainage canal	Once a year	After rainy season, sediment (earth and sand) will be removed by backhoe. On the other hands, excavated soil will be refilled. Regarding small drainage canals whose bottom lengths are smaller than 1.2 meters, maintenance is assumed to be done by man powers of beneficiaries, and the cost is excluded from the estimation.
Maintenance and repair of internal farm road	Once a year	After rainy season, road ruts will be refilled and compacted by machineries.
Repair of culvert	Accordingly	Damaged culvert will be repaired or replaced.
Repair of irrigation canal (including division box and inlet)	Accordingly	Damaged irrigation canal (Reinforced concrete) will be repaired or replaced.
Repair of inlet gate	Accordingly	Damaged steal gate will be repaired or replaced.

Table 8.3.13 Annual Maintenance Cost

Item	Amount / spot	Cost / spot [FCFA]	Quantity / year	Cost / year [FCFA]
Maintenance and repair of drainage canal	Excavation: 1.8m3 (W2m×D0.3m×L3m)	1.8*1030	1spot / 20m Length of drainage canals (Bottom length: more than 1.2m): 7.11km	659,353 (=1.8*736*1.4*(7110/20))
	Banking: 1.8m3 (W2m×D0.3m×L3m)	1.8*1067	1spot / 20m Length of drainage canals: 7.11km	682,645 (=1.8*762*1.4*(7110/20))
Maintenance and repair of internal farm road	Banking: 0.6m3 (W1m×D0.2m×L3m)	0.6*1067	1spot / 20m Length of farmroads: 28.02km	896,752 (=0.6*762*1.4*(28020/20))
	Compaction: 0.6m3 (W1m×D0.2m×L3m)	0.6*802	1spot / 20m Length of farmroads: 28.02km	674,329 (=0.6*573*1.4*(28020/20))
Repair of culvert	Construction quantity of a culvert	1*14,076	20spot / 935spots	281,512 (=10,054*1.4*20)
Repair of irrigation canal	Construction quantity of 1 meter of irrigation canal	1*92,347	1spot / 20m Length of irrigation canal: 8.07km	37,261,933 (=65,962*1.4*(8070/20))
Repair of inlet gate	Construction quantity of a gate	1*7,818	100 / 1644spots	781,760 (=5,584*1.4*100)
Total				41,238,284

8.3.2 Benefit Calculation of Access Road Development Component

(1) Conditions Precedent for the Benefit Calculation

As for the access road development component, the benefits are evaluated based on the benefits derived from the shortening of driving time and the reduction of driving cost by comparing the economical values of "without: before the road rehabilitation" and "with: after the road rehabilitation". The conditions precedent is stated as follows.

Annual traffic volume

The annual traffic volume is estimated based on the general traffic volume and traffic volume for the transportation of agricultural products of the target road. The general traffic volume is estimated based on the actual measurement of traffic volume in weekday. The table below shows the annual traffic volume for general use of target area.

Table 8.3.14 Estimated annual traffic volume for general use in each target road (2016)

Target Road	Big Truck	Small Truck	Bus	Van	4WD	Pick Up	Sedan	Motor-cycle
NW1	49,275	50,370	0	38,690	11,315	31,755	33,580	408,070
NW2	19.345	40,150	5,110	15,695	5,840	16,425	55,845	247,470
C1	0	0	0	1,825	1,460	20,075	33,215	853,735
S2	0	5,840	0	6,935	7,300	10,585	14,235	58,035

Source: JICA Study Team

In addition, it is assumed that annual traffic volume for general use would increase gradually by the economic growth and the increase of population in Cameroon. Thus, the future annual traffic volume is estimated based on the growing rate of GDP in Cameroon. The table below shows the growth rate of GDP in Cameroon in 2010-2015. The average of the growth rate is approximately 5%; thereby the annual traffic volume for general use for the future is estimated based on this growth rate.

Table 8.3.15 Transition of growth rate of GDP in Cameroon

	2010	2011	2012	2013	2014	2015	Average
Growth rate of GDP (%)	3.27	4.14	4.60	5.55	5.89	6.21	4.94

Source：IMF Country Report

In contrast, the traffic volume for the transportation of agricultural products is estimated based on the necessary traffic volume for the agricultural products produced and shipped along the target road. Since there is not adequate statistical data of the crop production area and land use map in the target area, the annual traffic volume for the transportation of agricultural products is estimated based on the survey results of hearing to the local residents such as the farmers population, crops produced and production amount. The table below shows the annual traffic volume for the transportation of agricultural products.

Table 8.3.16 Estimated annual traffic volume for the transportation of agricultural products in each target road (2016)

Target Road	Population	Average no. of person in households	No. of household	Annual shipment amount of products per households (t)	Annual shipment amount (t)	Method of shipment	Annual traffic volume for transportation
NW1	44,992	10.25	4,383	5.13	22,484	Pick Up (500 kg)	22,484
NW2	32,267	17.00	1,898	37.18	70,567	Pick Up (500 kg)	70,567
C1	7,836	7.75	1,011	4.08	4124	Motor-Bike (50kg)	51,550
S2	3,664	4.33	846	7.05	5,964	Motor-Bike (50kg)	74,550

Source: JICA Study Team

Hence, it is assumed that the vehicle type for the transportation would be changed after the rehabilitation of target road. Thus, based on the hearing from the local residents, it is assumed that the vehicle type would change after the rehabilitation as shown in the table below.

Table 8.3.17 Change of vehicle used for the transportation of agricultural products after the road rehabilitation

Target Road	Current Vehicle used for the transportation	Assumed vehicle used for the transportation after the road rehabilitation	
NW1	Pick Up：100 %	Small Truck：50 %	Pick Up：50 %
NW2	Pick Up：100 %	Small Truck：50 %	Pick Up：50 %
C1	Motor Bike：100 %	Pick Up：80 %	Motor Bike：20 %
S2	Motor Bike：100 %	Pick Up：80 %	Motor Bike：20 %

Source: JICA Study Team

Benefit derived from the shortening of driving time

The benefit derived from the shortening of driving time is calculated based on the comparison of time value between the non-rehabilitated road and rehabilitated road. The unit of time value is classified as the time value of person and that of vehicle. The table below shows the difference of driving time of "without: before the road rehabilitation" and "with: after the road rehabilitation".

