



GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

Naoko Ishii
CEO and Chairperson

September 08, 2016

Dear LDCF/SCCF Council Member:

World Bank as the Implementing Agency for the project entitled: ***Congo DR: Strengthening Hydro-Meteorological and Climate Services***, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with World Bank procedures.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by LDCF/SCCF Council in January 2014 and the proposed project remains consistent with the Instrument and LDCF/SCCF policies and procedures. The attached explanation prepared by World Bank satisfactorily details how Council's comments have been addressed. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.TheGEF.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

AW Naoko Ishii
Chief Executive Officer and Chairperson

Attachment: GEFSEC Project Review Document
Copy to: Country Operational Focal Point, GEF Agencies, STAP, Trustee



GEF-6 WORLD BANK APPRAISAL STAGE: GEF DATA SHEET
REQUEST FOR CEO APPROVAL
PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND: Least Developed Countries Fund

For more information about GEF, visit TheGEF.org

PROJECT INFORMATION

Project Title: Strengthening Hydro-Meteorological and Climate Services			
Country(ies):	Democratic Republic of Congo (DRC)	GEF Project ID: ¹	5451
GEF Agency(ies):	WB (select) (select)	GEF Agency Project ID:	P159217
Other Executing Partner(s):	MettelSat (under the auspices of Ministry of Transport & Communication Channels)	Submission Date:	2016-08-03
GEF Focal Area (s):	Climate Change	Project Duration(Months)	60
Integrated Approach Pilot	IAP-Cities <input type="checkbox"/> IAP-Commodities <input type="checkbox"/> IAP-Food Security <input type="checkbox"/>		
Name of Parent Program	N.A.	Agency Fee (\$):	506,298

A. FOCAL AREA STRATEGY FRAMEWORK AND OTHER PROGRAM STRATEGIES²

Focal Area Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Project Financing (\$)	Cofinancing (\$)
(select) CCA-1 (select)	Outcome 1.3: Climate-resilient technologies and practices adopted and scaled up	LDCF	3,329,452	16,350,000
(select) CCA-2 (select)	Outcome 2.3: Access to Climate information and early warning systems enhanced at regional, national, sub-national and local levels	LDCF	2,000,000	16,350,000
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
Total project costs			5,329,452	32,700,000

B. PROJECT FRAMEWORK

Project Objective: To improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors.

Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing (\$)	Confirmed Cofinancing (\$)
Component A. Institutional and regulatory strengthening,	TA	Reinforcement of the legal and regulatory framework of MettelSat in order to	Standard Operating Procedures (SOPs) with up to 8 relevant institutions have been	LDCF	905,000	11,000,000

¹ Project ID number will be assigned by GEFSEC.

² When completing Table A, refer to the excerpts on [GEF 6 Results Frameworks for GETF, LDCF and SCCF](#).

capacity building and implementation support		<p>develop partnerships and Standard Operating Procedures (SOPs) for delivery of service</p> <p>Strengthening of the Quality Management Systems to raise standards and quality control/verification procedures across the institutions</p> <p>Implementation of a long-term and on-demand capacity development and training program for staff..</p>	<p>developed or revised to avoid institutional overlap and improve hydromet data sharing and service delivery</p> <p>Design and implementation of a Quality Management System (QMS) for services delivered to aviation, early warning systems and agriculture</p> <p>Motivational and qualification upgrade trainings for up to 360 professionals in collaboration with international organizations like WMO</p>			
Component B. Modernization of equipment, facilities and infrastructure for basic observation and forecasting	Inv	<p>Improvement of MettelSat's hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors)</p> <p>Improvement of MettelSat's transmission, data management and data dissemination hardware capacities</p> <p>Refurbishment of facilities needed to support the services;</p> <p>Installation of technical systems and software for performing meteorological, hydrological and climate modelling and forecasting</p>	<p>The data from up to 80 stations is feeding the central online data platform on time</p> <p>ICT equipment including modems, routers, power supply and data collection systems, and tools to verify/clean data records</p> <p>Renewal of the central infrastructure and improvement of the buildings of some regional centers, and rehabilitation or improvement of up to 40 stations</p> <p>Creation of an access to WMO Global telecommunication System (GTS) and Eumetsat EumetCast for MettelSat to use more optimally international numerical</p>	LDCF	3,080,000	11,000,000

			weather prediction models			
Component C. Improvement of hydromet information service delivery	TA	Definition of requirements and development of feedback mechanisms with different user groups (in line with the National Framework for Climate Services) Development of customized products and services made available to user groups through dedicated interfaces; priority target end-users are those involved in (a) agro-meteorological information services, (b) food security; (c) civil protection emergency and contingency plans; and (d) aviation	Hydromet products and services are developed in line with identified user requirements (appropriate parameters, lead time, resolution, frequency, formatting and timing) Up to 4 different user groups have shared their needs and a resulting action plan to address them has been issued A Central Production System is installed to produce products tailored to users' needs, with a specific attention to services for flash flood warning, aviation and agriculture	LDCF	1,077,980	10,405,020
	(select)			(select)	0	0
	(select)			(select)		
	(select)			(select)		
Subtotal					5,062,980	32,405,020
Project management Cost (PMC) ³				LDCF	266,472	294,980
Total GEF Project Financing					5329452	32700000

If Multi-Trust Fund project: PMC in this table should be the total and enter trust fund PMC breakdown here ()

C. SOURCES OF CONFIRMED COFINANCING FOR THE PROJECT BY SOURCE AND BY NAME (\$)

Please include letters confirming [cofinancing](#) for the project with this form

Sources of Co-financing	Name of Co-financier (source)	Type of Cofinancing	Cofinancing Amount (\$)
GEF Agency	World Bank (GFDRR)	Grant	2,700,000
GEF Agency	World Bank (P129713)	Loan	20,000,000
GEF Agency	World Bank (P124720)	Loan	10,000,000
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	

³ PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

Total Co-financing	32,700,000
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D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY¹

GEF Agency	Trust Fund	Country Name/Global	Focal Area	Programming of Funds	(in \$)		
					GEF Project Financing (a)	Agency Fee (b) ²	Total (c)=a+b
WB	LDCF	Democratic Republic of Congo	Climate Change	(select as applicable)	5,329,452	506,298	5,835,750
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
(select)	(select)		(Select)	(select as applicable)			0
Total Grant Resources					5,329,452	506,298	5,835,750

¹ In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.

² Refer to the [Fee Policy for GEF Partner Agencies](#)

E. DOES THE PROJECT INCLUDE A “NON-GRANT” INSTRUMENT? No

(If [non-grant instruments](#) are used, provide in Annex B an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

F. PROJECT'S TARGET CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL BENEFITS⁴

Provide the expected project targets as appropriate.

Corporate Results	Replenishment Targets	Project Targets
1. Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society	Improved management of landscapes and seascapes covering 300 million hectares	<i>hectares</i>
2. Sustainable land management in production systems (agriculture, rangelands, and forest landscapes)	120 million hectares under sustainable land management	<i>hectares</i>
3. Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services	Water-food-ecosystems security and conjunctive management of surface and groundwater in at least 10 freshwater basins;	<i>Number of freshwater basins</i>
	20% of globally over-exploited fisheries (by volume) moved to more sustainable levels	<i>Percent of fisheries, by volume</i> ■
4. Support to transformational shifts towards a low-emission and resilient development path	750 million tons of CO _{2e} mitigated (include both direct and indirect)	<i>Metric tons</i>
5. Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern	Disposal of 80,000 tons of POPs (PCB, obsolete pesticides)	<i>Metric tons</i>
	Reduction of 1000 tons of Mercury	<i>Metric tons</i>
	Phase-out of 303.44 tons of ODP (HCFC)	<i>ODP tons</i>
6. Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks	Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries	<i>Number of countries</i>
	Functional environmental information systems are established to support decision-making in at least 10 countries	<i>Number of countries</i>

⁴ Update the applicable indicators provided at PIF stage. Progress in programming against these targets for the projects per the *Corporate Results Framework* in the [GEF-6 Programming Directions](#), will be aggregated and reported during mid-term and at the conclusion of the replenishment period. There is no need to complete this table for climate adaptation projects financed solely through LDCF and/or SDCF.

ANNEX A: PROJECT PREPARATION GRANT (PPG) REPORTING⁵

PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

PPG Grant Approved at PIF: 150,000			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Institutional workshop on evaluating cost recovery	7,500	0	0
Development of a provisional website for national meteorology, MettelSat and the project	5,000	0	0
Institutional diagnosis (mandate, resources, services)	64,000	0	0
Evaluation of the status of Quality Management at MettelSat	25,000	0	0
Missions for participation of MettelSat staff in technical diagnosis	12,000	0	0
Preparation of the ToRs for the Management firm (design, monitoring and evaluation)	9,000	0	0
Needs assessment related to MettelSat Hq buildings refurbishing	5,000	0	0
Recrutement of assistant-coordinator and fiduciary colleagues	22,500	0	0
Total	150,000	0	0

ANNEX B: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used)

Provide a calendar of expected reflows to the GEF/LDCF/SCCF Trust Fund or to your Agency (and/or revolving fund that will be set up)
n/a

⁵ If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities; and report to Trustee on the closing of PPG in the quarterly report to Trustee.

Document of
The World Bank

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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON PROPOSED GRANTS

IN THE AMOUNT OF US\$5,329,452 FROM THE GLOBAL ENVIRONMENT FACILITY'S
LEAST DEVELOPED COUNTRIES FUND (GEF LDCF)

AND

IN THE AMOUNT OF US\$2,700,000 FROM THE GLOBAL FACILITY FOR DISASTER
REDUCTION AND RECOVERY (GFDRR)

TO THE

GOVERNMENT OF THE DEMOCRATIC REPUBLIC OF CONGO (DRC)

FOR A

Strengthening Hydro-Meteorological and Climate Services PROJECT (P159217)
{RVP/CD CLEARANCE DATE}

Social, Urban, Rural and Resilience Global Practice
AFRICA

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CURRENCY EQUIVALENTS

(Exchange Rate Effective {Apr 07, 2016})

Currency Units	
SDR _{xxx} =	US\$1
US\$ _{xxx} =	SDR 1

FISCAL YEAR

January 1 - December 31

ABBREVIATIONS AND ACRONYMS

AAL	Average Annual Loss
AAP	Average Annual Population affected
ACE	National Environment Agency (<i>Agence Congolaise de l'Environnement</i>)
ACMAD	African Center of Meteorological Applications for Development
AFD	French Development Agency (<i>Agence Francaise de Développement</i>)
AFDB	African Development Bank
AMESD	African Monitoring of the Environment for Sustainable Development
ARMP	Market Regulation Authority (<i>Agence de Régulation des Marchés Publics</i>)
ASECNA	Agency for Aerial Navigation Safety in Africa and Madagascar
AWS	Automatic Weather Stations
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
BEAU	Architecture and Urbanism Design Office (<i>Bureau d'Etudes d'Architecture et d'Urbanisme</i>)
BIP-M	Basic Instruction Package for Meteorologist
CAS	Country Assistance Strategy
CEMAC	Central Africa Economic Community (<i>Communauté Économique et Monétaire des Etats de l'Afrique Centrale</i>)
CFAA	Country Financial Accountability Assessment
CGPMP	Project Management and Public Markets Cell (<i>Cellule de Gestion des Projets et des Marchés Publics</i>)
CICOS	Congo-Oubangui-Sangha Basin Intergovernmental Commission (<i>Commission Internationale du Bassin Congo-Oubangui-Sangha</i>)
CNIE	National Environment Information Center (<i>Centre National d'Information sur l'Environnement</i>)
COFED	European Development Fund National Authorizing Officer Support Unit
CONAPAC	National Congolese Confederation of Farming Producers
COPACO-	Congolese farmers' Confederation

PRP	
COP21	21st Conference of Parties
CPTM	Project implementation unit of the Multimodal Transport Project
CQ	Consultant Qualification
CRCE	Cellule Réglementation et Contentieux Environnementaux
CRG	Geophysics Research Center (<i>Centre de Recherche en Géophysique</i>)
CSO	Civil Society Organization
CTB	Belgian Cooperation (<i>Coopération Technique Belge</i>)
CVM	Maritime Transport Authority (<i>Congolaise des Voies Maritimes</i>)
DA	Designated Account
DCP	Data Collection Platform
DFID	Department for International Development
DMVN	Navy and River Transportation Directorate
DRC	Democratic Republic of Congo
ECWMF	European Centre for Medium-Range Weather Forecasting
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EP	Exceedance Probability
EU	European Union
Eumetsat	European Organization for the Exploitation of Meteorological Satellites
EWS	Early Warning Services
FAO	Food and Agriculture Organization of the United Nations
FB	Fixed Budget
FFGS	Flash Flood Guidance System
FM	Financial Management
FTP	File Transfer Protocol
GDP	Gross Domestic Product
GEEC	Groupe d'Etudes environnementales du Congo
GEF	Global Environment Facility
GFCS	Global Framework for Climate Services
GFDRR	Global Facility for Disaster Reduction and Recovery
GMES	Global Monitoring for Environment and Security
GPN	General Procurement Notice
GPRS	General Packet Radio Service
GRS	Grievance Redress Service
GTS	Global Telecommunication System
HFA	Hyogo Framework for Action
HRC	Hydrologic Research Center
HYCOS	Hydrological Cycle Observation System
IBRD	International Bank for Reconstruction and Development
IC	Individual Consultants
ICAO	International Civil Aviation Organization
ICB	International Competitive Bidding

ICR	Implementation completion and results
ICT	Information and communications technology
IDA	International Development Association
IFAC	International Federation of Accountants
IFR	Interim Financial Report
IGF	General Finance Authority (<i>Inspection Générale des Finances</i>)
INDC	Intended Nationally Determined Contribution
INERA	National Agronomical Study and Research Institute (<i>Institut National pour l'Etude et la Recherche Agronomiques</i>)
IP	Indigenous People
ISP	Implementation Support Plan
ISR	Implementation Status and Results
ISTA	Applied Studies Institute (<i>Institut Supérieur des Techniques Appliquées</i>)
LAM	Local Area Model
LCS	Least-Cost Selection
LDCF	Least Developed Countries Fund
M&E	Monitoring and Evaluation
MECNDD	Environment, Nature Conservancy and Sustainable Development Institute (<i>Ministère de l'Environnement, de la Conservation de la Nature et du Développement Durable</i>)
MESA	Monitoring for Environment and Security in Africa
MettelSat	National Agency for Meteorology and Remote Sensing
MoF	Ministry of Finance
MoTC	Ministry of Transportation and Communication Channels
MoU	Memorandum of Understanding
MSG	Meteosat Second Generation
MTAP	Projet de Transition Météorologique en Afrique
MTR	Mid Term Review
NAPA	National Adaptation Program for Action
NCB	National Competitive Bidding
NGO	Non-Governmental Organization
NMHS	National Hydrological and Meteorological Services
NOAA	National Oceanic and Atmospheric Administration
NPV	Net Present Value
NSC	National Steering Committee
NWP	Numerical Weather Prediction
OCHA	Office for the Coordination of Humanitarian Affairs
O&M	Operation and Maintenance
OP	Operational Policy
OP/BP	Operational Policy/Bank Procedure
PAARSA	Agriculture Rehabilitation and Recovery Project (<i>Projet d'Appui à la Réhabilitation et Relance du Secteur Agricole</i>)

PAD	Project Appraisal Document
PANA-ASA	Projet de renforcement des capacités d'adaptation et de gestion des impacts des changements climatiques sur la production agricole et la sécurité alimentaire en République Démocratique du Congo
PANA-AFE	Climate Adaptation and Resilience Project for Women and Children
PANA-ZC	Climate Adaptation and Resilience Project for Coastal Risk Management in Moanda Region
PEFA	Public Expenditure and Financial Accountability
PER	Public Expenditures Review
PIC	Project Implementation Cell
PIM	Project Implementation Manual
PMR	Procurement Management Report
PMURR	Multisector Emergency, Rehabilitation and Reconstruction Program (<i>Programme multisectoriel d'urgence de réhabilitation et reconstruction</i>)
PDO	Project Development Objectives
PSRP	Poverty Reduction Strategy Paper
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
QMS	Quality Management Systems
REGIDESO	Water Distribution Authority (<i>Régie de Distribution d'Eau</i>)
RPF	Resettlement Policy Framework
RVA	Airways authority (<i>Régie des Voies Aériennes</i>)
RVF	Waterways authority (<i>Régie des Voies Fluviales</i>)
SADC	Southern African Development Community
SADIS	Satellite Distribution System
SCTP	Congolese Company for Transportation and Ports
SEA	Sectoral environmental assessment
SERBaK	Monitoring and Evaluation of Water Resources of the Kasai Watershed
SNCC	Congo National Railway Company
SNEL	National Electricity Company (<i>Société Nationale d'Électricité</i>)
SOP	Standard Operating Procedures
SORT	Systematic Operations Risk- Rating Tool
SPN	Specific Procurement Notice
SSB	Single Side Band
SSS	Single Source Selection
SWFDP	Severe Weather Forecasting Demonstration Project
SYNOP	Surface synoptic observation
THEMA	Thematic Action
ToR	Terms of Reference
TTL	Task team Leader
UKMO	UK Met Office
UNAGRICO	National Union of Congolese Farmers

UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UNHAS	United Nations Humanitarian Air Service
UPS	Uninterruptible Power Supply
USAID	United States Agency for International Development
USD	United States Dollar
VSAT	Very small aperture terminal
VSL	Value of statistical lives
WB	World Bank
WIS	WMO Information System
WMO	World Meteorological Organization
WRI AGFA	World Resources Institute Aqueduct Global Flood Analyzer
WTP	Willingness-To-Pay

Regional Vice President: **Makhtar Diop**
Country Director: **Ahmadou Moustapha Ndiaye**
Senior Global Practice Director: **Ede Jorge Ijjasz-Vasquez**
Practice Manager: **Sameh Naguib Wahba Tadros**
Task Team Leader(s): **Jean Baptiste Migraine**

BASIC INFORMATION

Regionally tagged?	Country	Lending Instrument
No	Democratic Republic of Congo	Investment Project Financing

Situations of Urgent Need or Assistance/or Capacity Constraints

Financial Intermediaries

Series of Projects

Approval Date	Closing Date	Environmental Assessment Category	Focal Area
13-Oct-2016	31-Dec-2021	B - Partial Assessment	Climate change
Bank/IFC Collaboration	Joint Level		
No	No		

Proposed Development Objective(s)

The proposed Project Development Objective (PDO) is to improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors.