Table 8.3.18 Driving speed of the road before and after the road rehabilitation

Target Road	Before the road rehabilitation	After the road rehabilitation	Remarks
NW1	30km/hr（15km/hr after 2033）	60km/hr	As pavement
NW2	20km/hr（10km/hr after 2033）	40km/hr	Laterite pavement
C1	20km/hr（10km/hr after 2033）	40km/hr	Laterite＋DBST pavement
S2	20km/hr（10km/hr after 2033）	50km/hr	DBST pavement

Source: JICA Study Team

Hence, the time value of person and vehicle is calculated based on the average income and the rental cost in Cameroon respectively.

Table 8.3.19 Time value of person and vehicle

	Total price of time value	Unit price (FCFA/min)	Remarks
Person	1,186,416 FCFA/year	10.30	Cameroon Statistic Yearbook (2013)
Big Truck	147,544 FCFA/day	102.46	Based on the hearing from MATGENIE
Small Truck	133,544 FCFA/day	92.74	Based on the hearing from MATGENIE
Bus	108,000 FCFA/day	75.00	Based on the hearing from rent car company in Cameroon
Van	90,000 FCFA/day	62.50	Based on the hearing from rent car company in Cameroon
4WD	90,000 FCFA/day	62.50	Based on the hearing from rent car company in Cameroon
Pick Up	78,000 FCFA/day	54.17	Based on the hearing from rent car company in Cameroon
Sedan	40,000 FCFA/day	27.78	Based on the hearing from rent car company in Cameroon
Motor Bike	6,000 FCFA/day	4.17	Based on the hearing from rent car company in Cameroon

Source: JICA Study Team

Benefit derived from the reduction of driving cost

The benefit derived from the reduction of driving is calculated based on the difference of driving cost of "without: before the road rehabilitation" and "with: after the road rehabilitation" The unit of driving cost is classified as the fuel cost and amortization cost of vehicle. The fuel cost is calculated based on the general unit price of diesel which is 575 FCFA/L. The table below shows the purchasing price and its amortization cost of each vehicle type.

Table 8.3.20 Amortization cost of each vehicle type

	Purchasing price (FCFA)	Amortization term (Year)	Unit price of Amortization cost (FCFA/min)	Remarks
Big Truck	42,900,000	5	16.32	Mercuria 2016, MINFI
Small Truck	30,233,453	5	11.50	Mercuria 2016, MINFI
Bus	14,040,000	5	5.34	Mercuria 2016, MINFI
Van	14,040,000	4	6.68	Mercuria 2016, MINFI
4WD	20,714,000	4	9.85	Mercuria 2016, MINFI
Pick Up	17,190,776	4	8.18	Mercuria 2016, MINFI
Sedan	10,750,943	4	5.11	Mercuria 2016, MINFI
Motor Bike	600,000	3	0.38	Mercuria 2016, MINFI

Source: JICA Study Team

The fuel cost is estimated based on the calculation of fuel consumption rate at particular speed. The table below shows the fuel cost of each vehicle type and each driving speed.

Table 8.3.21 Fuel cost of each vehicle type and each speed (FCFA/min)*

	Speed (60km/hour)	Speed (50km/hour)	Speed (40km/hour)	Speed (30km/hour)	Speed (20km/hour)	Speed (15km/hour)	Speed (10km/hour)
Big Truck	2.40	2.52	2.78	3.23	4.71	4.80	6.17
Small Truck	1.92	2.02	2.23	2.59	3.77	3.84	4.94
Bus	1.92	2.02	2.23	2.59	3.77	3.84	4.94
Van	1.37	1.44	1.59	1.85	2.69	2.74	3.53
4WD	1.20	1.26	1.39	1.62	2.35	2.40	3.09
Pick Up	0.96	1.01	1.11	1.29	1.88	1.92	2.47
Sedan	0.80	0.84	0.93	1.08	1.57	1.60	2.06
Motor Bike	0.38	0.40	0.45	0.52	0.75	0.77	0.99

Source: JICA Study Team * The possible driving distance (km) per 1L of fuel at the speed of 60km/hr is set as follows. Big Truck：4km/L, Small Truck：5km/L、Bus：5km/L、Van：7km/L、4WD：8km/L、Pick Up：10km/L、Sedan：12km/L、Motor Bike：25km/L
The fuel consumption rate at each speed is calculated based on the following formula.
Amount of fuel consumed at speed Sv (cc/km))= $829.3/Sv - 0.8572Sv + 0.007659Sv^2 + 64.09$

(2) O&M cost of Access Road Development Component

For periodic maintenance and minor repairs, budgetary measures are taken by the municipal government's municipal government and UNVDA. Contents and costs pertaining to presumed maintenance for the road after maintenance are as follows.

Table 8.3.22 Periodic maintenance, Cost of minor repair workers (annual fee)

Repair Item	NW1 15.5km Asphalt	NW2 14.5km Laterite	C1 24.9km DBST:7.4km Latelite:17.5km	S2 8.8km DBST:8.8km
①Repair of cracks and holes in As, DBST and laterite pavem	1 place (3 m × 1 m = 3 m 2) every 200 m. 15.5 km / 200 m = 77 places	Scouring part of one place (5m × 10m = 50m2) for each 500m. 14.5 km / 500 m = 29 places	DBST: 1 place repair to 200 m as well as As of NW 17.4km÷200m ＝37places 17.5km/500 ＝35places	one place in 200 m as well as NW 1.8.8km/200m ＝44places
	248,000CFA/m^2 ×77places ×3m^2＝ 5,722,000CFA	21,000CFA/m^2 ×29places ×50m^2＝ 3,020,000CFA	134,000CFA/m^2×37places ×3m^2＝1,487,000CFA 21,000CFA/m^2×35places ×50m^2＝3,675,000CFA Sub-total 5,162,000CFA	134,000CFA/m^2 ×44places×3m^2 ＝1,769,000CFA
②Repair of side ditches	repair about 20 cm in width every 100 m.15.5km/100m ＝155 places	repair about 20 cm in width every 100 14.5km/100m ＝145 places	repair about 20 cm in width every 100 24.9km/100m ＝249 places	repair about 20 cm in width every 100 8.8m/100m ＝88places
	17,305,000CFA/km × 0.0002km×155 places ＝536,000CFA	17,305,000CFA/km × 0.0002km×145 places ＝501,000CFA	17,305,000CFA/km × 0.0002km×249 places ＝862,000CFA	17,305,000CFA/km × 0.0002km×88 places ＝305,000CFA
③ Repair of road shoulder	repair about 10 cm in width every 500 15.5km /500m ＝31 places	repair about 10 cm in width every 500 14.5km/500m ＝29 places	repair about 10 cm in width every 500 24.9km/500m ＝50 places	repair about 10 cm in width every 500 8.8m/500m ＝18 places
	574,000CFA/km × 0.010km×78 places ＝447,000CFA	574,000CFA/km × 0.010km×29 places ＝166,000CFA	574,000CFA/km × 0.010km×50 places ＝287,000CFA	575,000CFA/km × 0.010km×18 places ＝103,000CFA
Total	6,705,000CFA	3,687,000CFA	6,310,000CFA	2,177,000CFA
According to paragraph 4.2.6 Budget for maintenance, road NW is included in budget 2016, and C1 in budget 2015	76,000,000CFA		57,778,000FA	-
Percentage of budget (%)	13%		9%	-

Sauce：JICA Study Team

The O&M cost are calculated assuming that repair is required for one year in 500 m of earth work per year, one in 100 m of concrete work per year, and one in 200 m of paving work such as As, . In addition, the construction amount is to be ordered to the contractor, and the frequency of these maintenance and management needs to be accumulated in each town in the future to raise the accuracy of the numerical value and use it for the calculation of the maintenance cost.

8.3.3 Benefit Calculation of Installation of Agricultural Equipments Component

When calculating the benefits of agricultural machinery components, the project first collect data related to existing rice milling plants (without), then analyze the performance and processing capacity of the newly installed country elevator and rice milling plant (with) in UNVDA. By examinig the collected data and information, evaluate the benefit from installation of agricultural equipment with the viewpoint of UNVDA's rice milling business after setting up a new rice milling plant.

In addition to the country elevator and rice milling plant, the equipment included tractor, tractor implementation (rotary tiller), combine, and the benefits were also calculated for these equipment.

(1) Data for existing Rice milling plant

1) Storage of rice rice

The maximum storage capacity of paddies in the UNVDA's central agricultural warehouse located in Ndop is 4,500 tons. On the other hand, the storage amount at the end of February 2016 was about 2,753 tons. The monthly storage volumes for 2014 and 2015 are shown in the table below.

Table 8.3.23 Trend in rice volumes stored in central warehouse（unit: ton）

	Jan.	Feb.	Mar	Apr.	May	Jun	Jul	Aug	Sept.	Oct.	Nov.	Dec.
2014	2 899	2 871	3 150	3 240	3 154	2 952	2 739	2 489	2 302	2 994	3 269	3 102
2015	3 485	3 742	3 581	3 433	3 269	3 076	2 952	3 260	3 222	3 024	2 798	2 495

Source: JICA Study Team from UNVDA data

UNVDA has 18 points for buying rice in 5 areas, and the table below shows the amount of rice purchased at each point

Table 8.3.24 Purchase amount of Rice Buying Points (Unit: kg)

Name of Area	Name of point	2014		2015			Total
		Nov.	Dec.	Jan.	Feb.	Mar.	
Upper Bamunka	Mile 25	8,131	181,171	70,506	6,512	12,044	278,364
	Bamessing	686	105,202	76,268	13,318	4,542	200,016
	Balikumbat	0	63,612	94,768	34,253	1,538	194,171
	Kumbit	4,640	75,188	36,967	12,753	4,770	134,318
Lower Bamunka	Palace Road	5,588	159,458	154,677	6,378	11,805	337,906
	Pal Road Mobile	0	84,485	81,435	23,510	3,728	193,158
	Ntengwala	0	139,428	188,078	118,824	42,530	488,860
	Basale	0	54,357	78,461	20,526	4,148	157,510
Babungo	Mbukong	5,056	55,157	54,005	8,797	3,389	126,404
	Baba I	1,896	50,248	67,399	63,487	25,556	208,586
	Babungo	1,800	5027	9,325	10,492	3,075	29,719
	Babessi	32,152	159,684	116,773	46,947	11,176	366,759
Monoun	Bangolan	21,454	65,682	115,637	3,514	2,809	209,096
	Wasi	2,688	24,391	43,335	5,275	4,840	80,529
	Mambim	400	18,453	44,914	6,202	1,598	71,567
Bangolan	Ber Main St	3,687	48,033	135,070	36,503	39,411	262,704
	Mapuot	0	16,302	73,691	19,017	17,398	126,399
	koutoupit	11,575	77,477	128,326	14,525	5,029	236,932
Total		99,753	1,383,373	1,569,635	450,860	199,377	3,702,998

Source: JICA Study Team from UNVDA data

2) Amount of Polished Rice

The table below shows the amount of polished rice at the UNVDA rice milling plat.

Table 8.3.25 Trend in the amount of polished rice（unit: Tons）

	2011	2012	2013	2014	2015
Operated white rice volume	723	1 842	3 337	2 954	2 804

Source: JICA Study Team from UNVDA data

Existing rice milling plant owned by UNVDA is composed of three rice milling machines (of which, two are workable). Rice milling method of these machines are categorized into "one pass method", which is a method of polishing rice by applying pressure in order to obtain predetermined whiteness. In this method, since the pressure applied to a grain of rice increases, the incidence of crushed rice increases. The yield rate of existing rice milling plant is shown in the table below.

Table 8.3.26 Yield Rate of Existing Rice Milling Plant in UNVDA

	Dried rice percentage	Percentage from unpolished rice
White rice (product at sales)	42%	56%
Broken rice	18%	24%
Crushed rice	7%	9.3%
Small rice	6.5%	8.7%
Rice bran	1.5%	2%
Rice husk	25%	–

Source: JICA Study Team from UNVDA data

3) Operating time and power consumption

The following table shows operating time and power consumption of existing rice milling plant of UNVDA in 2015. Production is order production from customers, production fluctuates by month. The average occupancy rate in 2015 is 40% of the processing capacity of facility equipment.