Components

Component Name	Cost (USD)	Comments
Component A. Institutional and regulatory strengthening, capacity building and implementation support	US\$1,355,000	Component A will invest in strengthening institutional setup and building capacity of human resources: i) reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) for delivery of service; ii) strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions; iii) implement a long-term and on-demand capacity development and training program for staff.
Component B. Modernization of equipment, facilities and infrastructure for basic observation and forecasting	US\$4,568,000	Component B will finance i) hydrological and meteorological monitoring networks; ii) transmission, data management and data dissemination hardware; iii) refurbishment of facilities needed to support the services; and iv) technical systems and software for

		performing meteorological, hydrological and climate modelling and forecasting.
Component C. Improvement of hydromet information service delivery	US\$1,545,000	Component C will provide technical assistance for delivery of more accurate, timely and user-friendly products and services to users and decision-makers.
Component D. Project Management	US\$561,452	This component will finance incremental operating costs; technical design of sub-projects; procurement, financial management, safeguards, monitoring & evaluation, quality control and contract management; and audit; as required under various project components.

Organizations

Borrower : Government of Democratic Republic of Congo

Implementing Agency : National Agency of Meteorology and Satellite Remote Sensing (MettelSat)

PROJECT FINANCING DATA (IN USD MILLION)

<input type="checkbox"/> Loan	<input type="checkbox"/> IDA Grant	<input type="checkbox"/> IDA Credit	<input checked="" type="checkbox"/> Trust Funds	<input type="checkbox"/> Other
Total Project Cost:	Total Bank Financing:		Financing Gap:	
8,029,452	8,029,452		0.00	

Financing (in USD Million)

Financing Source	Amount
Global Environment Facility (GEF) – LDCF Project Grant	5,329,452
Global Facility for Disaster Reduction and Recovery	2,700,000
Total	8,029,452

Expected Disbursements (in USD Million)

Fiscal Year	FY17	FY18	FY19	FY20	FY21
Annual	300,000	700,000	3,000,000	3,000,000	1,029,452
Cumulative	300,000	1,000,000	4,000,000	7,000,000	8,029,452

INSTITUTIONAL DATA

Practice Area (Lead)

Social, Urban, Rural and Resilience Global Practice

Contributing Practice Areas

Agriculture
Transport
Energy

Cross Cutting Topics

- Climate Change
- Fragile, Conflict & Violence
- Gender
- Jobs
- Public Private Partnership

Sectors / Climate Change

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Agriculture, fishing, and forestry	General agriculture, fishing and forestry sector	25	25	
Public Administration, Law, and Justice	Public administration-Transportation	25	25	
Information and communications	Information technology	25	25	
Water, sanitation and flood protection	Flood protection	25	25	
Total		100		

Themes

Major Theme	Theme	%
Social protection and risk management	Natural disaster management	40
Rural development	Rural services and infrastructure	20
Environment and natural resources management	Climate change	20
Environment and natural resources management	Water resource management	20
Total		100

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF

Yes

Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment

Yes

Include Indicators in results framework to monitor outcomes from actions identified in (b)

Yes

SYSTEMATIC OPERATIONS RISK- RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	● Substantial
2. Macroeconomic	● Substantial
3. Sector Strategies and Policies	● Moderate
4. Technical Design of Project or Program	● Substantial
5. Institutional Capacity for Implementation and Sustainability	● Substantial
6. Fiduciary	● Substantial

7. Environment and Social	● Moderate
8. Stakeholders	● Low
9. Other	
10. Overall	● Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

Yes No

Does the project require any waivers of Bank policies?

Yes No

Have these been approved by Bank management?

Yes No

Is approval for any policy waiver sought from the Board?

Yes No

Does the project meet the Regional criteria for readiness for implementation?

Yes No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✓	
Natural Habitats OP/BP 4.04		✓
Forests OP/BP 4.36		✓
Pest Management OP 4.09		✓
Physical Cultural Resources OP/BP 4.11		✓
Indigenous Peoples OP/BP 4.10		✓
Involuntary Resettlement OP/BP 4.12		✓
Safety of Dams OP/BP 4.37		✓
Projects on International Waterways OP/BP 7.50		✓
Projects in Disputed Areas OP/BP 7.60		✓

Legal Covenants

Conditions

PROJECT TEAM

Bank Staff

Name	Role	Specialization	Unit
Jean Baptiste Migraine	Team Leader(ADM Responsible)	Early Warning Systems	GSU13
Lanssina Traore	Procurement Specialist(ADM Responsible)	Procurement	GGO07
Clement Tukeba Lessa Kimpuni	Procurement Specialist	Procurement	GGO07
Saidou Diop	Senior Financial Management Specialist	Financial Management	GGO25
Francis Tasha Venayen	Financial Management Specialist	Financial Management	GGO25
Aissatou Diallo	Team Member	Disbursement	WFALA
Claude Lina Lobo	Safeguards Specialist	Environmental Safeguards	GEN07
Grace Muhimpundu	Team Member	Safeguards	GSU01
Isabella Micali Drossos	Counsel	Legal	LEGAM
Joelle Mudi Nke	Team Member	Team Assistant	AFCC2
Laurence Elodie Esther Fanny Chalude	Team Member	Disaster Risk Management and Results Monitoring	GSU13
Lucienne M. M'Baipor	Safeguards Specialist	Social safeguards	GSU01
Marc Pierre Jacques Edmond Gillet	Team Member	Hydro-meteorologist	GSU13
Michel De Marigny	Counsel	Disbursement	WFALA
Robert Curle Jesse Reid	Team Member	Disaster Risk Management and Economic Analysis	GSU19
Lorenzo Carrera	Team Member	Economic Analysis	GSU13
Charlotte Yaiche	Team Member	Fragility and Institutional Strengthening	GSU13
Peter Chen	Team Member	General Advising	GSU13

Extended Team

Name	Title	Organization	Location
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I. STRATEGIC CONTEXT

A. Country Context

1. **The Democratic Republic of Congo (DRC) is located in west equatorial Africa and is the continent's third largest country.** An abundance of natural, forest and water resources are found across its 2.3 million square kilometers. DRC's climate is equatorial (warm and moist) in the center of the country, and tropical in the south and north. Rainfall, which is generally affected by the displacements of the Inter Tropical Convergence Zone (ITCZ), is regular and abundant, with a long-term average of around 1,490 mm per year.
2. **Despite its rich natural resources, the DRC has often been associated with political instability and poverty.** Since reaching independence in 1960, two wars have severely affected the country's economic performance and human security and left over 3 million people dead with nearly as many internally displaced. They have also led to continued rebellion in eastern DRC. As for poverty, with a per capita Gross National Income of US\$380 (World Bank, 2014), DRC's population – estimated at about 74.88 million (World Bank, 2014) – is among the most vulnerable in the world. Nearly 64% (World Bank, 2012) of its population lives below the extreme poverty line (less than US\$1.25/day). Food insecurity remains pervasive and a majority of people lack access to basic health. With a life expectancy of 58 years (World Bank, 2012) and severe child mortality (100 deaths/1,000 births), the DRC falls far behind other sub-Saharan African countries.
3. **The economy is growing fast, with an average increase of 7 to 9 percent in the Gross Domestic Product (GDP) per year and a large part of the economy is climate sensitive.** The main climate sensitive sectors in the DRC's economy are agriculture (39 percent of GDP in 2011), trade, construction and hydropower (60 percent of Africa's total hydropower potential is in DRC, however only 2.5% is tapped so far). Agriculture employs 62 percent of the nation's men and 84 percent of its women. Being an oil importer, the DRC is not suffering from the falling of oil prices. However, its economy may experience lower growth due to the sustained fall in the prices of metal, of which the DRC is a major exporter. Growth of agriculture remains an essential priority to the country's economic development.
4. **The country presents a clear deficit in relation with its infrastructure.** The DRC probably has the most challenging transport infrastructure in Africa, with a conjunction of geographic challenges, lack of investment and conflicts. Ground transportation has always been difficult as the country's vast geography, low population density, extensive forests, and crisscrossing rivers complicate the development of infrastructure networks. The country has thousands of kilometers of navigable waterways and water transport has traditionally been the dominant means of moving around approximately two-thirds of the country, albeit with insufficient port infrastructure. Air transport is developing rapidly but requires intensive effort with regards to security. The national telecom system remains one of the least developed in the region.
5. **Urban areas are increasingly becoming vulnerable to flooding.** For instance, at least 31 people died and 20,000 families were made homeless in November-December 2015 after weeks of heavy rain in the capital of Kinshasa. A sprawling city of more than 10 million people, Kinshasa has notoriously poor infrastructure, with improvised wooden shacks lining the waterfront and dirt



roads that often collapse, and is heavily exposed to flooding. The DRC is undergoing a rapid and unplanned urbanization process, with the twelve largest cities estimated to be growing at 4.7 percent annually. This results in unplanned development of cities, which in turn undermines economic growth, posing challenges to urban poverty reduction and provision of adequate urban services.

B. Sectoral and Institutional Context

Sectoral Context:

6. **Climate change is a prioritized development challenge for the Government of the DRC.** Under the Poverty Reduction Strategy Paper (PRSP-2) adopted in 2012, Pillar Five entitled “Provide Balanced and Sustainable Development” calls for “Environmental Protection and Combatting Climate Change”. In particular, the Government seeks to build resilience against the impact of climate change on agriculture, water resources and vector-borne diseases. However, there is still limited knowledge about the potential effects of climate change and increased variability in the DRC. Rising temperatures are predicted to cause a surge in crop diseases such as cassava mosaic virus, and droughts will cause major disruption to the agricultural calendar, resulting in failure of both food and cash crops, and intensifying food insecurity and poverty. Climate simulations for the region indicate that rainfall will become more intense and more destructive over the coming years, bringing floods, landslides and soil erosion, especially in the region of the central Congo basin. Although the possible effects of El Niño on precipitation remain still poorly documented in the DRC, torrential rains and subsequent flooding are already causing substantial impacts and losses. From October 2015 to March 2016 flood events along the Congo River Basin resulted in major impacts, including loss of lives, destruction of thousands of homes, vital food stocks and crops, and public infrastructure, with an estimated 550,000 people affected, including from large outbreaks of cholera. By contrast, climate simulations show that the rainy seasons will become shorter in the south, which is largely made up of the dry savannah belt and accounts for 80% of the rural population. Impacts from drought and water scarcity could be further exacerbated by El Niño variability, which has clear and documented drying effects over East Africa.
7. **An effective capacity to monitor and forecast hydro-meteorological (hydromet) conditions and transfer improved knowledge into decision making and planning is critical to increasing the DRC’s adaptation ability and resilience.** For instance, systematic meteorological and hydrological data collection is needed to establish early warning systems for wind storms, floods, drought and other hazards, preventing losses of human lives, delivering reliable information to farmers, and increasing accessibility and reliability of agriculture insurance products.
8. **Understanding hydromet and climate risks would help assess social and economic impacts and develop adequate policy responses to support the country’s sustained development.** A number of economic sectors in the DRC could specifically benefit from more accurate, relevant and timely hydromet information, warning and services. In particular, these sectors include: (i) airfreight and aviation, (ii) early warning, disaster reduction and civil protection, and (iii) agriculture investment and food productivity. Greater understanding, monitoring and forecasting of severe weather and weather events could result in reduced loss of life and property,



economic gains and prevention of losses, and most importantly, improved adaptation capacity within sectors having to adapt to the negative impacts of climate variability and change. According to USAID (2012) only 28% of rural households have improved water sources, including 2% that have water piped into their residences: as a result 43 million people, mostly women, are thus compelled to carry water, often for significant distances, for all household needs.

9. **Strengthening of hydro-meteorological services is considered a flagship program as part of the World Bank Climate Business Plan** presented at the 21st United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP21). The Africa Hydromet Program, launched in June 2015 as a partnership framework involving The World Bank, the Africa Development Bank and WMO (World Meteorological Organization) and other partners, will support the enhancement of climate- and disaster-resilience capacity in targeted Sub-Saharan countries, by strengthening hydromet, end-user (including early warning), and knowledge and advisory services and linking national systems with regional and global counterparts. The program aims to mobilize financial resources over time to strengthen national hydromet services by providing the investment, technical assistance, and capacity building needed for integrated modernization.

Institutional Context:

10. **The mandate for hydromet services resides in the Ministry of Transportation and Communication Channels (Ministère des Transports et Voies de Communications - MoTC) and the National Agency for Meteorology and Remote Sensing (Agence Nationale de Météorologie et de Télédétection par Satellite - MettelSat).** In the DRC, National Hydrological and Meteorological Services (NMHS) are provided by MettelSat, which monitors and forecasts weather, water and climate and is responsible for remote sensing, operational hydrology, thematic cartography, and environmental monitoring. Recently, the Government has expanded MettelSat's mandate on hydrological observation and forecasting (with the expectation that its Department of Hydrology will grow). Additional observation and forecasting is done by the Waterways Authority (RVF), the Airways Authority (RVA) and the Maritime Authority (CVM). Specifically, meteorological assistance to aviation handled by RVA works somewhat independently and better as RVA is a semi-commercial agency that has to comply with the International Civil Aviation Organization (ICAO) regulations and benefits from air traffic levies from airlines for airport and in-flight services.
11. **Overall, the national observation network is in a generally degraded condition and MettelSat faces significant challenges in delivering basic services to users (e.g. aviation, civil protection, agriculture, and the general public).** In the early 1960s, MettelSat had a network of 125 synoptic stations, 700 rainfall stations, 6 upper air stations and other infrastructure. At present, MettelSat has 22 manual synoptic stations and 27 automatic weather stations (AWS). All other essential elements of the observation system, such as upper air, meteorological radars, wind profilers, lightning detection are non-existent or were shut down many years ago. The communications system, based on high frequency radio signals, emails and regular post office delivery, is very outdated, unreliable and not intended to work in real time. In terms of media, MettelSat does, however, have a studio to prepare radio and TV broadcasts. Maintenance and calibration facilities are obsolete, with only thermometer and humidity chambers still functioning. Today, only 10



hydrological stations are functioning - 5 on the Congo River and 5 on the Kasai River.

C. Higher Level Objectives to which the Project Contributes

12. The successful implementation of the project will promote mainstreaming disaster risk management and climate adaptation in higher-level sustainable development strategies such as the examples below:
13. **The proposed Project aligns with the World Bank Country Assistance Strategy (CAS) for DRC (FY13-FY16)**, which calls for the essential need to build the capacity to monitor and forecast hydromet in the DRC, in particular for building climate adaptation and resilience.
14. **The Project is also a critical element of the UN - World Bank joint commitment of US\$1 billion**, announced in May 2013, to the “Peace, Security and Cooperation Framework for the DRC and the Great Lakes Region” in collaboration with the region's governments, the Southern African Development Community (SADC) and the African Union. This includes financing for hydroelectric power plants, roads, and agricultural infrastructure – all of which depend on adequate hydrological and meteorological information.
15. **The World Bank Strategy for Africa¹** - the proposed project contributes directly to Pillar 2 of the Africa Strategy ‘Vulnerability and Resilience’ which emphasizes the need to address Africa’s infrastructure deficiencies as essential to achieving long-term sustainable growth. Specifically, this project will contribute to addressing vulnerability to macroeconomic and idiosyncratic shocks such as natural hazards, food shortages and climate variability.
16. **Africa Regional Disaster Risk Reduction Strategy**, -endorsed by the African Union's Assembly of Heads of State and Government in July of 2004; its Program of Action underwent a significant revision that included its extension to 2015 and alignment with the HFA²-. The Project supports the Strategy’s main goals of attaining sustainable development and poverty eradication through the reduction of social, economic and environmental impacts of disasters.
17. **World Bank African Strategy for Climate Adaption³**; The project is aligned with both core principles of the Strategy, namely: “supporting ongoing development efforts while making them more resilient to climatic risks” and “linking development, climate change adaptation, and disaster risk reduction as one integrated agenda”.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

18. The proposed Project Development Objective (PDO) is to improve the quality of the Government of the DRC’s hydro-meteorological and climate services in selected sectors.

¹ Africa’s Future and the World Bank’s Support to It, March 2011

² United Nations, Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, 22 January 2005. <http://www.unisdr.org/we/inform/publications/1037>

³ Making Development Climate Resilient - A World Bank Strategy for Sub-Saharan Africa, report # 46947-AFR, October 2009



B. Project Beneficiaries

19. Beneficiaries are identified as the priority target end-users of hydromet information, i.e., those involved in and receiving (a) weather forecasts through different media, including television and internet, (b) agro-meteorological information services, (c) extreme weather warnings (mostly in urban areas and along fluvial navigation channels), and (d) aviation services. The table presented in Annex 6 lays out how the step-wise augmentation of MettelSat's capabilities will enable more sophisticated service delivery.
20. To measure progress during project implementation, MettelSat will undertake a survey with respective user groups each year to get an estimate of the number of beneficiaries reached through enhanced delivery of services. This survey will correspond to the above system so different user groups will be surveyed each year. The resulting data will be gender disaggregated. It is anticipated that beneficiaries will be more men than women in the first year, as it is expected that more men travel by air and have access to internet than women in DRC. In the latter years of the project, it is anticipated that this will balance out as the project carries out more targeted interventions in pilot communities, in both rural and urban areas. It is estimated that by the end of the project almost three million (2,979,690) people will benefit from the project.