Table 8.3.27 Operating time and power consumption (2015)

	Jan.	Feb.	Mar	Apr.	May	Jun	Jul	Aug	Sept.	Oct.	Nov.	Dec.	Total
Operating time (h)	83.51	40.06	58.79	48.48	55.37	58.28	93.63	65.42	91.23	105.41	105.24	163.76	969.18
Power Consumption (kWh)	6,660	2,540	4,620	3,780	3,900	4,380	7,500	4,740	6,480	7,500	7,380	12,180	71,660

* Power rate (FCFA) _150 FCFA/kWh

Source: JICA Study Team from UNVDA data

(2) Benefit calculation of agricultural equipments installation

1) Rice milling plan (new construction)

Yield rate of newly installed rice milling plant is improved to 65% from 42% of existing rice milling plant, and the incidence of crushed rice falls to 10%. Also, the incidence of rice bran is 1% and the incidence of rice grain is 5%.

When calculating the benefit, the selling price is set as 330 FCFA / kg for ordinary white rice, 700 FCFA / kg for high quality white rice, 700 FCFA / kg of brown rice, 250 FCFA / kg for broken rice, 100 FCFA / kg for rice bran, and 50 FCFA / kg for rice grain. The benefits were calculated as shown in the table below. In addition, the purchasing price of rice is set as 140 FCFA / kg (The current purchasing price of rice is set as 120 FCFA / kg).

Table 8.3.28 Benefit from agricultural equipments installation

	Qty. (ton)	Unit price (FCFA/kg)	Benefit	
White rice (standard)	4,500	330	1,485,000,000	FCFA
White rice (high quality)	3,000	700	2,100,000,000	FCFA
Unpolished rice	2,250	700	1,575,000,000	FCFA
Broken rice	1,500	250	375,000,000	FCFA
Rice bran	150	100	15,000,000	FCFA
Rice husk	3,000	50	150,000,000	FCFA
Total			5,700,000,000	FCFA

Source; JICA Study Team

(3) O & M cost of Agricultural Equipments

1) O&M cost of country elevator and rice milling plant

Following table indicates the annual Q&M cost of the country elevator and rice milling plant which

will be implemented in this project.

Table 8.3.29 O&M cost of country elevator and rice milling plant Cost

Item		Unit Price	Total（FCFA）
Primary Cost	Purchases Cost of Rice	140	2,100,000,000
	Labor Cost_Extention Worker	2.0	30,000,000
	Labor Cost_Buying Center Staff	1.0	15,000,000
	Transport Cost	1.5	22,500,000
	Rice Bag	3.0	45,000,000
Rice milling plant	Electrical Power rate	4.0	60,000,000
	Labor Cost	1.0	15,000,000
	O & M (Spare parts)	37.8	567,000,000
	Amortization Expense	25.2	378,000,000
	Administration and Technical Cost	6.0	90,000,000
Packaging	Bag	39.0	585,000,000
	Bagging and Carrying	9.0	135,000,000
Total		270	4,042,500,000

Source; JICA Study Team

2) O&M cost of tractor

As shown in the following table, the hourly Q&M cost for the tractor's service is 8,795 FCFA/hr. The work load area (operating area) for the 10 tractors planned to be newly implemented is 1,082ha/year (108.2ha/1unit).

Table 8.3.30 O&M cost of tractor Cost (per hour)

Item	Unit	Unit Price（FCFA）	Qty.	Total（FCFA）
Labor Cost_Operator	hr	380	1	380
Labor Cost_Mechanic	hr	320	1	320
Labor Cost_Demonstrator	hr	500	1	500
Spare parts	hr	1,065	1	1,065
Amortization Expense	hr	2,130	1	2,130
Fuel	ℓ	500	4	2,000
Oil	ℓ	2,200	1	2,200
Other	lot	200	1	200
Total				8,795

Source; JICA Study Team

3) Combine harvester

As shown in the following table, the hourly Q&M cost for the combine harvester's service is 14,007 FCFA/hr. The work load area (operating area) for the 10 combines planned to be newly implemented is 624ha/year (62.4ha/1unit).

Table 8.3.31 O&M cost of combine harvester Operation and Maintenance Cost (per hour)

Item	Unit	Unit Price（FCFA）	Qty.	Total（FCFA）
Labor Cost_Operator	hr	380	1	380
Labor Cost_Mechanic	hr	320	1	320
Labor Cost_Demonstrator	hr	500	1	500
Spare parts	hr	2,969	1	2,969
Amortization Expense	hr	5,938	1	5,938
Fuel	ℓ	500	3	1,500
Oil	ℓ	2,200	1	2,200
Other	lot	200	1	200
Total				14,007

8.3.4 Economic Internal Rate of Return and Sensitivity Analysis

The economic analysis has been carried out based on economic cost and benefit flows. The following indicators are to be applied:

- Benefit cost (B/C) ratio is used to compare the benefit with the cost, on present value basis at 12% discount rate.

- Net production value (NPV) is used to convert the amount of incremental benefit into the present value using 12% discount rate. The NPV figures indicate the project investment advantage.
- EIRR is used to examine the economic viability of the project.
- Sensitivity analysis is used to examine the economic sensitivity against future adverse changes in cost and benefit such as: 1)increase / decrease in cost (+ 10% and -10%) due to increase and decrease in cost caused by price change of construction materials and increase in work volume caused by unforeseen conditions; 2) increase / decrease in benefit by 10% and -10% due to decline / increase in amount of agricultural production and sales; and 3) combination of both factors; and
- In milling business, the target collecting amount per year is set by 15,000 tons. However, it is planned that the amount of collecting of rice will be gradually increased to 40% for the target amount at the first year, 60% for the second year, 80% for the third year and 100% for the fourth year. Therefore, the occurrence of the benefits from milling business is in line with the collection plan of rice.

Table 8.3.32 Results of Economic Evaluation

Indicator	Sensitivity analysis			
	Benefit	Cost increase/decrease		
	Increase/decrease	±0	＋10%	－10%
EIRR	±0	12.3	11.3	13.5
	＋10%	13.4	12.3	14.6
	－10%	11.2	10.2	12.3
NPV(12%)：1,060 million FCFA				
B/C(12%)：1.03				

Source: JICA Study Team

8.4 Financial Analysis

8.4.1 Financial analysis

The financial evaluation of the proposed project was undertaken in terms of financial status of agricultural machinery services (rice mill, tractors, combine-harvesters) and average producer's farm income in the irrigation development.

(1) Financial analysis of agricultural equipments installation component

This component is to provide the UNVDA a rice mill country elevator, tractors and combine harvesters. Using these agricultural machineries, UNVDA conduct; (1) the rice milling work, (2) rental services for plowing (with tractors) and (3) rental services for harvesting and threshing rice (with combine harvesters).

1) Basic Assumption of financial analysis

i) Rice Milling

The rice milling work has three steps. UNVDA adds value through the milling after purchasing rice from farmers, and UNVDA sells several types of value added rice which are competitively compared to imported rice. For this it is necessary to produce a high quality rice and available stably throughout the year on the market. To achieve these, it is essential to introduce a rice milling unit with high efficiency. As for milling work of new Introduced unit, the purchase price of rice from farmers is set higher than 120 CFAF / kg at the present level to motivate producers as shown in the table below. Rice to sell will be three types, rice (usually), rice (high quality) and brown rice (high quality). Rice (usually) is assumed to be widely sold to consumers in the public market with the same retail price level of imported rice (selling price of UNVDA at the 400FCFA / kg. On the other hand, as for the white rice (high quality) and the brown rice (high quality) with

perfume, the target consumers will be middle and high income earners who are supermarket users. The table below as proposed shows the purchase price of rice from producers and selling prices of milled rice by UNVDA.

Table 8.4.1 Purchase price of rice and selling prices of rice

Unit：FCFA/kg

Purchase price of rice (selling price of producers)	Selling prices of rice (selling price of UNVDA)
140	White rice（regular） ：330
	White rice（high quality）：700
	Brown rice(high quality)：700

ii) Services work of tractor and combine-harvester

This is services for plowing the land and harvesting/threshing of rice. The table below shows the rental rates of tractors and combine-harvesters. The rate of tractor is same price with the present level of 300 FCFA / min. For combine-harvesters, the rental price is set at 600 FCFA, because they perform harvesting and threshing at the same time. These rates were set to cover the cost of spare parts and the cost of depreciation in the case of achieving the target works/services, and to ensure the minimum profit needed to maintain the service.

Table 8.4.2 Rental rate

Unit: FCFA/minute

	Rental rate
Tractor	300
Combine-harvester	600

2) Analysis of income and expenditure

The table below shows the annual plan of income and expenditure of agricultural equipments installation component. The annual net income in the case of achieving the targets of the work, are 1 billion 658 million CFCA for milling, 47 million FCFA for the work of tractors and 43 million FCFA for work combine-harvester. As mentioned above, in these services, the rice milling prices and rental rates for tractor and combine harvester covers the spare parts and the depreciation cost, and they ensure the financial sustainability of the services.

Table 8.4.3 Annual plan of income and expenditure for the installation of agricultural equipments component

Unit: million FCFA

	Target	Income	Expenditure	Net income
Rice milling	Rice：15,000 ton	5,700	4,043	1,658
Tractor	Area： Rice 541ha Upland 541ha	93	46	47
Combine-harvester	Area：624ha	85	42	43

(2) Farm income analysis

Producers of the targeted irrigation development sites have an average of 0.25 ha of farmland in the perimeter. They grow mainly rice and corn in double culture. With the Project, the average producers will increase their gross income of 172,420 FCFA compared to the present condition.

Table 8.4.4 Incremental gross income

Crop	Present			Plan			Incremental gross income (FCFA)
	Cultivation Are (ha)	Yield (ton)	Gross income (FCFA)	Cultivation Are (ha)	Yield (ton)	Gross income (FCFA)	
Rice	0.14	3.1	52,080	0.25	5.0	175,000	122,920
Maize	0.19	1.8	51,300	0.24	2.8	100,800	49,500
						Total	172,420

Note: Gross income = production amount × selling price

8.5 Socio-Economic Benefits

(1) Promotion of a Cameroonian Rice Brand

Since there is almost no Cameroonian rice in distribution on the market in Cameroon, the introduction of a rice mill will make possible the steady flow of Cameroonian high quality rice (UNVDA rice) that can compete with imported rice, and UNVDA rice shall be known as one of rice brand among consumers.

(2) Activation of the Local Economy

The distribution of high-quality rice of UNVDA will contribute to the creation of a new market, increasing business transactions of fertilizer makers and distributors. And then, the entire project will activate the local economy.

With the development of rural roads: (1) agricultural activities so far limited by the poor condition of the roads will be revitalized; (2) agricultural productivity will be increased by improving the efficiency of agricultural work in the production process; (3) it will be expected to develop the local economy through the smooth distribution of agricultural products and consumer goods and the increase in value added products.

(3) Increase of Indirect Benefits for Rural Women and Children

Rural women under the jurisdiction of the UNVDA work both on land for family and on their own farmland. On the latter, they are themselves responsible for all farm works from production to sales. According to the document of the UNVDA, half of the registered producers in irrigation perimeters are women. Therefore, promoting the development of irrigation facilities and farm mechanization by the Project will benefit equally to the rise in agricultural incomes of men and women.

Increase in farm income that can be used freely for rural women (wife) by the project will result in an indirect benefit to children and women themselves.

8.6 Operational and Effect Indicators

Selected operational indicators with present (base line) and target values for three components are shown in Table 8.6.1 respectively.

Table 8.6.1 Operational Indicators

Indicator	Unit	Present (2016)	Target (2025)
1. Irrigation			
Irrigation potential area	ha	918	918
Cropped area：rice	ha	459	818
：maize	ha	597	780
2. Farm road			
Annual average daily traffic：NW1	vehicles / day	1,707	2,648
：NW2	vehicles / day	1,112	1,725
：C1	vehicles / day	2,494	3,869
：S2	vehicles / day	282	437
3. Agricultural machinery			
Rice mill：milling ration	%	42	65
Tractor：Service area	ha/year	457	1,082
Combine：Service area	ha/year	0	624

Selected effective indicators with present (base line) and target values for three components are shown in Table 8.6.2 respectively.