C. PDO Level Results Indicators

21. The Results Framework (Annex 4) will be used to monitor progress towards achievement of the PDO and of intermediate indicators. Indicators would be collected and updated at the minimum with an annual frequency, while some indicators would be updated every trimester. The PDO level indicators identified are as follows:
 - a. Improved hydromet service delivery to key user groups;
 - b. Operational forecast, climatology and production;
 - c. Direct project beneficiaries (number), of which female (percentage)
22. An improvement of MettelSat technical capacities to provide basic services to key user groups will be assessed based on a four-level system that considers both the capabilities and capacity of MettelSat, as well as its ability to connect with key user groups in order to provide services that serve different needs.
23. From the MettelSat capacity development stand-point, a four-level system will be used to demonstrate the different phases of capacity development that MettelSat is expected to follow: Level 1: operational forecast is produced on paper on a daily basis for 24 hours; Level 2: strengthened use of remote sensing; forecast bulletins are updated every 6 hours to deal with extreme weather; Level 3: operational forecast is performed numerically and experimentally by crosscutting data from other stations, from remote-sensing and from other global and regional models; Level 4: operational forecast is performed numerically and systematically by crosscutting data from other stations, from remote sensing and from other global and regional models.
24. In terms of the provision of user services, the project will be designed around the ICAO Quality



Management System (QMS) approach. This approach encourages organizations to analyze customer requirements, define the processes that contribute to the achievement of a product which is acceptable to the customer, and keep those processes controlled. This approach expresses the need for validation and verification procedures to be established which ensure that quality requirements (accuracy, resolution, and integrity) and traceability of data are met. At the core is the "process approach", which defines a process as any activity that resources and transforms inputs into outputs. A simple example of an AIM process is data input to database which is converted to output for chart production. QMS requirements focus on systematically identifying, organizing, documenting, managing and improving processes, and interactions between processes. For the purposes of this project, this will be done with respect to three main user groups/sectors: aviation, agriculture and civil protection, with specific systems setup to service each one to ensure consistent service delivery.

III. PROJECT DESCRIPTION

A. Project Components

25. **Component A. Institutional and regulatory strengthening, capacity building and implementation support** (US\$1,355,000) will invest in strengthening institutional setup and building capacity of human resources. This includes: i) reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) for delivery of service; ii) strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions; iii) implement a long-term and on-demand capacity development and training program for staff. Women are often not represented in environmental governance processes: their concerns as the primary beneficiaries are not included in policy design or implementation. Capacity building in gender awareness, along with promoting more women in hydro-meteorological services, will be supported under this component.
26. **Component B. Modernization of equipment, facilities and infrastructure for basic observation and forecasting** (US\$4,568,000) will finance: i) hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors); ii) transmission, data management and data dissemination hardware; iii) refurbishment of facilities needed to support the services; and iv) technical systems and software for performing meteorological, hydrological and climate modelling and forecasting. Few women are employed by the hydromet sector and/or water-sector agencies or utilities more broadly. In addition to ensuring that the modernization of equipment, facilities and infrastructure for basic observation and forecasting will include the participation of women, the equipment purchase should also take into account literacy level of the rural population, and limited resources for consumables such as batteries.
27. **Component C. Improvement of hydromet information service delivery** (US\$1,545,000) will provide technical assistance for delivery of more accurate, timely and user-friendly products and services to users and decision-makers. The component will specifically (i) define requirements and develop feedback mechanisms with different user groups (in line with the National Framework for Climate Services); and (ii) develop and deliver customized products and services made available



to user groups through dedicated interfaces. Priority target end-users are those involved in (a) agrometeorological information services, (b) food security; (c) civil protection emergency and contingency plans; and (d) aviation. This component will target beneficiaries with a gender-disaggregated approach. Within this context, the delivery of information will use a combination of media (radios, TV, newspapers), Internet, cellphone and smartphones to reach users according to their needs. Within the agriculture sector, women could learn from evening radio broadcasts, which could provide hands-on instruction, encouragement, and follow-up (USAID, 2012). The following steps are recommended: i) carry out gender analysis early, ensuring balance among the needs and interests of women, men, girls, and boys, and make sure it is comprehensively applied in detailed planning and implementation of all activities; ii) use sex-disaggregated statistics in all phases of work, and ensure prompt adjustments in response to intermediate results to promote better outcomes. iii) Build a solid and robust Monitoring and Evaluation System. The success of this service delivery component will be dependent upon how users of hydro-meteorological information will receive support (from other projects) in developing capacities at the right level (local governments, farmers' associations, etc.) in select zones in order to convert information into action/decision. This component is essential in promoting the image of the hydromet service to the public and decision makers and potentially generating new sources of revenues in the future.

28. **Component D. Project Management** (US\$561,452) will finance the following activities: (i) incremental operating costs; (ii) technical design of sub-projects; (iii) procurement, financial management, safeguards, monitoring and evaluation, quality control and contract management; and (iv) audit, studies and assessments required under various project components
29. **Areas of Interventions and specific criteria for pilot sites:** Some basic services will be provided at a national level (seasonal and daily forecasting, ten-day agrometeorological reports, etc.) while other more specialized services (such as flood forecasting systems, personalized agrometeorological information services, warning reports to anticipate impacts, etc.) will be provided to pilot zones to be identified based on the following general criteria: (i) presence of specific hydro-meteorological natural hazards; (ii) exposure of populations and critical infrastructures (urban zones, roadblocks, irrigation, transport, hospitals, schools, etc.); and (iii) presence of investment projects, which would allow for an optimal utilization of hydro-meteorological services (notably across urban development, agriculture and hydro-electricity).
30. More specifically, criteria for the selection of the 2 to 4 urban pilot sites will be i) the vulnerability of the municipalities to heavy rains; ii) the presence of populations affected by flash floods and erosion phenomena (at their houses, works place or public buildings providing essential services); and iii) the existing support in these municipalities of the World Bank Urban Development Project (P129713), to ensure optimal collaboration with the municipal authorities and maximization of benefits to the populations.
31. More specific criteria for the selection of the 3 rural pilot sites will be i) the vulnerability of farmers and agriculture workers to climate variabilities, including those linked to natural hazards like droughts and heavy rains affecting the normal cycle of the agriculture production; ii) the presence of established networks of farmers and/or NGOs (Caritas, World Vision, etc) supporting farmers and the agriculture production; and iii) the existing support in these areas by the World Bank Western Growth Pole Project (P124720) and/or the UNDP implemented PANA-AFE project, in order to rely on the existing lessons-learned and existing networks, and maximize



benefits.

32. **Relevant World Bank Operations in the DRC:** The Bank has a large portfolio with several ongoing operations across the urban, agriculture, transport, and energy sectors. Based on discussions with the projects' teams, the project will work closely with: i) the DRC Urban Development Project (P129713), which covers nine municipalities; ii) for agriculture and optimal use of the agriculture, the Western Growth Poles Project (P124720) in the Bas-Congo province, the Rehabilitation and Recovery Support Project (P092724) in Equateur, and the Regional Great Lakes Integrated Agriculture Development Project (P143307) in South Kivu; iii) Goma Airport Safety Improvement Project (P153085) in transport; and iv) the DRC Electricity Access & Services Expansion (EASE) (P156208). Establishing linkages and synergies across these projects will ultimately help support food security, vulnerability reduction and economic advantages. Annex 7 below describes the main synergies between the Hydromet Services Enhancement Project and relevant Bank and donors' projects in the DRC.
33. **Relevant partner initiatives in the DRC:** The ongoing cooperation activities by UNDP (United Nations Development Program), WMO (World Meteorological Organization), the European Union, the African Development Bank, SADC (Southern African Development Community), ACMAD (African Center Meteorological Applications for Development), and the Popular Republic of China have been taken into account to design the project. For a more detailed description of these activities, see Annex 7.

B. Project Financing

34. The lending instrument is Investment Project Financing, through two Grants, in the respective amounts of US\$5,329,452 provided by the Global Environment Facility (GEF) Least Developed Country Fund (LDCF) and US\$2,700,000 provided by the Global Facility for Disaster Reduction and Recovery (GFDRR). The total estimated project cost is US\$8,029,452. The implementation period is five years. In addition to the project financing, a project preparation grant of US\$150,000 has been provided by the Global Environment Facility (GEF) Least Developed Country Fund (LDCF).

Project Cost and Financing

Project Components	Project cost (US\$)	IBRD or IDA Financing (US\$)	Trust Funds – GEF LDCF (US\$)	Trust Funds - GFDRR (US\$)
Component A: Institutional and regulatory strengthening, capacity building and implementation support	1,355,000	0	905,000	450,000
Component B: Modernization of equipment, facilities and infrastructure for basic observation and forecasting	4,568,000	0	3,080,000	1,488,000



Component C: Improvement of hydromet information service delivery	1,592,980	0	1,077,980	515,000
Component D: Project management	513,472	0	266,472	247,000
Total Project Cost	8,029,452	0	5,329,452	2,700,000

C. Lessons Learned and Reflected in the Project Design

35. This project is prepared under the Africa Hydromet Framework Program. It is the first one prepared under the Program, which is jointly developed by the World Meteorological Organization, the African Development Bank and the World Bank Group. Being part of the Program, it will be able to pull lessons learned from decades of engagement of respective institutions in hydromet modernization projects and will focus on:
- a. improving hydromet and early warning capacity and strengthening networks through open data and information sharing;
 - b. leveraging partnerships and fostering interagency coordination to maximize economies of scale and regional integration and promote south-south cooperation to ensure transformational change and longer-term sustainability;
 - c. aligning with the principles of the Global Framework for Climate Services (GFCS) and identifying the requirements of users as a starting point for generation of services, products and data.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

36. The **implementing agency** will be MettelSat, defined in a decree of 2012 as the official national hydromet agency, a publicly funded technical and scientific service with legal status and financial autonomy under the Ministry of Transportation and Communication Channels and supported by the State Subsidiary Budget.
37. **Project National Steering Committee (NSC):** Since many other agencies and ministries have a stake in hydromet information generation, dissemination and use, a National Steering Committee will be established to coordinate project activities and ensure that they are harmonized with related activities of other government stakeholders. The role of the project National Steering Committee will be to provide overall policy direction on project implementation resolving any policy hurdles, inter-ministerial barriers or policy conflicts. The NSC will be responsible for approving the overall implementation plan and annual project budget, and will meet as often as needed but at least every quarter to review and follow up on project progress. The NSC will ensure that adequate staffing arrangements in MettelSat are in place. Within three months following effectiveness, the NSC will ensure that an Internal Audit Department is set up and adequately staffed with an internal auditor whose terms of reference will cover all activities under the project. The Chair of the Steering Committee will be the Secretary General of Transport and Communication. Annex 2 provides a list of the Steering Committee's members.



38. **Implementing Arrangements:** To facilitate project implementation a Project Implementation Cell (PIC) will be established within MettelSat, bringing together the required expertise from across the organization, and strengthening its capacity with consultants, where needed. The PIC will perform day-to-day project implementation activities and will also function as a Secretariat for the Steering Committee. Annex 2 provides a list of the PIC team's main members/functions.
39. The main responsibilities of the PIC will be to (a) prepare annual implementation plans for the project activities, as well as the annual budget, for Steering Committee approval; (b) carry out all work related to fiduciary functions including procurement, financial management, disbursement, audit, reporting and monitoring and evaluation. The PIC will be responsible for the overall project's fiduciary management and procurement in compliance with World Bank's regulations. The PIC will be responsible for processing all the International Competitive Bidding (ICB) and selected National Competitive Bidding (NCB) contracts and payments. In addition, the PIC will interact with relevant stakeholders, including non-governmental organizations (NGOs) and municipalities, to guide them in the implementation process where necessary.

B. Results Monitoring and Evaluation

40. The PIC will be responsible for the overall coordination of M&E activities and the preparation of periodic M&E reporting. The project M&E system will be based on the Results Framework and implementation arrangements. The PIC will take responsibility for data collection, and for following procedures and methods established within each involved Ministry.
41. The PIC will also take steps to build overall M&E capacity within the hydromet sector. This will include technology, equipment, training on data collection, content management, information updates and basic system troubleshooting and maintenance.
42. Gender indicators will be included in the M&E system. Although collecting outputs such as the number of women beneficiaries or the number of women trained is important, the project will consider outcomes that enable opportunities for women's empowerment. Better early warning systems should not only reach and be understood by both women and men, but also promote women's agency and exploit technical assistance more fully to reach wider development objectives⁴.

C. Sustainability

43. Sustainability is a challenge to hydromet services globally and presents risks to both GEF LDCF and GFDRR investments. In the past, MettelSat benefited from donor support that has not led to

⁴ Radio programming, for example, is preferable to text messaging, due to the country's limited cell phone coverage, and because of the high cost of sending teams to conduct interactive programs in remote locations. Radio programming should include debates and call-in question and answer programs to encourage the use of practical information. They should employ easy-to-understand serial stories (soap operas) of family life in the context of changing social and economic conditions to catalyze discussion and foster acceptability of more flexible roles for men and women. Some civil society innovators are planning women's radio programming, and there are reportedly more women trained in or working in media in DRC than in any other sector. If people listen to the experiences of others who call in for advice on improving their use of a new technique for child rearing cultivating for a new crop, they may be more inclined to try it themselves. Well-facilitated discussions about the acceptability of changing social norms may similarly contribute to greater openness to change and possibly serve as topics for debate within local associations (USAID, 2012).



sustainable achievements due to a lack of investment in operation and maintenance. To mitigate these risks, components 1 and 3 of the project will directly support an improvement of Mettelsat's capacities to recover the costs of its services, in particular from the aviation sector. In addition, attention will be given to: (i) the optimal use of hydromet equipment that can be easily maintained; (ii) a long-term plan for consolidating institutional, human and ICT capacity for modelling, forecasting and decision support systems; and (iii) developing other solutions to ensure financial sustainability in the hydromet sector. Already during project implementation, additional financing in the amount of US\$800,000 is included in the provisional budget of MettelSat to ensure availability of funds for operation and maintenance during and after project implementation.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

44. The overall risk for the proposed operation is rated as **substantial** with regards to risks anticipated during implementation, as well as with regards to sustainability of hydromet services in the long run. This will be mitigated, through strong management support, long-term capacity building activities, focus on quality standards and project planning, strengthening financial planning and management and balancing investments with consideration to long-term, optimal use. The team also considered the risk of inaction. If the World Bank is unable to provide support to DRC's hydromet services, new investments in economic sectors (such as transport, navigation, hydropower etc.) will face undermining uncertainties. Equally, with a continued weakened monitoring and analysis of water and weather, the Government of DRC may not be able to build resilience and adaptation capacity in the face of negative impacts of climate change. In line with the SORT table in the data sheet, the risks are indicated as follows:
- (i) **Political and Governance: Substantial.** This risk may interfere with hiring of international consultants and procurement of imports and supervision. However, the project will be implemented by MettelSat which is an independent legal entity, and should be able to operate in a difficult political environment; for this reason the risk is rated as substantial and not high.
 - (ii) **Macroeconomic: Substantial.** A satisfactory macro-economic environment can be expected over the duration of the project, however fluctuations are still likely to happen and could have impacts on imports of goods and services.
 - (iii) **Sector strategies and policies: Moderate.** The relationship and collaboration between ministries will require to be improved to ensure optimal use of hydromet products and services across sectors and realize all benefits; however this is expected to be supported under component 1.
 - (iv) **Technical design of the project: Substantial.** The design is relatively simple with one entity carrying out all project management activities, however, given the lack of experience of the entity with World Bank operations, additional supervision support is expected to be needed in order to ensure full delivery of services to customized services to end-users in selected sectors.



- (v) **Institutional Capacity for Implementation and Sustainability: Substantial.** The implementing agency would be MettelSat, which faces budgetary, governance and infrastructure challenges in a poverty-stricken and post-conflict context. Specific risks anticipated are related to the capacity of staff to develop new capacities and skills to maintain, operate and sustain the equipment used for observation, forecasting and service delivery; and, secure the necessary financial resources for the long-term sustainability and continued development of the services.
- (vi) **Fiduciary: Substantial.** MettelSat does not have experience with Bank policies and procedures. It is expected that these risks can be mitigated by hiring support and training services during implementation. Procedures for administration and finance will be detailed in the Project Implementation Manual.
- (vii) **Environmental and social: Moderate.** The project will have limited, if any, environmental or social impacts, and is expected to be Category B. Impacts would primarily be associated with (i) the installation and rehabilitation of observation equipment, (ii) any required establishment of access road or paths to these observation stations, and (iii) poor social and environmental safeguards management and implementation experience and capacity of Mettelsat.
- (viii) **Stakeholders: Low.** Stakeholder risks are assessed as low and the dissemination of customized services to users and stakeholders would be supported from other ongoing projects.

VI. APPRAISAL SUMMARY

A. Economic and Financial (if applicable) Analysis

45. To estimate the value of strengthening DRC's hydro-meteorological services, an economic analysis that estimates both costs and benefits of the proposed project has been undertaken. In this analysis, the assumed benefits derived by different economic sectors are estimated through benefit transfer methods. The analysis follows the overall structure of the "Triple Dividend of Resilience" framework⁵, which include: i) avoided damage and losses; ii) unlocked economic potential; iii) development co-benefits. For each dividend a set of sectoral benefits are considered, based on a "conservative" approach towards benefits' estimation, data availability and reliability constrains. Because of project's characteristics and baseline conditions of NMHS in the DRC, the project's benefits are considered as 10% of the benefits generally assigned to improved hydro-meteorological services. The time frame of the analysis is 15 years from project starting, assuming an average lifetime of equipment of 10 years and 30-40 years for buildings. The Benefit Cost Ratio of the project is also reported at project completion (5 years). Where a range of potential assumptions are generated, the most conservative values are taken, meaning that for a range of potential benefits the lowest value is used. This results in the analyzed net present value and benefit-cost ratio representing the lowest threshold of expected economic effectiveness; most

⁵ Tanner, T.M., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J.E., and Rajput, S. (2015). The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. www.odi.org/tripledividend.

likely the truly realized economic efficiency will be greater..