Table 8.6.2 Effective Indicators

Indicator	Unit	Present (2016)	Target (2026)
1. Irrigation			
Production：rice	ton/year	1,423	4,090
：maize	ton/year	1,075	1,950
Yield：rice	ton/ha	3.1	5.0
：maize	ton/ha	1.8	2.8
Gross annual average income[33]	FCFA/producer	103,380	376,600
2. Farm road			
Shorten of traveling time：NW1	minute	31	16
：NW2	minute	43	22
：C1	minute	75	37
：S2	minute	26	11
3. Agricultural machinery			
Rice mill：Milling amount	ton/year	1,260	9,750
Tractor：Income of service	thousand FCFA/year	16,575	93,485
Combine：Income of service	thousand FCFA/year	0	85,363

[33] According to the results of the survey of producers in the targeted irrigation sites ,producers have 0.25 ha of farmland in average in the irrigation perimeter, and they grow mainly rice and corn in double culture.

Chapter 9 Procurement Plan

9.1 Procurement of Consultant

Japanese consultant is responsible for a detailed design, preparation of tender documents, tendering, tender evaluation in the detailed design stage according to a contract agreement with MINADER that is the implementation agency for the project. The consultant also conducts supervisory works of construction and machineries and equipment procurement works by a Japanese contractor, makers and suppliers. International competitive bidding (ICB) is applicable for the employment of the Japanese consultant under the STEP loans. The prime consultant shall be either of the following.

(1) A Japanese company. Specifically the company must satisfy all of the following condition:

- A majority of the subscribed shares of the company shall be held by Japanese nationals,
- A majority of the full-time directors of the company shall be Japanese nationals, and
- The company shall be a juridical person incorporated and registered in Japan.

(2) A Joint Venture (JV) composed of a Japanese company(ies) and a company(ies) in a recipient country. Specifically, JV must satisfy all of the following condition:

- The lead partner shall be a Japanese company,
- The total share of the work of Japanese partners in JV is more than fifty percent (50 %) of the contract amount, and
- The partners except Japanese partners shall meet all of the following conditions:
- A majority of the subscribed shares of the partners shall be held by nationals of a recipient country or Japan.
- A majority of the full-time directors of the partners shall be nationals of a recipient country or Japan.
- The partners shall be juridical persons incorporated and registered in a recipient country or Japan.

Consultant selection procedure is as follows:

1) Preparation of the Terms and Reference
2) Preparation of Short List of Consultants
3) Preparation of the Request for Proposals
4) Evaluation of Technical Proposals
5) Evaluation of Financial Proposals and Ranking of Proposals (Quality and Cost-based selection (QCBS), a method that takes into account the quality of the proposal and the cost of the services, is the commonly recommended method.)
6) Contract Negotiations
7) Contract Signing

9.2 Procurement of Contractor(s)

Any of the following is applicable for the contract:

- One package deal contract with consortium of trading company as a lead partner, makers of agricultural machineries and equipment, or
- Three packages deal contracts composed of irrigation development, rural road improvement and agricultural machineries and equipment installation. (Construction Company (ies) is for irrigation development, access road development components, and trading company, maker(s) and Construction Company (ies) are for agricultural machineries and equipment installation.

The hearing is conducted to the Japanese enterprises to clarify their opinions about the plans mentioned above. As a result, the one package deal contract is desirable for the Japanese enterprises for this project. The reason is as follows.

- In case of three packages deal contract, the Japanese enterprises that would bid the irrigation and access road packages are hardly existed due to the politically unstable situation in Africa. In addition, if those enterprises do not have on-going project in Cameroon, their priority to do their business would be lower in Cameroon than the project conducted in South-East Asia. If one package deal contract is approved, the Japanese enterprises can reduce the various risks by organizing Japanese enterprise consortium and negotiating with Cameroon government and local contractors.

- In case of three package deal contract, the competitiveness of the bidding would extremely reduce and even the failure of bidding could be caused.

Considering the results of hearing, the one package deal contract is applied for the procurement of contractor in this project.

The prime contractor shall be either of the following:

(1) A Japanese company. Specifically, the company must satisfy all of the following condition:

- The company shall be a juridical person incorporated and registered in Japan.
- The company shall have its appropriate facilities for producing or providing goods and services in Japan, and
- The company actually conducts its business in Japan.

(2) A Joint Venture (JV) composed of a Japanese company(ies) and a company(ies) in a recipient country. Specifically, JV must satisfy all of the following condition:

- The lead partner shall be a Japanese company,
- The total share of the work of Japanese partners in JV is more than fifty percent (50 %) of the contract amount, and
- The partners except Japanese partners shall meet all of the following conditions:
- The partners shall be juridical persons incorporated and registered in a recipient country or Japan.
- The partners shall have their appropriate facilities for producing or providing goods and services in a recipient country or Japan.
- The partners actually conduct their business in a recipient country or Japan.

(3) A consolidated subsidiary of a Japanese company in a foreign country ("the company"). Specifically, the company must satisfy all of the following conditions:

- The company shall be a subsidiary company whose financial statements are required to be included in a consolidated financial statement of a Japanese company.
- The company shall be incorporated and registered in a country where it is located.
- The company shall have its appropriate facilities for producing or providing goods and services in a country where it is located, and
- The company actually conducts its business in a country where it is located.

Contractor selection procedure is as follows:

1) Preparation of the Pre-qualification Documents
2) Preparation of Short List of Contractors
3) Preparation of the Bidding Documents
4) Preparation of the Request for Proposals
5) Evaluation of Technical Proposals
6) Evaluation of Financial Proposals and Ranking of Proposals (Two envelopments: operation maintenance cost will be reviewed for the proposals of the agricultural machineries and equipment installation, Goods and services: Reduction of the construction period, environmentally conscious effort, etc.)
7) Contract Negotiations
8) Contract Signing

Chapter 10 Conclusion and Recommendation

10.1 Conclusion

As stated in Chapter 3, Cameroon is currently depending on the importing rice for the domestic consumption. In order to cast off this situation, it is stated in NRDS that the national rice production in Cameroon shall be increased up to 970,000 t/year by 2018. However, according to FAOSTAT, the national rice production in Cameroon is reported as 203,000 t/year at 2014, indicating that there is a considerable gap between the goal and the reality. It is indispensable for increasing the national self sufficiency of rice to prepare and implement the necessary plan to solve the constraints impeding the increase of national rice production.

The government of Japan has implemented the technical cooperation project regarding the promotion of rice cultivation in Cameroon. The PRODERiP which started from 2011 and PRODERIP which started from 2016 are the projects aiming for the improvement of rainfed and lowland rice productivity by the system development of rice seed adopting the local natural condition, technical development and extension for the proper post harvest technique and the capacity development of extension workers and local farmers in terms of cultivation techniques to contribute the promotion of rice cultivation in Cameroon.

On the other hand, this project focuses on the basic infrastructure development such as the development of irrigation facilities to increase the rice productivity, the development of access road to facilitate the rice distribution and the procurement of agricultural equipments such as post-harvest facilities that can cover the increasing volume of rice production in the target area to promote the synergy effects with PRODERIP and rice cultivation in Cameroon. The brief summary of the project is shown in the table below.

Table 10.1.1 Brief Summary of the Project

Items	Contents
(6) Civil Works for Irrigation Development	1) Construction of drainage channel: 46.34 km 2) Construction of internal farmroad: 28.22 km 3) Construction of irrigation channel: 7.43 km 4) Land leveling and integration of small farm lots: 164.3 ha 5) Rehabilitation of existing irrigation channel: 0.04 km 6) Construction of bridge: 2 7) Construction of other facilities such as culverts, tractor passages and inlets
(7) Civil Works for Access Road Development	1) Rehabilitation of the route of Bamali (N11) - Bamali 3 Corners – Balikumbat (15.5km) : width of road is 9m including 2m road shoulder, asphalt pavement. 2) Rehabilitation of the route of Bambalang - Bamali 3 Corners (14.5km) : width of road is 6m including 1m of road shoulder, laterite pavement. 3) Rehabilitation of the route of Mboua I (N4) - Mbele II – Edokassi, Mbele II - Bilon – Nkoledouma, Mbele II – Nkolndongo – Mengama - Nyeannam J.C. and Mengama – Ntsaekang (24.9 km) : width of road is 6m including 1m of road shoulder, DBST(7.4km) and laterite pavement(17.5km). 4) Rehabilitation of the route of Nkoetye – Nkolbitye (8.8 km) : width of road is 6m including 1m of road shoulder, DBST pavement.
(8) Architecture Works and Procurement of Agricultural Equipment	1) Construction of the building for the Rice Milling Center: Administration Office, Storage Warehouse, Rice Dry Facility, Rice Milling Facility, Parts Storage and Husk Ash Storage. 2) Procurement and Installation of Agricultural Equipments: Country Elevator, Rice Milling Facilities, 10 Tractors (40HP), 10 Harvesters and 2 Road Stabilizers
(9) Consulting services	1) Detailed Design 2) Tendering Assistance 3) Construction Supervision and Technical Assistance for the Operation, Maintenance and Management of the facilities procured. 4) Facilitation of Implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)
(10) Soft Component	1) Training for the O&M and management of water use and irrigation facilities. Training for the Planning, Designing and Supervision of irrigation facilities 2) Training for the O&M and management of Stabilizer, Training for the management and maintenance of access road 3) Training for the O&M and management of country elevator , milling plant, tractors and harvesters 4) Training for the administration of milling plant , Training for Marketing

Source : JICA Study Team

The following is the necessity and validity of the plan described in chapter 6.

(1) Necessity of Irrigation Development

The target area of this project, Upper Bamunka area in Ndop commune, would be the core rice producing area in Cameroon since 1) it has more than 50 years history of lowland rice cultivation, 2) it has high potential to be the important rice supplying area for the Big cities in Cameroon such as Yaoundé or Duala due to the closer distance to those cities than other rice producing area such as Far North region, and 3) it is also the project target area of PRODERIP which would improve the rice productivity there drastically. Currently, there are several constraints to increase the rice productivities and promotion of agricultural mechanization there such as 1) poor drainage system, 2) lack of irrigation channel and internal farm road and 3) unleveled farmland. Based on the recognition of those situations, this project would construct the proper irrigation facilities to dissolve those bottlenecks and to increase the rice productivities drastically in combination with the activities of PRODERIP.

(2) Necessity of Access Road Development

As stated in chapter 3, although the rural road dominates 80 % of entire roads running in Cameroon, the pavement rate of those roads are 0 %, which becomes the bottleneck of the distribution of agricultural products, thereby it is the urgent issue to be dissolved as much as possible. The total length of the target roads in this project is estimated as 64 km approximately, which may not be the sufficient length compared with the total length to be rehabilitated in the future. However, the selected target roads through this study are key roads in terms of the distribution network of rice and other agricultural crops. Thus, it is highly recommended to rehabilitate those roads through this project.

The another constraint for the low pavement rate of rural road in Cameroon is the lack of state budget for the road rehabilitation. This project plans to adopt the roadbed method of road reformation to decrease the road rehabilitation cost and to procure the road stabilizer which is required to utilize the roadbed method of road reformation. Since in Cameroon, there are not many experiences to use this method for the road rehabilitation, the rehabilitation of target rural roads of this project by using this method could be the model of the development of access road to market, thereby it would contribute the increase of pavement rate in Cameroon.

(3) Necessity of Agricultural Equipments Installation

1) Necessity of Tractors and Combines

Currently, several tractors in UNVDA are not operated due to the malfunction of the machineries. As described in Chapter 4, the main cause for the malfunction is 1) the extraneous materials such as huge stones in the rice field cause damages to the tractors and 2) Inadaptable implement is attached to the tractor. While, the former can be improved through the land improvement through this project, it is dispensable to introduce the tractors and adaptable implements as a package for the latter. Hence, UNVDA has 1 combine which is not in use for the harvesting. Thus, the rice harvesting is conducted manually in the target area. Therefore, introducing necessary machineries such as tractors and combines through this project would promote the agricultural mechanization in the future. In this project, it is proposed to procure the Japan-made machineries for the procurement of those equipments. The superiority of Japan-made equipments are those durability, low failure rate, low fuel consumption, low vibration, better operability, lighter machinery weight and water-proof for the bottom-part of machinery. Thus, it is strongly recommended to procure the Japan-made equipments especially in terms of reducing the failure rate and operability under the wet rice condition.