46. **The costs associated with the proposed project amount to a total of around US\$8 million.** During and beyond implementation, the economic analysis includes the costs for operation and maintenance and repair, at an assumed 10% of total project investment for modernization of equipment and new installations, along the time period of the analysis. Operation and maintenance (O&M) costs of the additional infrastructure (value US\$6 million) delivered by the Government of China to the DRC are also considered in the analysis. A present value of US\$17.65 million of costs is estimated using a 3% rate of discount.
47. **A net present value of the proposed project of US\$112.27 million is estimated, with a benefit-cost ratio of 7.36 to-1** using the baseline assumptions and a 3% rate of discount. The present value of benefits is estimated as the sum of the dividends of resilience provided by the project. The first dividend considers how improved forecasting and EWSs reduce national asset and livelihood losses. The second dividend considers how increased risk awareness and forecasting accuracy increases agriculture productivity. It also includes the benefits of reducing weather related risks to the aviation sector, through route optimization and landing. The third dividend considers the co-benefits to households, through a willingness to pay benefit transfer from Mozambique. The analysis shows a project's benefit-cost ratio (BCR) of 2.39 at project completion.

Summary table of benefit to cost analysis (BCA)	Present value (mil US\$)	Net Present Value (mil US\$)	Benefit-Cost Ratio (BCR) 5yrs	BCR 15 yrs
Project costs	17.65			
Benefits - First Dividend	30.93			
Benefits - Second Dividend	134.56			
Benefits - Third Dividend	1.69			
Project benefits	129.92	112.27	2.39	7.36

Table 1: Summary table of the proposed project BCA.

48. A basic sensitivity analysis is done with respect to assumptions on the discount rate, potential improvements in forecast quality and financial support to Mettelsat for operation and maintenance (O&M). Results are relatively insensitive to the discount rate and the same policy recommendation emerges whether using a 1%, 3% or 10% rate of discount. On the other hand, if the improvements in forecasts are less than assumed in the baseline BCA, a significant reduction in the net present value (NPV) is expected. Assuming only 5% rather than 10% of project's contribution to the potential overall benefits of improved hydro-meteorological services, the overall NPV falls by more than 50% and the BCR to 3.81. Finally, if there is no budget increase for the relevant agencies to support project operation and maintenance, the NPV estimates fall precipitously. In this case, while potentially having a positive NPV due to the short term benefits, it is assumed to generate no benefits after the system degrades again to pre-project levels within a few years.

Sensitivity Analysis	Parameter Value	Overall NPV	BCR 5 yrs	BCR 15 yrs
Baseline	3.00%	112.27	2.39	7.36



Discount Rate	1.00%	133.69	2.40	7.79
Discount Rate	10.00%	64.66	2.34	6.07
Percent improvement in forecast ¹	See Footnote 1	49.57	1.42	3.81
Failure to support budget for long-term operation, maintenance, and repair ²	See Footnote 2	25.28	2.39	2.43
¹ The benefit of the project are assumed 5% (instead of 10%) of the potential overall benefit of improved hydro-meteorological systems.				
² Assumes that there is no spending on operations maintenance and repair above and beyond the initial investment. Assumes that the benefits realized in the first five years then degrade proportionally over the following 5 years as the system returns to current (pre-project) status.				

Table 2 – Sensitivity analysis of the proposed project BCA.

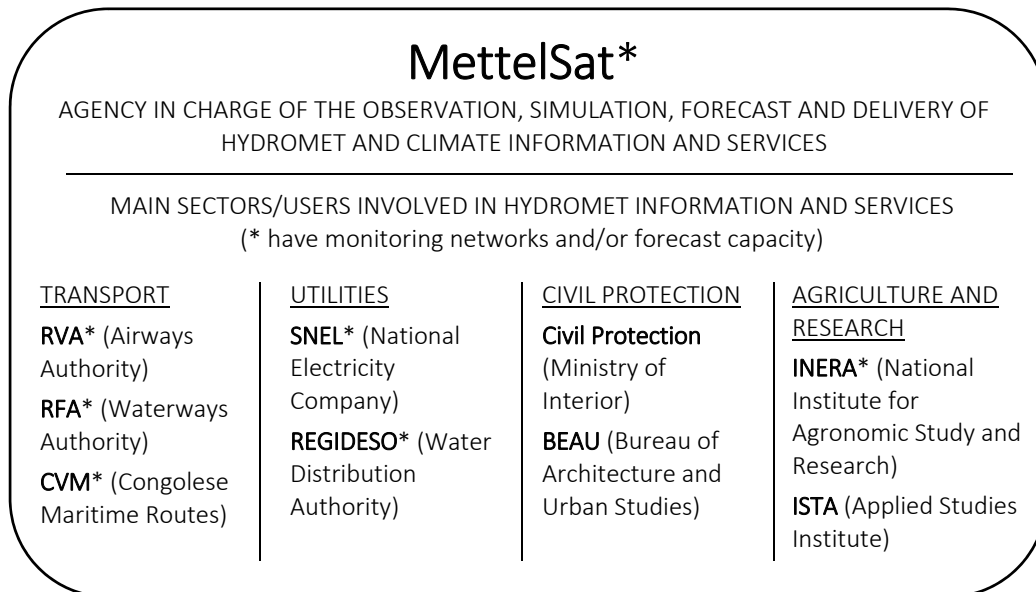
49. The analysis presents a number of omission, biases and uncertainties. This type of economic studies can consider only a part of the potential benefits and costs of a specific project, especially with respect to all of the potential indirect effects and co-benefits. This analysis only considers few sectoral benefits. For example, benefits do not include the value of statistical life by improving weather observation and forecast in the aviation sector and through early warning of natural hazards. Moreover, the analysis does not include the potential value of climate information for longer term planning of infrastructure such as dams and water resources, hydropower production and fluvial transportation facilities.
50. The World Bank adds value to the project by bringing its previous experience in supporting the preparation and implementation of projects supporting hydro-meteorological services (150 operations since the 1980s, a dozen projects implementation and many more at the conceptual stage). The Bank’s experience has led to the adoption of a holistic approach to the strengthening of these services. Currently, the Bank manages dedicated support programs such as the Global Facility for Disaster Reduction and Recovery (GFDRR) Hydromet Program, the Africa Hydromet Program, as well as several hydromet operations. The Bank also provides technical and financial assistance for increasing DRC’s resilience in the agriculture, urban development, energy and aviation sectors, through which potential linkages, synergies and use of hydromet services can be envisaged. Strengthening of hydro-meteorological services is considered an integral part of the World Bank climate business plan presented at the COP21. Improving hydromet services is integral to strengthening resilience to extreme weather events and enabling economic development across Sub-Saharan Africa. Specifically, accurate hydromet information is a critical requirement for i) developing water resources for irrigated agriculture, hydropower and improved water supply; ii) better planning for health services; iii) providing access to safe air and road transportation, and; iv) reducing the economic and social impacts of floods, drought and other extreme weather events.
51. The public sector vehicle is relevant given the public value of hydromet data and services which are critical for strategic and security matters, such as long-term planning for environment, social and economic development and protection of vulnerable population and their livelihoods. Hydromet services have an official mandate naturally fulfilled by the public sector. Partial cost-recovery through commercial activities may be targeted as part of the longer-term business plan of MettelSat but may not be achieved during implementation of the Project due to the large number



of beneficiaries spread in non-structured user groups and time needed to reach production of high-quality marketable services.

B. Technical

- 52. After 30-40 years of neglect, the DRC hydromet system needs considerable resources and efforts to rebuild its institutional framework, create the most basic infrastructure and develop a service delivery culture and capacity.
- 53. According to the decree N°12/40 of 2 October 2012 MettelSat is the agency in charge of meteorology, climatology and inventory of natural resources in the DRC. However, the current institutional context is highly fragmented. Roles and responsibilities for the hydrometeorological and climate observation and forecast are blurred and scattered across a number of entities. Over the last years, because of insufficient financial and human resource, and the institutional complexity, MettelSat has not been able to coordinate the different entities involved in hydromet information and services in the country (Figure 1).



*Figure 1: Institutional arrangement and main entities related to hydromet information and services in the DRC. Entities which have monitoring and/or forecast facilities/capacities are marked with *.*

- 54. Currently, the Government of the DRC is in the process of proposing a new legislation on meteorology. When approved, the law will provide a legal framework that will allow the coordination and harmonization of hydromet activities in accordance with the practices and standard procedures of WMO. The proposed legislation defines missions, mandates and responsibilities of the various entities involved in NMHS, with MettelSat as the leading agency.
- 55. The WMO Strategy for Service Delivery and its Implementation Plan⁶ will guide the improvement of hydromet service delivery to users and customers. WMO provides a flexible methodology to

⁶ WMO (2014). Strategy for Service Delivery and its Implementation Plan. World Meteorological Organization, Geneva, Switzerland.



help those services to evaluate their current service delivery practices and to serve as high-level guidance for developing more detailed methods and tools to improve the service delivery process. WMO strategy is based on a continuous cyclic process for developing and delivering services based on six elements necessary for moving towards a more service-oriented culture, which include: i) evaluate user needs and decisions; ii) link service development and delivery to user needs; iii) evaluate and monitor service performance and outcomes; iv) sustain improved service delivery; v) develop skills needed to sustain service delivery; and, vi) share best practices and knowledge.

56. Milestones for the implementation of the strategy are set for the short term, medium term and long term. The key tasks resulting from the implementation of the strategy over the short term are: i) an assessment of the current level of service delivery; ii) putting in place the necessary action plan to start improving service delivery, which should include strengthening user interaction; and, iii) an assessment of the resources required to implement the action plan. Over the medium term, the implementation plan aims to help a certain percentage of hydromet services gain at least one level in their service delivery development and to document the process and share lessons learned with other hydromet services. Over the long term, the aim of the strategy is to develop or strengthen a service culture and facilitate the mainstreaming of service delivery in the programs and activities of hydromet service providers, resulting in a tangible improvement in the user’s perception of their services.

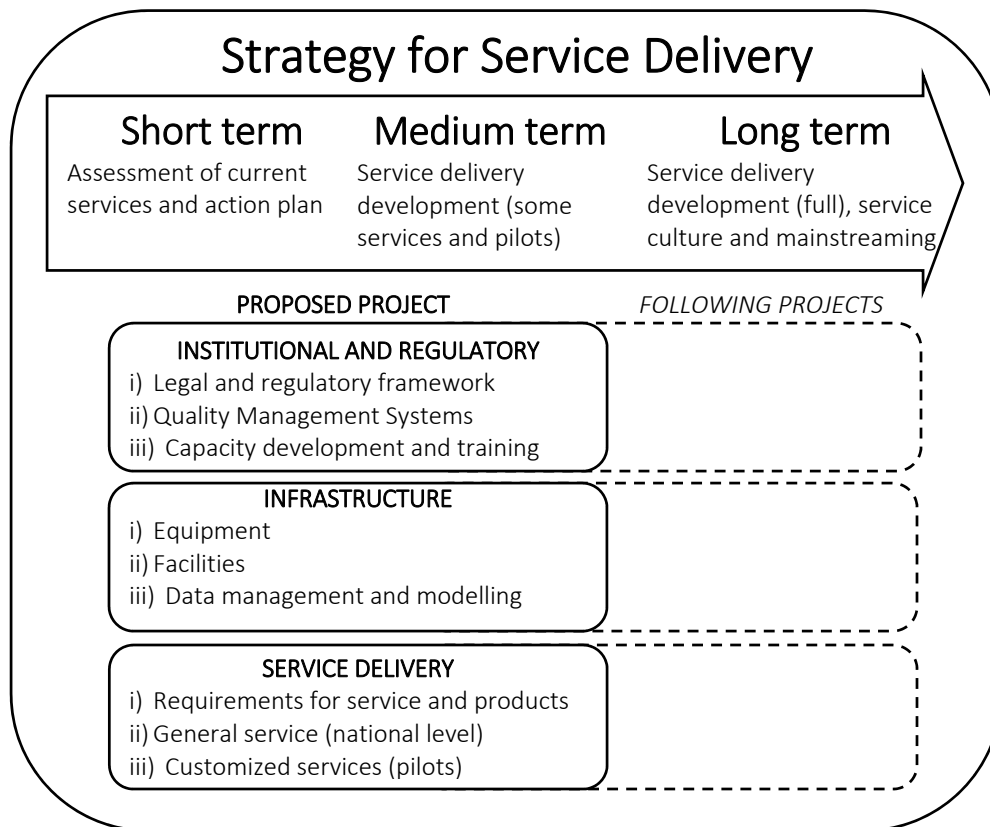


Figure 2: Strategy for Service Delivery and Implementation Plan: WMO Strategy and proposed project’s activities.



57. The proposed project will work with the DRC Government, WMO and other partners to contextualize and achieve the short and medium term objectives of the strategy (Figure 2), through coordinated efforts aiming at strengthening the institutional and regulatory context, modernizing the infrastructure systems and improving the production and delivery of hydromet information and services to the different sectors. The proposed project will support the development of a specific strategy and action plan for MettelSat, which will identify the main actions to improve the cooperation between agencies and MettelSat's coordination capacity, ensuring an efficient development of NMHS in the country.
58. Finding appropriate technical balance between significant and competing development needs and limited government resources and capacity will be one of the key challenges. The project will identify priorities among possible improvements in order to demonstrate at first the capacities of MettelSat to deliver services to the expectation of a limited number of users. The focus will be on high impact severe weather prediction and warnings, which are mainly associated with strong convection, resulting in heavy precipitation, floods, landslides and erosion. In addition to the short-range predictions, predicting the change in the weather regimes such as onset and end of rainy seasons will also be pursued, at least when associated with agricultural impacts.
59. The project's design is based on successful approaches and well-known methodologies as well as on lessons learned from past and/or ongoing global, regional and national technical capacity development projects, sustainable land and water management; urban planning and development; and disaster risk management projects.

C. Financial Management

60. In accordance with the Financial Management Manual issued in November 2005, and as revised on March 2010, the financial management arrangements of MettelSat have been assessed to determine if the implementing entities have acceptable financial management arrangements in place that satisfy the Bank's Operation Policy/Bank Procedure (OP/BP) 10.00. These arrangements would ensure that the implementing entities: (i) use Project funds only for the intended purposes in an efficient and economical way; (ii) prepare accurate and reliable accounts as well as timely periodic financial reports; (iii) safeguard assets of the Project; and (iv) have acceptable auditing arrangements.
61. Financial Management (FM) arrangements were found to be adequate subject to meeting the following requirements: (i) opening the designated account in a financial institution acceptable to the Bank, (ii) the updating of the current manual of procedures in order to take in account the grant specificities, (iii) implementation of a customized Excel spreadsheet for bookkeeping to bridge the period, not longer than two months after effectiveness, during which the acquisition of a management accounting software will take place, (iv) the recruitment of a Chief Financial Officer, (v) the recruitment of an Accountant, (vi) the recruitment of an internal auditor, and (vii) agreeing the ToRs for the recruitment of the external auditor acceptable to the International Development Association (IDA).
62. The conclusion of the assessment is that the financial management arrangements in place meet the World Bank's minimum requirements under OP/BP10.00, subject to meeting some initial requirements, and therefore are adequate to provide, with reasonable assurance, accurate and timely information on the status of the Project required by World Bank (IDA). The overall



Financial Management residual risk rating at project preparation is considered *Substantial*. Additional details on the FM assessment are found in Annex 2.

D. Procurement

63. Project procurement activities will be carried out by the procurement unit (*Cellule de Gestion des Projets et des Marchés Publics*, CGPMP) to be set up within MettelSat. The project will recruit a procurement consultant that will be responsible for procurement in the first year and gradually transfer responsibilities to a selected procurement officer within MettelSat. The consultant will be responsible for both carrying out the necessary procurement procedures, but also to train the designated MettelSat procurement staff. Given: (i) the country context and associated risk; (ii) the fact that MettelSat has to set up a procurement unit to handle procurement activities; and (iii) the fact that MettelSat has no procurement experience and no procurement capacity, the procurement risk is rated high. Details are provided in Annex 2

E. Social (including Safeguards)

64. The proposed Project is not expected to have any negative social impacts or risks related to social safeguards. No land will be acquired that would lead to economic or physical displacement of people; construction of new hydro-meteorological equipment installations will be limited to public lands or buildings where they do not affect users' livelihoods; no project activities will take place on lands traditionally occupied by Indigenous Peoples (IPs). Therefore, the project will not require involuntary resettlement (OP/BP 4.12).

F. Environment (including Safeguards)

65. The proposed Project has an Environmental Risk Category B investment under the World Bank's Operational Policy on Environmental Assessment (OP/BP 4.01) and has a very low environmental risk. OP/BP 4.01 is the only policy triggered under the proposed Project. Impacts would primarily be associated with the installation and rehabilitation of observation equipment and any required establishment of access road or paths to these observation stations. The project will mostly rehabilitate existing hydrological (manual scales and automatic recorders) and meteorological stations (synoptic, meteorological, agro-meteorological, rain gauges) with preference when relevant for keeping the previous/current location (for continuation of homogenous climate series).

G. World Bank Grievance Redress

66. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For



information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.



Annex 1: Detailed Project Description

Capacities and Constraints of Hydromet Services in the DRC

1. The status of MettelSat is defined by the decree N°12/40 of 2 October 2012 that defines its missions, structure, organization, management and financial obligations. MettelSat is the government agency in charge of meteorology, climatology and of the inventory of natural resources in view of their management for a sustainable development. This also includes operational hydrology, hydrometry, hydrological forecasting and the hydrological cycle, as well as general geophysics.
2. Mettelsat owns a large number of buildings across the country, many of them more than 50 years old, all in very bad condition. These buildings, located in Binza (headquarters), Lubumbashi, Mbandaka, Kisangani, Bunia, Bukavo, Kananga and Ilebo, include administrative buildings, technical buildings, and housing for the personnel. MettelSat owns 5 vehicles only, of which only one is presently in condition of use.
3. Mettelsat did not get funding for operations and maintenance since the early 1990s. During this period, government budget was only allocated to support the staff. MettelSat has a significant workforce of 483 staff, among which 330 are in Kinshasa and 153 in the provinces. However more than 75 percent of them are at or exceeding the retirement age. The qualification of the workforce needs significant improvement too. 146 new staff are being hired in order to compensate for the departure of senior staff. The number of engineers is 20, and of forecasters 37.
4. The observation infrastructure has seen a dramatic decline since 1960, when 125 full-scale stations and 900 stations limited to rainfall measurements were operating. Presently, only 22 stations are considered as fully or partly operating, all of them on aerodromes. Few instruments are in working condition, and all systems are extremely obsolete and need replacement. There is no radio-sounding station in condition to operate. The transmission of data from the stations to the central facility in Kinshasa/Binza is made by voice through old fashioned SSB (Single side band HF) channels. As an example, the automatic station of METTELSAT in Kinshasa N'djili airport does not work because the wireless link to the control tower is down. Observers (who in N'djili are RVA workers) have to cross the road every 30 min to get the data which is then recorded manually. These observations and synoptic observations received from 9 other Congolese airports through SSB voice liaisons (at 6:00, 9:00, 12:00, 15:00 and 18:00 UTC) are translated into SYNOP messages and transmitted by a MESSIR-COM Terminal through a V-SAT link directly to the Regional Telecommunications Center in Brazzaville which is expected to insert these data into the Global Telecommunication System of WMO (GTS). The aviation specific weather observation messages (METAR) for N'djili and interior airports are made in N'djili based on the SYNOPs. It may also be noted that no observations are made at 21:00, 00:00 and 03:00 UTC. The 22 stations are equipped with Data Collection Platforms (DCP) transmitting SYNOPs by satellite which can be received by the PUMA system through EumetCast about two hours later. Presently only 12 DCPs are working, but the data is not fed into the GTS because the connection between Binza and Brazzaville is down. Other elements of the stations are out of order in many places. Most stations have not been visited by the maintenance teams since their installation, which was generally done in 2008 and 2009. As a result of the lack of financial and human capacities, MettelSat lacks the



capacity to address the requests of potential clients. It has not been able to develop a fully functional customer service and marketing unit, and the list of its clients and corresponding revenues in the past 5 years is very limited in terms of number and revenue generation.⁷

5. There is no weather forecasting permanent shift positions, working hours are from 6 A.M. to 3 P.M. Although the forecasters accept to spend the night at work in case of severe weather, this does not allow for a good follow-up of the meteorological situations for a large country like the DRC. Forecasting at the headquarters is based principally on the utilization of the PUMA satellite receiving stations which were donated by the EU and will be upgraded in 2016. The microwave point to point connection of the headquarters in Kinshasa/Binza to the WMO Information System (WIS), which is accessible across the Congo River at the Regional Telecommunications Centre of Brazzaville, is not working. Although the V-SAT connection installed by RVA between Kinshasa N'djili airport and Brazzaville is operational, this liaison does not reach Binza. There is also very limited access to high speed Internet, where many useful data and international weather forecasting products could be found. The weather forecasting numerical models received on PUMA are the Local Area Model (LAM) of the UK Met Office, Météo-France Arpège and ECMWF. The ECMWF model gives 8 day forecast, LAM 48h, Arpège 5 days and allows viewing of the vertical profiles. The 24 hours forecasts covering the country are made for the general public. Nowcasting is being experimented with forecast at 12 hours for severe weather. Currently, specific predictions for the provinces are made only for Katanga. Nowcasting utilizes SWFDP (Severe Weather Forecasting Demonstration Project) products disseminated through Internet from South Africa which are very appreciated despite the differences between different models. Forecasts of extreme weather indicate rainfall superior to 20mm in 24 hours in some sensitive sites. A SWFDP is starting to be developed for Western Africa, which could greatly benefit the DRC because of the use of the French language. Everything is done manually due to the lack of software and skills for analyzing the input of data and for developing products. MettelSat would benefit from a data production system which would prepare the information according to the needs of the specific users.
6. Meteorological assistance to aviation is made in relation with the Airways Authority (RVA). RVA is a private company owned by the State that has to comply with the ICAO regulations and benefits from air traffic levies collected from airlines for airport and en route services. The meteorological infrastructures of the international airport of N'djili Kinshasa as well as of the other airports in the country do belong to MettelSat. RVA has hired about 50 meteorologists based in Kinshasa, and is in the process of training and recruiting 20 new meteorologists. Presently the meteorological services to aviation are provided by RVA in N'djili and in 3 other international airports, and by MettelSat in the other airports. N'djili airport was equipped with a Satellite Distribution System (SADIS) satellite receiving station which is out of order. In any case the satellite distribution will be terminated in July 2016, and replaced by FTP transfers. According to the MettelSat 2016-2019 Action Plan for the development of aeronautic meteorology⁸, there is no aviation forecasting position at the central forecasting office in Binza and no forecaster from MettelSat in any aerodrome. In N'Djili the forecasters are RVA personnel.
7. Only a very tiny part of the climatological records that sometimes go back to more than 40 years

⁷ Based on the list provided by MettelSat of "Repertoire Clients"

⁸ Plan d'actions de Développement de la Météorologie Aéronautique en R.D.C 2013-2016



has been digitized. As most of these records are still on paper and sometimes stored in bad conditions in Binza and across the country, they run the risk of being lost. Records anterior to the country's independence might still be accessible in Belgium, but no inventory has been done. Extended time series are necessary to provide basic climate information to users as required by GFCS. MettelSat does not produce nor publish official climate change projections for the country. Climate data are sent from the stations at the end of each month on paper (by post) and there is a lack of equipment and staff for input. The department publishes the past weather in each province every month, and is preparing a publication on the climate in the DRC which has 4 distinct climates: mountain, equatorial, tropical moist, tropical dry. MettelSat's staff has participated in WMO and other training sessions, and the digital records are made using CliCom, ClimSoft, SYSTAT and Excel (for daily data). Measuring instruments for radiation are also missing. The service has daily data records from 80 stations, but mostly with long interruptions.

8. MettelSat also has eight hydrologists of baccalauréat+3 level (bachelor level) among its staff, but does not operate hydrological stations and does not produce hydrological forecasts.
9. Agrometeorology clearly lacks software and computers but also simply diagrams for recording instrumental data. Decadal bulletins are produced only for the PANA-ASA project in cooperation with INERA, the National Institute of Agronomic Research. INERA is in charge, among others, of ensuring that the provision of crops and other planting material is adapted to the local climate conditions.⁹
10. This PANA-ASA project will be followed by PANA-AFE and PANA-ZC. With the PARSA project, METTELSAT trained staff of the Ministry of Agriculture but the project will close soon. The monthly bulletin which is currently made for Kinshasa will be extended to other regions.
11. The laboratories of remote sensing, of calibration and of hydrology are out of order. MettelSat also has an Internet site at <http://www.meteo-congo-kinshasa.net>, but it has not been updated since 2008.
12. As a result of the above deficiencies, the overall performance of MettelSat seems to be so poor that without urgent and massive intervention it may become completely irrelevant to the country's needs. There is an overall lack of reliable, or sometimes any information, on weather, climate and hydrology in the DRC. There are only few regular products presented to the country users such as basic weather forecasts for the next 24 hours often distributed through weather studio, aviation forecasts, seasonal forecasts, agro-meteorological bulletins, some remote sensing data and data on hydrology. Much of this data and information is not reliable. There is no objective estimates of the availability of data neither of the quality of the forecasts. The DRC does not produce hydrological forecasts, severe weather forecasts or other products necessary for reduction of weather hazards and better functioning of weather dependent sectors.
13. Many organizations contribute to hydrometeorological observation in the DRC to fulfill their specific needs. Cooperation with MettelSat on this activity would benefit both sides.
 - a. INERA (Institut National pour l'Etude et la Recherche Agronomique) has 22 agrometeorological stations which are not automatic and 6 semi-automatic (FAO stations, EU

⁹ For more information on INERA's mandate and activities, see "Dépliant INERA"



funding, PANA-ASA, PARRSA) non-functional stations due to the poor quality of batteries. Sensors include rain gauges, evapotranspiration trays, hygrometers, heliographs, air temperature and ground temperature (50 cm). There are also numerous secondary stations with rain gauges and thermometers (min / max). The data is used mainly for research programs to identify adapted seeds. Only some farmers involved in participatory research have access to the data. The Ministry of Agriculture is in charge of the outreach. Pooling networks would allow INERA to reduce operating costs and enjoy better coverage nationwide. The data which INERA could use could come from airports, National Electricity Company (SNEL) stations, the METTELSAT and NGOs involved in agriculture.

- b. The organization of Civil Protection depends on the Ministry of Interior. At national level, a permanent office is responsible for monitoring extreme events. The Committee for the Prevention and Management of Disaster Risk chaired by the Minister of the Interior decides to launch alerts. Then the interdepartmental committee chaired by the Deputy Prime Minister can make public warnings. Provincial security committees are chaired by provincial governors, and Municipal committees by the mayors. Civil Defence also has competence to move populations out of dangerous areas. At present the forecasting bulletins are issued by MettelSat at 14h for the next 24 hours, 7 days a week, and are received by email. 12h forecasts are being tested and extreme weather forecasts are available for the next 72 hours. Civil Protection would like to have forecasts at 5am for use during the working sessions of the daily coordination, and a website with specialized interface providing data on rainfall for the next 6h, 24h, 72h.
- c. The Régie des Voies Fluviales (RVF) is the main institution measuring the level of rivers for navigation purposes. It has resumed observations which were interrupted at 5 stations on the Congo River and 5 other stations on the Kasai River. The World Bank has provided equipment and has pledged to restore 25 stations (Multimodal Transport Project, CPTM). The 10th EDF (PANAV project) has committed to rehabilitate 60 stations starting in June 2016. It is expected that the RVF will have a total of 95 stations available within 2-3 years. Staff costs, maintenance, telecommunications, operating and depreciation replacements are not yet assured. Data on water levels for navigation are communicated to ship-owners (upon payment of navigation fees) to anticipate the passage of boats on the river. RVF could benefit from a provision from METTELSAT observations and precipitation forecasts to model hydrology alerts for the weather, especially over lakes. Sedimentation patterns (for sedimentation depends heavily on rainfall patterns) could also benefit from METTELSAT data. RVF could help in disseminating warnings to anticipate river overflows which affect municipalities and civil protection.
- d. The CVM (Congolaise des Voies Maritimes) operates 33 gauging stations of which 5 with recorder on the navigable part of Congo between Banana and Matadi (6-8 hours of sailing). The hydrological stations of the CVM function normally, except for Bulambemba which has continued to produce only specific ocean observations limited to the tide and the Congo River gauging. CVM could benefit from METTELSAT severe weather warnings, data and



forecasts. It could cooperate with MettelSat to disseminate warnings to anticipate river floods. In the water sector, it can be noted that there is some confusion in the respective powers of the institutions involved.

- e. The National Electricity Company (SNEL) has its own hydrologists that monitor rainfall over catchments and do rainfall-runoff modeling. This allows to anticipate releases of water to avoid risks on dams and optimize production. SNEL has fifty precipitation stations. It measures evaporation at a few sites, and a few water limnometric stations to ensure some modeling. The production of dams with reservoirs may be better optimized. A transfer of the stations to METTELSAT could be considered to reduce the workload and benefit from the expertise of METTELSAT on rainfall-runoff modeling. SNEL is also interested in estimated real-time rainfall and forecast rainfall for the next 7-10 days to anticipate floods, in seasonal forecasts to anticipate the rains over the next 3 months and optimize production and in installing rain gages, water level gauges and thermometers to quantify the flow and check the strength of dams.
- f. The water company REGIDESO also makes measurements on the hydrological potential and sites of water capture on Congolese rivers. It has 95 drinking water treatment centers of which 75 are in operation, some without storage. REGIDESO is interested in hydrometeorological forecasts to avoid pollution of drinking water when rain causes sedimentation and pollution and in anticipation of low flows to ensure the sustainability of the collection point and avoid pumping sand.
- g. The BEAU (Bureau d'Etudes d'Architecture et d'Urbanisme) has a network of stations in Kinshasa to anticipate urban floods. It is interested in return periods of extreme meteorological and hydrological events under the present and future climate for the location, orientation and design of adequate structures.

Current Initiatives in Support of DRC's Hydromet Services

14. Hydrometeorology in DRC already benefits and benefited from the technical assistance from or cooperation with a large number of agencies. An evaluation of the networks for the systematic observation of climate was recently done for the Ministry of Environment. The main activities that have been identified at this stage are as follows:
 - a. Under the assistance of the PMURR (Multisectoral Emergency, Rehabilitation and Reconstruction Program), MettelSat has obtained 22 automatic meteorological stations which were installed in 2008 in the main airports of the country, in order to improve the capacities of meteorological services to aviation. The project is now completed.
 - b. The World Meteorological Organization (WMO) provides support for training in aviation meteorology, climatology and other fields like EWS. Together with SADC in the framework of the Hydrological Cycle Observation System (SADC-HYCOS) project, 3 DCP and 6 hydro-meteorological stations have also been provided, which still need to be installed. Congo- HYCOS project was developed by WMO, in collaboration with Congo-Oubangui-Sangha Basin Intergovernmental Commission (CICOS) and its member countries, to the revival of hydrometric monitoring across the Congo Basin. After the



implementation of the preparatory phase, during which a detailed project document was developed and validated by all the countries, CICOS and WMO are collaborating in sourcing fund for the development phase of the project.

- c. The MTAP project (Meteorological Transition in Africa Project, or in French PTMA for *Projet de Transition Météorologique en Afrique*) in 2005-2006, financed by the European Development Fund, was initiated by the European Union and the African Union in order to help the African countries south of Sahara to obtain Meteosat Second Generation (MSG) data receiving stations and to provide them with the necessary technologies in order to best benefit from the data disseminated by the European Organization for the Exploitation of Meteorological Satellites (Eumetsat). The MTAP included the pilot Monitoring and Evaluation of Water Resources of the Kasai Watershed project (SERBaK) for the benefit of the Republic of Congo and of the Democratic Republic of Congo. The Belgian Technical Cooperation (CTB) offered additional financing to the DRC in view of preparing and structuring the users of satellite data around Mettelsat.
- d. In the framework of the PUMA and African Monitoring of the Environment for Sustainable Development (AMESD) projects, which followed the MTAP project and terminated in 2013, the European Union and the African Union have provided Mettelsat with a new workstation for receiving and using the information disseminated through the EUMETCast satellite dissemination system operated by Eumetsat, as well as training.
- e. The new Monitoring for Environment and Security in Africa (MESA) program builds on the results obtained by MTAP, PUMA and AMESD, in order to consolidate and widen the operational environmental services developed in AMESD, and to propose new services, such as African climate services. Funding is obtained from the 10th European Development Fund of the European Union, with a budget of 37 million Euros. The timeframe of the implementation is from 2013 to 2017. MESA has started deploying satellite receiving stations to the beneficiary institutions in Africa, with a first batch of seven reference stations and a training center which are being shipped in 2016 to Botswana, Mauritius, Niger, Kenya and Democratic Republic of Congo. In total, 55 stations for meteorological services, 115 stations for environmental services and related sectors, and 4 training centers will be installed. At the time of the mission, 5 new PUMA stations had just arrived to Kinshasa, which will be installed shortly at Mettelsat Binza, at CICOS, at RVF, at the Applied Studies Institute (ISTA) and at the water management authority in the Ministry of Environment. The EU also provides for technical and user training. The MESA Program should end in 2017 but the plans are to continue the collaboration (formulation mission carried out in 2015) in the scope of the "GMES & Africa" initiative (based on collaboration with the European program "Copernicus"). A total amount of €28 million should be allocated to the Global Monitoring for Environment and Security program ("GMES Africa") starting in 2017 for a duration of 3 to 5 years, which should ensure as much as possible continuation, consolidation and extension of the services, including the development of new ones.



- f. The government of the UK has donated a studio for preparing TV broadcasts and should renew it in the future.
- g. The government of China has donated 20 weather stations, 8 automatic weather stations and a radio-sounding station and will provide for their installation.
- h. The International Commission of Congo-Oubangui-Sangha (CICOS) is an intergovernmental organization created in 1999. Its members are Cameroun, Central African Republic, the Republic of Congo and the DRC, Angola being an observer. CICOS has a mandate of a river catchment organization, in charge of promoting the navigation and the integrated management of water resources. Important programs for ancient hydrological data recovery (until the early twentieth century) have already been conducted. The river flows have not been recalibrated since 1980. The rate of the Ubangi River has declined by 30%. Modeling the hydroelectric potential of the rivers has been achieved. The French Development Agency (AFD) has recently signed with CICOS a 500,000 euros project to improve the hydrological monitoring of the Congo River and an integrated management of water resources. CICOS is one (among 6 others) of the implementing centres of MESA, and which is mandated by the Economic Community of Central African States (*Communauté Économique et Monétaire des Etats de l'Afrique Centrale*, CEMAC) for the Thematic Action ("THEMA") "Water Management in Central Africa ". The MESA grant contract is of a value of €1,846,051. More specifically CICOS is in that scope developing the following services:
 - Water level alert system for navigation, including in situ and satellite measurements (Oubangui sub-basin), low waters alert system (Oubangui sub-basin)
 - Monitoring the water cycle in the main sub basins of the region (Rainfall, Evapotranspiration over Oubangui sub-basin) in order to issue Water cycle / Humid Forests monitoring bulletins, Oubangui sub-basin. Key users are Ministries, Universities and Research centres, Agro pastoral services, etc.
- i. The PANA-ASA and PARRSA (North of Equateur province) projects have installed and refurbished around 30 agro-meteorological stations of INERA (Institut national des études et recherches agronomiques) with the participation of MettelSat to pursue research on seeds. MettelSat has developed decadal bulletins for this purpose. There will be an additional PARRSA financing of US\$50 million of US\$ from July 2017, and MettelSat could receive additional equipment in this framework. A new project on women and children (PANA-AFE) will start shortly and MettelSat will be associated.
- j. A number of international organizations (WMO, ACMAD, SADC, etc.) and of advanced hydromet services (Météo-France, United Kingdom Met Office), provide training at various levels of competency.