2) Necessity of Country Elevator and Milling Plant

As stated in chapter 4, yield ratio from husked rice to milled rice processed by existing milling plant

of UNVDA is 42 %. The main cause of this is 1) creation of broken rice by excess drying at harvest stage or the rice prepared for the milling is already mixed up with various rice varieties, 2) creation of broken rice by excess drying at storing stag, 3) existed milling machine causes broken rice due to its high pressure towards rice in order to obtain the white color as prescribed. Although the issue of 1) would be improved through the technical cooperation of PRODERIP, that of 2) and 3) require the procurement of necessary equipments which has sufficient capacity for the proper post harvest of rice. Similar to the case of tractors and combines, it is proposed to introduce the Japan-made equipments for the post harvesting machineries such as country elevator and milling plant in this project. The superiority of Japan-made equipments is described in the table below, and it is strongly recommended to introduce them for the promotion of production and distribution of domestic rice with high competitiveness.

Table 10.1.2 Superiority of Japan-Made Country Elevator and Milling plant

Equipment	Item	Superiority
Country Elevator	Silo	Introduction of Hopper Bottom Type Silos to avoid blocking up of vent with grains for the rapid discharge of unhulled rice.
	Dryer	Introduction of Dryer with combustion furnace of rice husk for the utilization of by-product (rice husk) which is not currently utilized effectively.
Milling Plant	Rice Husking Machines	Introduction of Rice Husking Machine with Double Drive system which can reduce the work forces for the roll rotation.
	Shaking Separator	Introduction of Shaking Separator with automatic control system to reduce the energy and work burden.
	Polishing Machine	Introduction of Rice Polishing Machine with triple implicated system to reduce the polishing impacts which causes the broken rice.
	Optical Rice Grain Sorter	Introduction of Optical Rice Grain Sorter to improve the screening performance of rice

Source: JICA Study Team

(4) Necessity of Soft Component

The necessity of soft component for this project is 1) the capacity development of the human resources who are in charge of operation, maintenance and management of the facilities or equipments introduced through this project, and 2) the capacity development of the human resources who promote the extension of the development model such as irrigation development in the future. The table below describes the necessity and validity of the soft component activities.

Table 10.1.3 Necessity and Validity of the soft component

Sector	Name of Training	Candidate Human Resource	Necessity and Validity
Irrigation	Training for the O&M and management of water use and irrigation facilities.	Water Management Unit Individual Farmers	To establish the O&M and management system of the sustainable water use and irrigation facilities.
	Training for the Planning, Designing and Supervision of irrigation facilities.	Staff of UNVDA	To train the technical staff who would take responsibility for the extension of irrigation development model created through this project.
Access Road	Training for the O&M and management of Stabilizer,	Technical Staff of MINTP and MATGENIE	To establish the O&M and management system of the sustainable utilization of those equipments.
	Training for the management and maintenance of access road	Technical Staff of UNVDA and MINTP	To improve the O&M and management technique of the target staffs in order to establish the sustainable system for the O&M and management of access road.
Agricultural Equipment	Training for the O&M and management of tractors and combines	Staff of UNVDA	To establish the O&M and management system of the sustainable utilization of those equipments.
	Training for the O&M and management of country elevator , milling plant	Staff of UNVDA	To establish the O&M and management system of the sustainable utilization of those equipments.
Marketing	Training for the administration of milling plant	Staff of UNVDA	To improve the management system for the sustainable rice milling business of UNVDA
	Training for Marketing	Staff of UNVDA	To strengthen the competitiveness of UNVDA rice by establishing proper marketing system based on the consumer's

Sector	Name of Training	Candidate Human Resource	Necessity and Validity
			needs.

Source: JICA Study Team

In addition to the necessities and validities mentioned above, this project and PRODERIP are complementary each other, and the synergy created through the coalition of these projects would bring the higher outcomes for the promotion of rice cultivation in Cameroon.

It is concluded that the implementation of this project has higher appropriateness and would contribute the promotion of domestic rice production in Cameroon. Therefore, the JICA study team strongly recommends implementing this project by Cameroon government.

10.2 Recommendation

(1) Application of STEP

Based on the result of quantity survey, the procurement cost for the Japan-made agricultural equipments and engineering services exceeds 30% of total project cost, which satisfy the condition of STEP. The merits for Cameroon side to apply the STEP are 1) lower interest rate and 2) longer period for the redemption and deferment compared with other yen loan scheme. Considering the fact that the introduction of Japan-made agricultural machinery would promote the highly competitive rice production and its distribution to the domestic market, it is indispensable to proceed the discussion between Cameroon and Japan side for the application of STEP until the signing of L/A. As a supplement, this project would be the first case of the STEP applied project in agricultural sector for JICA, this project is expected to be the model for other similar project in the future.

(2) Formulation of National Rice Development Strategy after 2018

NRDS is the existing plan for the rice promotion in Cameroon. Considering the fact that the NRDS covers the action plans for the term of 2008-2018, it is indispensable for Cameroon side to formulate the subsequent plan of NRDS as rapidly as possible to clarify the goal and action plans for the further increase of self sufficiency rate of rice in Cameroon.

(3) Contribution of the Development of Macro-Economic

The continuous development of agricultural infrastructure is the urgent issue for not only to decrease the import volume of rice by the promotion of domestic rice production but also to increase the export volume of rice to neighboring countries such as Nigeria, thereby contribute the macro-economic growth and reduction of external debt of Cameroon. In particular, the rehabilitation of existed rural road is the critical issue to promote the utilization of unused land in rural area where natural condition is suitable for agricultural production. Therefore, it is recommended that Cameroon side would continue to improve those roads by the application of low-cost method for road rehabilitation proposed for this project.

(4) Institutionalization of Water Management and Irrigation Development Sector

Since the proper data collection regarding the water resource such as river flow rate is not conducted in Cameroon, there is a difficult condition for the irrigation engineers to collect the necessary information for the designing and construction of irrigation facilities. Hence, not only the design standard or technical policy regarding the designing of irrigation facilities but also the technical report describing the water requirement volume, design drainage discharge and basic design are not existed in Cameroon. The JICA study team strongly recommends that Cameroon side should prepare those design standard and technical policy regarding water management and irrigation development for the expansion of irrigated rice cultivation in Cameroon.