Detailed Component Description

15. After 30-40 years of neglect, the hydromet sector of the DRC needs considerable resources and efforts to rebuild its institutional framework, create the most basic infrastructure and develop a



culture and capacity for service delivery. At the same time the project should be affordable to the government in order to remain sustainable in the long run. Finding the appropriate balance between significant and competing development needs and limited government resources and capacity will be one of the key challenges. The project will therefore identify priorities among possible improvements in order to demonstrate at first the capacities of MettelSat to deliver services to the expectation of a limited number of users. The focus will be on high impact severe weather forecast and warnings, which are mainly associated with strong convection, resulting in heavy precipitation, floods, landslides and erosion. As an example, according to the Office for the Coordination of Humanitarian Affairs (OCHA), the toll in DR Congo after five months of floods which took place from October 2015 to February 2016 was of more than 550,000 people affected, 65,000 dwellings damaged or destroyed and 5,000 hectares of cultures submerged. The most affected province was the Eastern Province. In addition to the short-range predictions of severe weather a few days ahead, predicting the change in the weather regimes such as onset and end of rainy seasons will also be pursued, at least when associated with agricultural impacts.

16. The indicative breakdown of project financing is as follows:

Component, Sub-Component and indicative budget (US\$)	LDCF	GFDRR	Total
Component A - Institutional and regulatory strengthening, capacity building and implementation support	905,000	450,000	1,355,000
A(i) - Reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) for delivery of service	80,000	40,000	120,000
A(ii) - Strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions	165,000	85,000	250,000
A(iii) - Implement a long-term and on-demand capacity development and training program for staff	660,000	325,000	985,000
Component B - Modernization of equipment, facilities and infrastructure for basic observation and forecasting	3,080,000	1,488,000	4,568,000
B(i) - Hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors)	1,400,000	640,500	2,040,500
B(ii) - Transmission, data management and data dissemination hardware	300,000	137,500	437,500
B(iii) - Refurbishment of facilities needed to support the services	900,000	465,000	1,365,000
B(iv) - Technical systems and software for performing meteorological, hydrological and climate modelling and forecasting	480,000	245,000	725,000
Component C - Improvement of hydromet information service delivery	1,077,980	515,000	1,592,980
C(i) - Define requirements, delivery and feedback mechanisms with different user groups (in line with the National Framework for Climate Services)	80,000	45,000	125,000
C(ii) - Develop customized products and services made available to user groups through dedicated interfaces	997,980	470,000	1,467,980
Component D - Project Management	266,472	247,000	513,472
D(i) - Coordination and technical implementation support	190,452	111,000	300,452
D(ii) - Fiduciary and safeguard aspects and audit	76,020	136,000	212,020
Total	5,329,452	2,700,000	8,029,452

Component A. Institutional and regulatory strengthening, capacity building and implementation support

17. Component A will invest in the human and institutional resources that can implement and sustain hydromet observation and forecasting. Considering the need to address the current challenges in staffing and policy mandates, the Component will include three sub-components.

i) Reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) and delivery of service

18. MettelSat has a mandate given in the Decree of 2 October 2012 that defines its duties and responsibilities. However, in order to make this mandate fully effective, it remains necessary to clarify the respective roles of the main public services or agencies that act on hydrometeorology,



and may supply MettelSat with data or utilize its information. An Institutional diagnosis, including a comparative review of the roles and mandates of these agencies will be made, with a priority to the Régie des Voies Aériennes (RVA), the Régie des Voies Fluviales (RVF), the Congolaise des Voies Maritimes (CVM), the Civil Security and the Ministry of Agriculture. Efforts will also be made towards the Ministry of Transports and Communication Channels (MTVC) and the Ministry of Finance with the objective of raising the level of the government financial contribution to MettelSat.

19. Following this comparative review, a Strategy and an Action Plan will be defined for MettelSat, which will identify the main actions in order to increase cooperation and avoid overlap between agencies, ensuring an efficient development of hydrometeorology in DRC.
20. The first priority is to agree on new working arrangements with the Airways Authority (RVA) in order to organize the cooperation on meteorological service delivery to aviation and guarantee a fair and sustainable revenue for these services, bringing in return a reliable and quality assessed service to airline companies with a high level of security. The organization, the equipment, the personnel and the procedures of the meteorological services to aviation in DRC are at present very far from being compliant with the ICAO and WMO requirements, as stated in the Convention on International Civil Aviation (Convention of Chicago) and its annexes. MettelSat owns and operates presently 22 observing stations on airports, but most of the data are not available and MettelSat issues no forecasts for aviation. The services to aviation in N'djili, which is the largest airport in DRC, are provided by RVA. RVA has recruited recently 47 meteorological staff to provide meteorological services mainly in N'djili but also in a few other airports. As MettelSat does not receive at present any substantial revenue from aviation, an institutional workshop on evaluating cost recovery from aviation involving all key players and stakeholders will be organized as soon as possible. Improving cooperation between MettelSat and RVA, and both institutions' capacity to provide quality meteorological services to the aviation sector would significantly support DRC's needed efforts to comply with the international requirements and safety of flight.
21. A number of other working arrangements will be reviewed or initiated with organizations operating hydrometeorological networks and with users or potential users of hydromet information. This includes the Régie des Voies Fluviales (RVF) concerning the hydro-meteorological network development and operation and the exchange of data, the Ministry of Interior which is in charge of civil protection, the Ministry of Agriculture which is a consumer of agro-meteorological products and services, the Ministry of Environment, the Geophysics Research Center (CRG), the National Electricity Company (SNEL), the Applied Studies Institute (ISTA), the National Institute for Agronomic Study and Research (INERA), the Congolaise des Voies Maritimes (CVM) and the Water Distribution Authority (REGIDESO). Agreements shall then be negotiated and signed with these potential partners. The implementation of the agreements will need ministerial-level approval and an agreement with the Ministry of Environment should also be sought. The Parties to those agreements will need to coordinate the development and implementation of protocols and guidelines so as to ensure their effective implementation across the agencies and to avoid overlaps. An Institutional workshop on MettelSat missions and expected services and possible cooperation (for instance concerning data exchange) will be organized with all the concerned institutions at the very beginning of the project. This could be an opportunity to address the question of the coordination of hydrological, meteorological and climate observing



networks and of data exchange for mutual benefit.

22. The cooperation activities in progress in relation with WMO, European Union, UK, China, ACMAD, AFD, CICOS which have been mentioned above and other possible relevant similar initiatives will be taken into account in the design of the project in order to build synergies and to avoid overlaps. The objective in terms of observation will be to obtain a consistent and operational system from these different contributions, more especially in relation with the observation network. The different projects may result in disparity in the types of hydromet stations with some implications related to the telecommunication, concentration and processing schemes. Synergies will also be sought concerning training.

ii) Strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions

23. In accordance with the requirements of the Convention on Civil Aviation and its annexes a Quality Management System (QMS) will be designed and implemented by MettelSat which will be focused as a priority on the services which must be delivered to aviation. A QMS is a collection of business processes focused on consistently meeting customer requirements and enhancing their satisfaction. It is the organizational structure, policies, procedures, processes and resources needed to implement quality management. A QMS workshop will be organized for MettelSat, followed immediately by deployment of an expert to assist MettelSat in the implementation of QMS and documentation of processes. This will be done through a twinning arrangement between the DRC (Mettelsat) and the Agency for Aerial Navigation Safety in Africa and Madagascar (ASECNA). Building on this development, QMS will also be designed and implemented for EWS and Agriculture. It is recalled that, as of 15 November 2012, the QMS requirement became a standard practice for the meteorological services to aviation, supplemented by a set of recommendations on the conformity of the QMS with the International Organization for Standardization (ISO) 9000 series of quality assurance standards. For these reasons, priority in time will be given to QMS for services to aviation, followed by services for early warning systems and agriculture.
24. By setting and monitoring standards at all levels, the QMS may be subsequently extended to other main applications and ultimately cover all MettelSat activities, functioning as a management tool and plan for achieving the quality requirements within meteorology. The design of the QMS will build on the previous draft QMS, the MettelSat Strategic and Action Plan and international experience. It will include the upgrading of standard operating procedures (SOP) and protocols on aspects such as standards for data collection (equipment and routines, WMO standards etc.); upgrade to easy-use manuals for data collection, O&M, weather forecasting and climate data management; and assigning clear lines of responsibilities in delivering quality services. Definition and enforcement of protocols and manuals on data standards and on data sharing are also particularly critical for MettelSat as they could greatly benefit from the surface observations done, among others, by RVA and RVF.

iii) Implement a long-term and on-demand capacity development and training program for staff

25. Because human resources are a significant challenge to maintaining and expanding services, this subcomponent will look at ways to motivate staff and to upgrade its qualification. Building on



collaborations with national universities and training institutes such as the ISTA (*Institut Supérieur De Techniques Appliquées*) will be necessary because MettelSat is not entitled to give the academic degrees which are required by ICAO. ISTA currently offers trainings in agrometeorology and hydrometeorology but has a very low number of graduates in these fields. It has not had any graduates in the field of meteorology since the academic year 2011-2012, in which only 9 students graduated.¹⁰ Some support to these institutions and to in house training facilities will be considered, for instance for equipping training facilities or inviting trainers. Collaboration will be pursued with international institutions such as WMO, ACMAD and SADC as well as twinning arrangements with other hydromet services.

26. Staff capacity is a key priority. Needs in training are huge, because ageing personnel is retiring and all observation, forecasting and service delivery activities need to be modernized and developed. In addition, new requirements are appearing. The qualification requirements for aviation meteorological forecasters in the WMO Technical Regulations will become a standard practice for all countries on 1 December 2016. Consequently, weather services will need to ensure that the level of qualification of the operational personnel making forecasts for aviation follows the WMO qualification standard, i.e., to be compliant with the relevant sections of the Basic Instruction Package for Meteorologist (BIP-M). Skills are needed at all levels, from basic operation and maintenance of meteorological or hydrological stations to processing complex data streams, operating forecasting models, climate services, early warning systems and management. The project will undertake at its beginning an assessment of the staffing needs. The **Staffing assessment** will outline the necessary staff/skills needed at different critical functional levels according to the Strategy and Action Plan, and draw up solutions to meet staffing needs. A **long-term training plan** will then be designed, taking into account the fact that MettelSat has just hired 146 staff in order to replace departures of senior staff and that new staff will be continuously hired. This plan is expected to be updated annually based on staff evolution and emerging needs. Training will be considered in technical areas including maintenance of weather, climate and hydrological observation instruments and networks, early warning systems (EWS), information and communications technology (ICT), operational hydrology, climatology, agro-meteorology, aviation meteorology, general weather forecasting and climate services. Options for training will include, for instance, courses with visiting lecturers, participation to WMO training activities, south-south cooperation opportunities and online learning courses. Workshops will be organized on each subject in order to share the knowledge among the staff. Technical training should also be included in the procurement process of meteorological or ICT equipment. A sufficient number of study trips will also be fore sought in order to improve skills on specific fields.

Inclusion of gender in Component A:

27. The DRC received the lowest Human Development Index (HDI) rating in the world in 2015: 176 out of 188. The country was ranked at the same level of the HDI Gender Inequality Index¹¹ (GII); at 176 out of 188 countries. The Human Development Report of 2015 noted a mean of 9.8 years of schooling throughout the country. There are huge differences in literacy between men and

¹⁰ For more information see: « Présentation De L'institut Supérieur De Techniques Appliquées ISTA/Kinshasa »

¹¹ A composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health (maternal mortality), empowerment and the labor market.



women, with differentials in access and completion of secondary and tertiary education. Women representation in the public administration, public offices, and formal private sector enterprises is among the lowest in the world. As a consequence, women are not represented at decision-making level and their agency is low, including in regards to early warning systems.

28. Furthermore, although women's livelihood activities outnumber men in agriculture and trade¹², there is little awareness at ministerial level of their role and their capacity to cope with climate risks. It is thus important to build capacity in mainstreaming gender into services and procedures of hydro-meteorological services as such services trigger early warnings where women are the main beneficiaries in certain sectors.
29. Women are often not represented in environmental governance processes; in other words, their concerns as the primary beneficiaries are not included in policy design or implementation. Similarly, women's voices are often unheard in labor unions, especially in large utility and hydromet sectors dominated by males. This increases the likelihood of poorly targeted reforms and negative impacts, such as higher and gender-differentiated safety impacts (see World Bank, 2013). With flooding impacting mainly livelihoods in urban areas (trade, services, mainly occupied by women) and landslides affecting agricultural work, capacity building in gender awareness, along with quota for training and including more women in hydro-meteorological services, are strongly recommended for this component.

Component B. Modernization of equipment, facilities and infrastructure for basic observation and forecasting

30. Component B will invest in the reinforcement and rebuilding of the basic networks for observation and forecasting, as well as in infrastructure needed for provision of services by MettelSat. A highly focused approach to investments is required in the DRC considering the current status of hydromet services, and allocation of investment will have to be made based on priority sectors/user-groups being served, core-capacity for observation and forecasting and the long-term ability to operate and maintain the services.
31. The basic technical specification information for equipment should comply with the recommendations of WMO as they appear in the *WMO Guide to meteorological instruments and methods of observation*, the *WMO Guide to climatological practices*, the *WMO Manual on stream gauging*, the *WMO Manual on the Global observing system*, the *WMO Manual on codes*, the *WMO Manual on telecommunication systems* and the *WMO Manual on the WMO Information system (WIS)*.
32. Investments under component B will focus on:

i) Hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors):

¹² "Women's agricultural work, which revolves largely around market gardening, involves tedious planting, tending and harvesting, while men's work is usually limited to clearing the field with machetes and cutting down trees. Women often work in the fields from early morning until sunset, and then walk long distances with heavy head loads of produce to sell in a local market. They lack access to the tools and machines that some men have, including bicycles. They also carry water and firewood, soak and dry manioc so it is not poisonous, and pound grain manually for many hours" USAID, DRC Gender Assessment, 2012.



33. This activity will finance the optimization of the hydro-meteorological observation network, targeting an overall operational system (i.e. observation- transmission- forecasting and service delivery) sustainable after the end of the project. At that time, it is expected that the data from 60 meteorological synoptic automatic stations, 20 hydro-meteorological automatic stations and one radio-sounding station (donated and to be installed at N'djili airport by the Government of China) are received on a reliable and regular basis at the central forecasting office of MettelSat in Kinshasa/Binza and posted in due time on the GTS. The measurements taken by the synoptic stations should include at least temperature, barometric pressure, humidity, wind speed, wind direction, and precipitation amounts. Those data should arrive at the headquarters at least every 3 hours at synoptic times and at least every 30 minutes locally when the station is on an aerodrome, without interruption. The synoptic data should be accessible on the central system in Binza within a few minutes after measurement. Automatic stations on aerodromes will need additional observations like cloud basis height and visibility which will be provided by observing personnel. The measurements made by automatic hydro-meteorological stations will include at least river gauging and rainfall and shall also comply with WMO specifications. Data from automatic hydro-meteorological stations should be available at the central system at sufficiently close intervals and within a delay of a few minutes after measurement.
34. The network considered here includes:
 - a. The 22 aerodrome stations which were installed by 2008 under the PMURR project in cooperation with RVA
 - b. The integration of the data received from the stations donated by the government of China, which will also provide for their installation (20 classical stations, 8 automatic stations and one radio-sounding station)
 - c. The 3 DCP and 6 hydromet stations provided by HYCOS still to be installed
 - d. Automatic stations operated by partners such as CICOS, INERA , RVF or CVM, whose data would become available to MettelSat on an operational basis
 - e. The revival of one radio-sounding station at Kinshasa airport
 - f. The purchase and installation of complementary stations in order to fulfill the objective of a total of 60 synoptic and 20 hydromet stations over the country. Technical specifications of new synoptic, hydrological and climate stations will be defined.
35. Prior to the implementation, an inventory with a cartography and detailed description of the stations linked to the project (synoptic, hydrological, agro-meteorological, climate) will be made, and a workshop on observation networks organized with the major hydromet and climate data providers and users. The operational observation network management, operations and maintenance procedures will be defined and the procedures for quality control and validation of observation data (hydrological, meteorological and climate) will be specified. The operation costs of the network according to different scenarios will be identified.
36. It must be understood that over the project duration the cost of telecommunication (both equipment and transmission cost) and of logistics (infrastructures, access to the sites, spare parts, maintenance, personnel, vehicles, missions, gasoline, etc.) may be important in comparison to the costs of the bare stations' equipment. The necessary equipment, including vehicles, will be



provided to the central observation network maintenance and calibration unit and to the 6 regional observation installation and maintenance units. The project will contribute to covering telecommunications costs between stations and the central facility and missions costs of observation and maintenance teams, so that the stations may be visited at least once a year for preventive maintenance or repair. Indeed most of the 22 automatic stations which were installed generally in 2008 or 2009 were never visited by a maintenance technician since then.

37. Transmission of data from stations is presently made using SSB (High Frequency Single Side-band) either manually or automatically for a few synoptic stations. A plan will be designed in order to obtain a cost effective, reliable and efficient transmission scheme from the automatic stations to the central facility. Possibilities of using SSB, mobile phones, VSAT, Internet or other technologies will be considered, taking into account cost of operation and reliability aspects.
38. The investments made are expected to allow a nominal operation of these observations during at least five years after the end of the project, and to demonstrate the capacity of MettelSat to manage an observation network.



Maps of MettelSat equipped networks in 1960, 2016, and post-project:

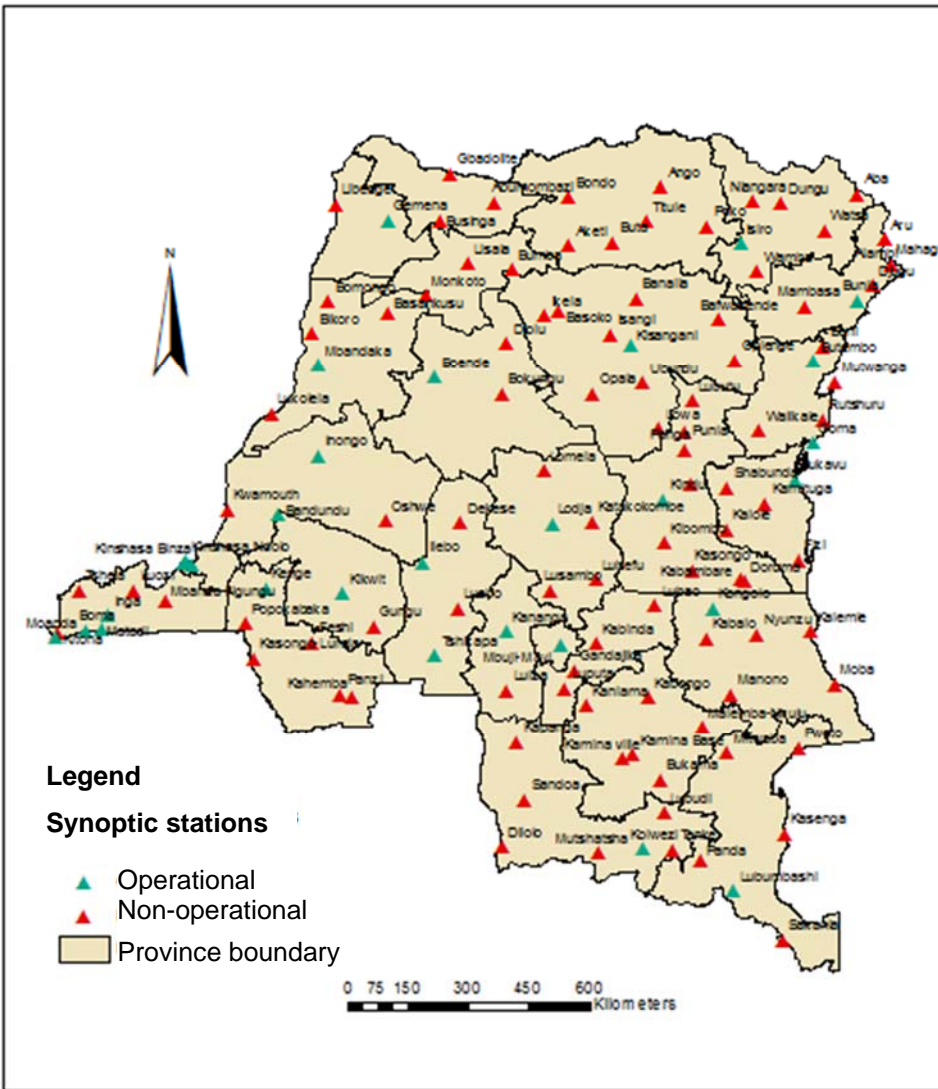


Figure 1: Synoptic stations network of the DRC (operational and non-operational)

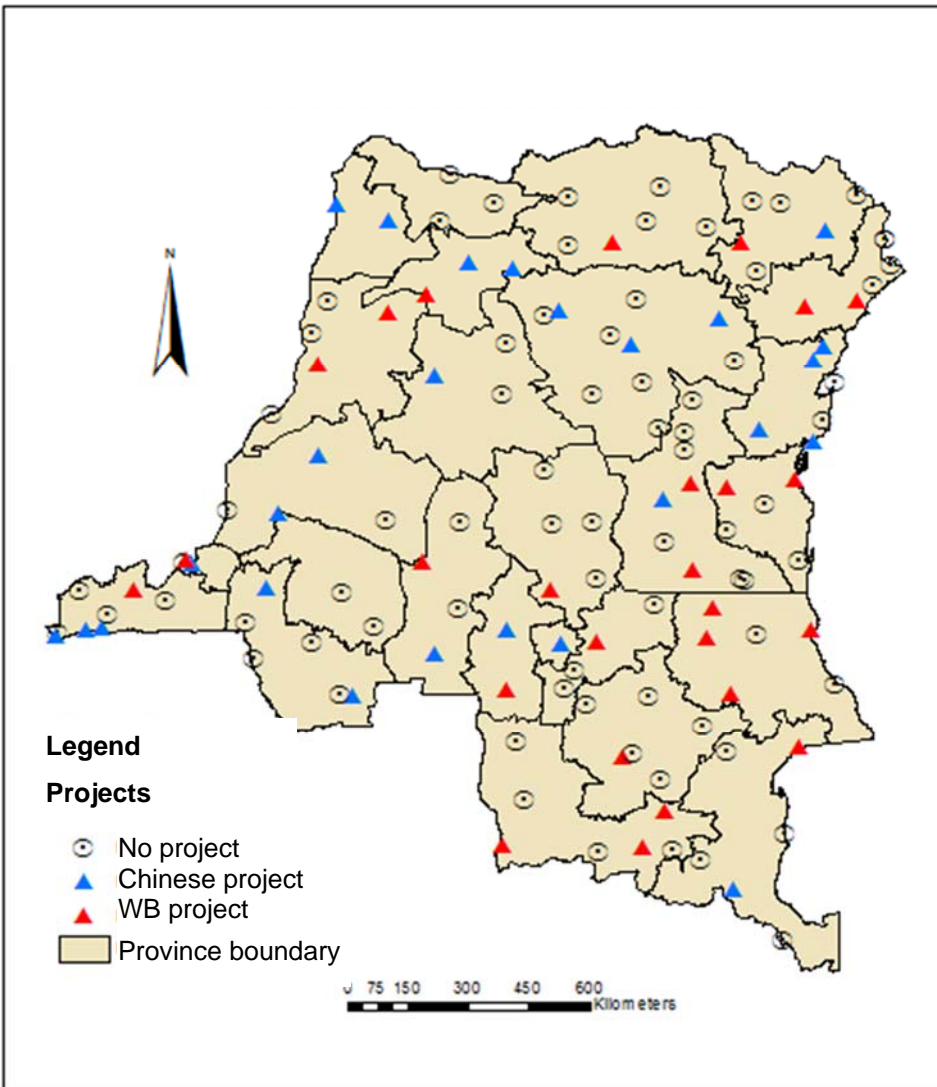


Figure 2: Map of Synoptic stations – Projects' contributions

ii) Transmission, data management and data dissemination hardware;

39. The transmission of data from the MettelSat hydro-meteorological stations is discussed in section B(i). The central facility must be designed in order to accept and process these observations, but it must also be fully inserted into the WMO Information System (WIS), which means being capable to manage in real time many other data streams, including the data from the WMO GTS, data from EUMETCast and data from foreign forecasting centers accessible through high speed Internet. A priority is to provide full access to the WMO GTS, which should be made available through the connection with Regional Telecommunication Center of Brazzaville.

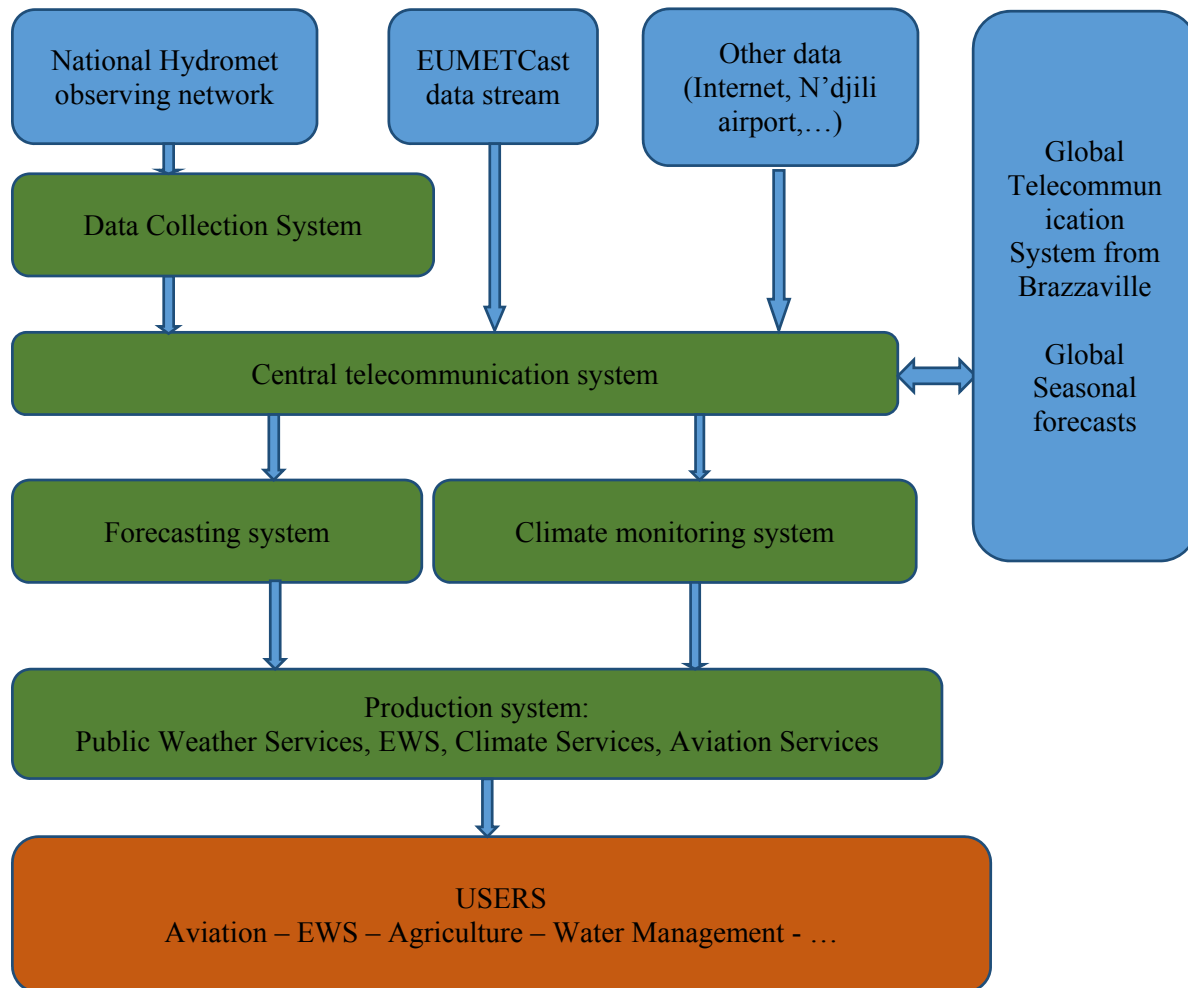


Figure 3: Block diagram of the DRC central forecasting system

40. Currently:

- (a) The VSAT liaison between N'djili airport and Brazzaville is functioning but does not reach the MettelSat headquarters and the central forecasting unit
- (b) The central telecommunications system is an outdated MESSIR-COM system complemented with manual entry of data from non-automatic stations and observations
- (c) The forecasting system is based on the PUMA station
- (d) There is no climate monitoring system
- (e) There is no production system

41. The project will aim at installing a comprehensive and reliable system. To improve the transmission of data coming in and out of MettelSat, this activity will finance data management improvements which include: ICT infrastructure to improve connectivity (such as reliable and hazard proof network internet/ GPRS/ fiberoptic connections to manage high volumes and fast data flows; as well as servers, licenses and soft/hardware); necessary ICT equipment including modems, routers, power supply and data collection systems; and tools to verify/clean data records.



42. The observations Data Collection System which allows the reception of the information sent by the stations, whether they are automatic or manual, will be modernized. It should allow the reception of all the national hydromet data of interest for MettelSat and their handling so that they may be used by the central forecasting and the climate monitoring systems.
43. The quality of the forecasts will depend first of all on the data received from abroad, mainly foreign numerical models results and satellite data. It will be necessary to support MettelSat in upgrading and complementing its current data central communications system, which at present relies basically on the PUMA station provided by the EU. This system will have full access to the WIS, including GTS, EumetCast and high speed Internet. Taking this into account, a new central Data Telecommunication System will be specified, procured and installed.

iii) Refurbishment of facilities needed to support the services

44. Because of a lack of financial resources, the headquarters of MettelSat are in a very poor condition. It has three main dilapidated buildings that have water infiltration due to poor waterproofing of terraces. Paints, floors, electricity are also in poor condition, and the rooms are generally not air-conditioned. Electrical breakdowns are frequent and it will be necessary to install a generator and uninterruptible power supply (UPS) equipment to ensure the continuity of service required for the headquarters of a national hydromet service. The furniture and basic office equipment is also in bad condition. In order to ensure the safety of equipment and well-being of staff a full rehabilitation of the premises is urgently needed.
45. Measures will be taken to renew the central infrastructure, beginning with a national expertise for determining the priorities in the MettelSat Hq buildings' refurbishing. The specification of the refurbishment will then be defined and the Project will contribute to the refurbishing of Hq buildings of MettelSat, to the technical integration of the ICT equipment described in other activities and to the improvement of furniture and basic office equipment such as computers.
46. Efforts will also be deployed to improve the infrastructures of the most critical hydro-meteorological stations and to provide up to 6 regional centers with improved buildings, the necessary means for transportation and for receiving and utilizing products from the central facility.

iv) Technical systems and software for performing meteorological, hydrological and climate modelling and forecasting

47. Specification, procurement and installation processes will be implemented for a new central weather forecasting system, a new central climate monitoring system and a new central hydrological monitoring system.
48. With the GTS, EUMETCast and high speed Internet connections working, MettelSat will have access to international numerical weather prediction models operating 24 hours a day which will be useful both for extending its forecasting range and for EWS. In addition, with the data received from the national observing network it will be possible to run finer scale meteorological models. This will allow MettelSat to benefit from the WMO "Cascading Forecasting Process" which links Global Products Centres, Regional Centres and national hydromet service and allows that global products of the major numerical forecast centers may be fully utilized. MettelSat would always



have access to the most advanced products and could focus using this information on its alerting and warning services.

49. The specifications of the Central Forecasting System will take these options into account, and software may be obtained through bilateral cooperation with universities or other meteorological services. The central facility will:
 - (a) Integrate and archive all type of meteorological information data according to specific data policies defined according to forecaster's requirements and standards.
 - (b) Offer an easy access to all data making research and retrieval of any meteorological information a simple process.
 - (c) Provide high processing capacities allowing to run numerical weather prediction models or other computation tasks.
 - (d) Simplify the forecaster work by automating operational tasks: from data control to specific daily processing (such as but not limited to satellite processing) or Numerical Weather Prediction model runs, allowing to create and schedule various meteorological tasks.
50. A Central hydrological monitoring system will be specified and procured in order to process the hydrological information. Hydrological models will be developed over a few selected catchments, where digital elevation models and geographic information tools are available. Modeling software for analyzing data and forecasting floods may be obtained freely from universities or public hydrological institutes.
51. The new Climate Monitoring System will offer the following main functions:
 - (a) Collect and safely store all climate data (historic as well as real time data).
 - (b) Allow an extensive management of metadata making the climate database richer and more accurate, particularly with the implementation of a Climate Data Management System including training
 - (c) Ensure an efficient quality control of the data to ensure that data series are precise and relevant
 - (d) Provide a flexible and scalable production system in order to add value to the raw data and deliver standard climatological reports and statistics, as well as customized products (graphs, charts, maps, etc.) especially elaborated to fulfill the needs of specific end-users
 - (e) Enable easy access to the data and share the national data heritage worldwide according to the data policy and WIS recommendations
52. These developments will need the presence of well-trained staff, capable of adapting the models' parameters to the local conditions, interpret correctly the results, and maintain the software. This will imply a specific training program, which will take time and should begin at the start of the project.
53. Twinning actions will be sought with advanced centers in order to implement a Local Area meteorological Model (LAM), a downscaling climate model and to receive supply of Data Flow from leading NMHS or modeling centers.
54. The project will contribute to the operation cost of the central system during up to 3 years.



Inclusion of gender in Component B:

55. In the DRC a large gap exists between the perceived roles of government and civil society¹³. According to the USAID-led gender assessment (2012), officials at territory, district and provincial levels consistently noted that their first responsibility was “control”. A major responsibility of government is collecting, compiling (usually manually), and forwarding data (usually not sex disaggregated) from territory to district, province and ultimately to the national government. Officials other than senior provincial administrators are apparently not expected to analyze these data, share or discuss information with leaders of other sectors, engage in strategic planning, or prepare budget recommendations related to observable trends¹⁴.
56. Hydromet services in DRC are provided mainly by Mettel Sat, which monitors and forecasts weather, water and climate and is responsible for remote sensing, operational hydrology, thematic cartography, hydrological observation and forecasting. It is interesting to notice how so few women are employed by this sector and/or water-sector agencies or utilities more comprehensively. According to USAID (2012) only 28% of rural households have improved water sources, including 2% that have water piped into their residences: as a result 43M of women are thus compelled to carry water, often for significant distances, for all household needs. Hydrological observation and forecasting should involve more women, especially in decentralized areas. At all level, from remote sensing, to data transmission and management, not to mention equipment maintenance, women are not involved in hydrological and climate risk information. Equipment purchase should also take into account literacy level of the rural population, and limited resources for consumables such as batteries.

Component C. Improvement of hydromet information service delivery

i) - Define requirements and develop feedback mechanisms with different user groups (in line with the National Framework for Climate Services)

57. Component C will focus on the delivery of more accurate, timely and relevant information to users and decision-makers. In agreement with selected users, and through pilot and tailored information for target audiences, MettelSat will try, modify and develop appropriate formats and timings of hydromet information. The focus will be the definition of hydromet information requirements for end users. In line with recommendations from the Global Framework for Climate Services (GFCS) this is expected to be a long-term process, with a continuous user feedback mechanism, including in the aftermath of major events. This component will target beneficiaries with a gender-disaggregated approach. Within this context, the delivery of information to the media (radios, TV, newspapers) should also be strengthened. This is essential in promoting the image of hydromet services to the public and decision-makers as well as generating new sources of revenues.

¹³ This appears to reflect the pattern established under the colonial regime: government was primarily responsible for control of the population and provision of roads and rails for transporting goods to the market, and churches took care of education and health care.

¹⁴ Instead they report upward and execute the instructions they receive from higher levels. Lateral collaboration among ministries and departments is rare. Staff of government departments that are responsible for education and health spoke about how they struggle to deliver adequate services despite poor facilities and limited funds.



ii) - Develop customized products and services made available to user groups through dedicated interfaces

Central Production System

58. In order to assist the forecasters in making different products tailored to the users' needs, a Central Production System will be specified, procured and installed, using Numerical Weather Prediction and all available data to provide cutting edge products for public weather services, for early warning systems, as well as for climatology and other climate services. Climate data rescue, digitization and integration of non-electronic records will be also taken into account. This system should be able to:
- (a) Ingest raw weather data provided by other information systems, such as PUMA, the Central Forecasting System and the Central Climate System and process them with optional human validation
 - (b) Design and generate customized meteorological outputs such as weather alerts or business-oriented weather products
 - (c) Disseminate customized meteorological products in a timely manner, in the most adapted format and through the most suited channel according to the type of end-user you are targeting
59. The new climatological database and central production system which will be built progressively will also allow MettelSat to apply the standards of the WMO Global Framework for Climate Services and to respond efficiently to users' growing number of needs.

Application to flash flood warning

60. Services and procedures for optimal use of hydro-meteorological services for the triggering of early warnings for flooding on 2 to 4 urban zones prone to floods will be specified and developed in agreement with civil protection. Synergies will be sought with local activities of already ongoing development projects. In the urban sector, the World Bank is undertaking the Urban Development Project and its additional financing (P129713) which covers 6 communities with a total financing of USD 200 million. UNDP also supports activities relating to disaster risk reduction: national DRR strategy, early warning strategy and the constitution of a database on disasters. A pilot project in Kinshasa is being defined to anticipate flood risk and another project on landslides in South Kivu has started in May 2015. In Kinshasa there is a plan to reduce the vulnerability of people who have been evicted several times. This activity should build on hydrological modeling and include the identification of specific thresholds for selected hazards in the 2 to 4 urban high-risk zones to be jointly determined, in order to enable the utilization of the hydro-meteorological information for the activation of warnings by competent authorities. The 2 to 4 urban zones subject to hydromet risks will be selected and for each of these zones a process will be implemented with stakeholders such as local authorities, local communities, Civil Protection and NGOs in order to define pilot products useful for disaster prevention and warning. A specific user interface for Civil Protection will be specified, procured and installed, and training will be provided. Services and procedures may also be designed in order to respond to specific requirements expressed by user groups from the civil protection and humanitarian communities.



61. Hydrometeorological hazards, including flash floods, landslides, and urban flash flooding are major causes of the human losses and property damages in DRC. It is anticipated that intensity and frequency of the flash flood events across the globe and in the region may increase due to climate variability and change. Flash floods are caused by heavy rainfall with short duration associated mostly with convective and tropical storms. The DRC is located in a flash flood prone region where flash floods are due to strong tropical convection. Within the scope of WMO Flood Forecasting Initiative, the Flash Flood Guidance System (FFGS) with Global Coverage has been jointly developed by the World Meteorological Organization (WMO) and the Hydrologic Research Center (HRC), with the support of the National Oceanic and Atmospheric Administration (NOAA) and the United States Agency for International Development (USAID) to mitigate the impacts of flash floods by enhancing early warning capabilities at regional and national levels. It currently covers fifty two countries and more than two billion people saving lives and decreasing economic losses.
62. Within the scope of this World Bank project, the Flash Flood Guidance System could be developed and implemented in the 2 to 4 urban pilot sites chosen by the project for flash flood warning, in close collaboration with WMO. Flash Flood Guidance System is a state of art of the hydrometeorological modelling that ingests satellite, in-situ, high resolution mesoscale Numerical Weather Prediction (NWP) precipitation data as well as geomorphological data to produce flash flood warning products such as soil moisture, flash flood guidance, and flash flood threats. Its advance capabilities such as Urban Flash Flood Early Warning, Landslide Susceptibility maps, and Riverine Routing may be applied for the further enhancement of the hydrometeorological early warnings in DRC.

Application to agriculture

63. It appears that presently only two MettelSat operational products are of value to agriculture, the 24 hours forecast bulletin and the 3-month climate seasonal prediction. In accordance with the users, and building over the project's results, MettelSat will consider issuing additional products. Hydro-meteorological information is commonly communicated via radio, TV or mobile phones. The project will involve the design, implementation and evaluation of pilot information for weather forecasts (seasonal, medium and short term) for 3 sites to be selected. Present World Bank projects in the agricultural sector in the DRC include the Western Growth Poles Project (P124720 US\$114.7 million, 2013-2019) in the province of Bas-Congo, the Agriculture Rehabilitation and Recovery Support Project (P092724 US\$130 million, 2010-2017) in the Equateur Province and the Regional Great Lakes Integrated Agriculture Development Project (P143307, in pipeline for an indicative amount of US\$ 154.79 millions) in the province of South Kivu. Many other agencies also have activities in this sector. Pilot areas could also be considered around the INERA areas (cassava, maize, rice, groundnuts, beans, soy) that could benefit from the presence of NGOs (Caritas, World Vision, etc.). If the number of rain gauges appears not to be sufficient, it would be possible to add some field instruments. Outreach could be organized in collaboration with community radios. A user interface for agriculture will be specified and developed, and training sessions for users will be organized. The products will be defined and evaluated in cooperation with the users, such as local communities or organizations, NGOs, or other development projects in progress. Their dissemination will be done through the most appropriate channels, such as radio, mobile phones or other. The action will be implemented in relation with the Ministry of Agriculture and the national and local radio stations. The improvement of the capacities for climatology and



for climate services should enable MettelSat to issue decadal climatological bulletins and other products useful to agriculture. In addition to the decadal bulletins, some capacities to develop 3-5 days forecast could assist with optimal use of inputs and pesticides and reduce post-harvest. Some rolling seminars on agro-meteorology could be customized to the needs of DRC. Inter-operability of networks (synoptic, agro-meteorological) could be supported.

Inclusion of gender in component C:

64. With women occupying agriculture and trade in high numbers, gender awareness will inform the way hydrometeorological information is customized for end-users. However, there is a risk that only formal and unionized sectors will be taken into consideration. If some sectors are male dominated, like for example transport and mining, women are typically a minority in these labor forces, their specific concerns (e.g., safety, health and childcare services) are often neglected. Therefore it is important to consult women and women's organizations during project design and monitor project implementation.
65. For example, it appears that presently only two MettelSat operational products are of value to agriculture, the 24 hours forecast bulletin and the 3 months climate seasonal prediction. In accordance with the users, and building over the project results, MettelSat will consider issuing additional products. Hydro-meteorological information is commonly communicated via radio, TV or mobile phones. The project will involve the design, implementation and evaluation of pilot information about weather forecasts (seasonal, medium and short term) for 5 sites to be selected.
66. Gender and considerations for literacy differentials need to be mainstreamed into these 5 sites. According to the USAID gender assessment (2012) **women perform 70% of agricultural labor and marketing of produce in DRC**. Substantial disparities exist between wealth quintiles in women's literacy: 28% were literate in the poorest quintile, 33% in the second, 41% in the third, 56% in the fourth, and 89% in the highest quintile.
67. Women-farmers use age-old techniques, while men benefit more from mechanized agriculture. Agricultural and grazing land is usually considered traditional tribal property, which excludes women from any claim to ownership, even though the state is also the legal owner of the land. Agricultural work, in its present form of traditional crop sharing or leasing one or two hectares of land, is not generally considered employment, since it is mostly reserved for women and the poor for subsistence purposes.
68. Women could learn from evening radio broadcasts, which could provide hands-on instruction, encouragement, and follow-up (USAID, 2012). The following steps are recommended: i) Execute critical gender analysis early, ensuring balance among the needs and interests of women, men, girls, and boys, and make sure it is comprehensively applied in detailed planning and implementation of all activities; ii) Demand the gathering and use of sex-disaggregated statistics in all phases of work, and ensure prompt adjustments in response to intermediate results to promote better outcomes. Early and penetrating gender analysis will lead to more effective and sustained results. Rather than generating expensive and relatively inapplicable data, sex-disaggregated gender analysis will facilitate adjustments to guide implementation to best promote the interests of



women and men, and girls and boys; iii) Build a solid and robust Monitoring and Evaluation System.

Component D. Project Management

i) - Coordination and technical implementation support

69. This sub-component will finance the following activities:

- (a) Steering Committees
- (b) Preparation of the ToRs for the Management firm (design, monitoring and evaluation)
- (c) Preparation of the ToRs for the Observation, ICT and Logistical firms
- (d) Support to execution 2 months/year during 3 years including technical management of firms
- (e) Assistant to the coordinator
- (f) Monitoring and evaluation
- (g) Other operating costs

ii) - Fiduciary and safeguard aspects and audit

70. This sub-component will finance the following activities:

- (a) Financial management
- (b) Procurement
- (c) Accounting
- (d) Environmental and social management framework (ESMF)
- (e) Environmental and social safeguards
- (f) Operations manual
- (g) Internal audit
- (h) External audit

Annex 2: Implementation Arrangements

Project Institutional and Implementation Arrangements

1. Successful project implementation requires people with different skills and functions to work together to achieve mutually agreed goals to meet the project objectives. This also requires effective and timely coordination between various line ministries and entities.
2. The implementing agency will be MettelSat, defined in a decree of 2012 as the official national hydromet agency, a public technical and scientific service with legal personality and financial autonomy under the Ministry of Transportation and Communication Channels and supported by the State Subsidiary Budget. MettelSat is responsible for the monitoring and forecasting of



weather, water and climate, and provision of geographical information system services. MettelSat has a significant workforce of 483 staff, among which 330 are in Kinshasa and 153 in the provinces. Mettelsat will be responsible for the overall financial management of the grant. However, it has not direct experience in Bank fiduciary procedures. Reliance on Mettelsat to implement the grant is subject to the completion of its financial management system on a base acceptable for the Bank, and to development of procurement, safeguard and M&E capacities.

3. The Ministry of Finance with support of the sectorial ministries will be responsible for:
 - a. Ensuring the attainments of outcomes by facilitating coordination amongst the governmental agencies and institutions participating in the implementation and by addressing coordination issues as they arise;
 - b. Reviewing progress reports as submitted by the Project Coordinator and take action thereon if needed; and
 - c. Providing guidance as needed.



Project administration mechanisms

4. Since so many other agencies and ministries have a stake in hydromet information generation, dissemination and use, a National Steering Committee will be established to coordinate project activities and ensure that they are harmonized with related activities of other government stakeholders. The role of the project National Steering Committee will be to provide overall policy direction on project implementation resolving any policy hurdles, inter-ministerial barriers or policy conflicts. The NSC will be responsible to approve overall implementation plan and annual project budget, and will meet as often as needed but at least every quarter to review and follow up on project progress. The NSC will ensure that adequate staffing arrangements in MettelSat are in place. Within three months following effectiveness, the NSC will ensure that an Internal Audit Department is set up and adequately staffed with an internal auditor whose terms of reference will cover all activities under the project.
5. The Chair of the Steering Committee will be the Secretary General of Transportation and Communication Channels. The committee will include the following members:
 - (i) The Project Coordinator
 - (ii) Representative of RVF (waterways authority)
 - (iii) Representative of RVA (airways authority)
 - (iv) Representative of CVM (maritime transportation authority)
 - (v) Representative of INERA (Institut national pour l'Etude et la Recherche Agronomique)
 - (vi) Representative of ISTA (Institute of Applied Technologies)
 - (vii) Representative of SNEL (Société Nationale d'Electricité)
 - (viii) Representative of the Civil Protection Department in the Ministry of Interior.
 - (ix) Representative of the Ministry of Agriculture
 - (x) Representative of the General Secretariat of Environment
6. To facilitate project implementation a Project Implementation Cell (PIC) will be established within MettelSat, bringing together the required expertise from across the organization, and strengthening its capacity with consultants, where needed. The PIC will perform day-to-day project implementation activities and will also function as a Secretariat for the Steering Committee.
7. The team will comprise of the following main functions:
 - (i) Project Coordinator – the Director General of MettelSat
 - (ii) Deputy Project Coordinator – the Deputy Director General of MettelSat
 - (iii) Assistant to the Project Coordinator – to be recruited
 - (iv) Financial Management Officer – to be recruited
 - (v) Procurement Officer – to be recruited
 - (vi) Environmental Safeguards Officer – to be identified
 - (vii) Social Safeguards Officer – to be identified
 - (viii) Internal Auditor – to be recruited
8. The main responsibilities of the PIC will be to (a) prepare annual implementation plans for the project activities, as well as the annual budget, for National Steering Committee approval; (b) carry out all work related to fiduciary functions including procurement, financial management, disbursement, audit, reporting and monitoring and evaluation. The PIC will be responsible for the



overall project's fiduciary management and procurement in compliance with World Bank's regulations. The PIC will be responsible for processing all the International Competitive Bidding (ICB) and selected National Competitive Bidding (NCB) contracts and payments. In addition, the PIC will interact with relevant stakeholders, including NGOs and municipalities, to guide them in the implementation process where necessary.

9. The PIC will be responsible for organizing all state level training programs involving the concerned state level line ministry, national and international research and development institutions, including NGOs operating in the country. The PIC will also be responsible for the recruitment of national and international consultants for the project, strictly per the guidelines and instructions of the World Bank, and invariably involving the line ministries in their selection and day to day functioning as per the details provided in the Project Operational Manual. A Project Implementation Manual will be developed and disseminated (prior to effectiveness), to take into account current institutional configurations and detail roles and responsibilities.
10. The PIC Director shall take steps to strengthen the overall sustainability of the project, building upon strong commitment of the Government. The Director will review all the factors that are critical to the sustainability of the project and take steps to address through adequate M&E procedures carried out. Counterpart financing of US\$800,000 is included in the provisional budget of MettelSat, US\$200,000 per year. These funds will cover bonuses paid to civil servants working on this project to ensure a high level of motivation and commitment to the project. This will improve the capacity of staff to operate and maintain the system.



11. The ongoing cooperation activities supported by UNDP (United Nations Development Programme), WMO (World Meteorological Organization), the European Union, the African Development Bank, SADC (Southern African Development Community), ACMAD (African Center Meteorological Applications for Development), and the Popular Republic of China have been taken into account in the project design in order to build synergies and to avoid overlaps. The objective will be to obtain a consistent and operational system from these different contributions, especially in relation with the observation network. The different projects may result in disparity in the types of hydromet stations with some implications related to the telecommunication, concentration and processing schemes. Synergies will also be sought concerning training.



Financial Management, Disbursements and Procurement

Financial Management

12. The World Bank and other donors' assessments notably, the CFAA (Country Financial Accountability Assessment), PER (Public Expenditures Review), and PEFA (Public Expenditure and Financial Accountability) 2008 and 2012 have shown an unsatisfactory economic and financial control environment including weak budgeting preparation and control, financial reporting, external audit and human resources. As a result, the overall country fiduciary risk is still considered high. The repeated PEFA, concluded at the end of 2012, took stock of the areas of progress and revised the existing PFM strategy plan accordingly. The new project "Strengthening PFM and Accountability" (P145747), effective since May 2014, will strengthen the Public Financial Management system both at the central and some provinces levels. The outcomes of the use of the country national PFM systems assessment report which had been undertaken in April 2013 will be gradually implemented for the Bank-financed projects. Concerning internal and external audits, discussions will be engaged with the Government to organize the working environment of the General Finance Authority ("Inspection Générale des Finances", IGF) and the Court of Audit ("Cour des comptes").
13. The proposed project will be entrusted to MettelSat as main implementing agency. Given MettelSat's limited project implementation experience, its capacity to carry out some tasks will be strengthened through the recruitment of consultants. These consultants will be responsible for carrying out the procurement and financial management functions in the first year of the project, but also to train MettelSat staff in the PIC, so that they can gradually take over these functions and be fully proficient to carry out these functions themselves by the end of the first year.

Risk Assessment and Mitigation Measures

14. The Bank's principal concern is to ensure that project funds are used economically and efficiently for the intended purpose. Assessment of the risks that the project funds will not be so used is an important part of the financial management assessment work. The risk features are determined over two elements: (i) the risk associated to the project as a whole (inherent risk), and (ii) the risk linked to a weak control environment of the project implementation (control risk).



Risks and Mitigation Measures

Risks	Risk Rating	Risk Mitigating Measures	Residual Risk Rating
Inherent Risk			
Country Level: Poor governance and slow pace of implementation of PFM reforms that might hamper the overall PFM environment.	H	Some PFM reform programs are currently ongoing through IDA-financed projects Enhancing Governance Capacity (P104041), and Establishing Capacity for Core Public Management (P117382), in addition to the project “Strengthening PFM and Accountability” (P145747) approved on January 2014 by the World Bank’s Board. These reforms will address the key new challenges the country is facing.	H
Entity Level: Lack of prior experience with World Bank financed projects	S	Reinforce the existing fiduciary arrangements. Provide Technical Assistance to MettelSat by rolling out the fiduciary training plan which aims at strengthening the capacity of MettelSat fiduciary staff.	S
Project Level	M		M
<i>Overall Inherent Risk: M</i>			
Control Risk			
Budgeting: Weak budgetary execution and control inducing budgetary overspending or the inefficient use of funds.	M	Annual work plan and budget will be prepared for each year. The project FM Manual of Procedures will define the arrangements for budgeting, budgetary control and the requirements for budgeting revisions. Annual detailed disbursement forecasts and budgets will be required. Interim Financial Reports (IFRs) will provide information on budgetary control and analysis of variances between actual and budget.	M
Accounting: Risk of an increase of the FM team’s workload leading to delays in the submission of the required reporting.	S	Appropriate accounting procedures are in place for the bookkeeping of the transactions such as advances and fixed assets. The members of the financial team to be recruited, must have experiences and qualifications acceptable to the Bank.	S
Internal Control: Weak compliance with FM manual of procedures and risk of circumventing internal control systems.	S	(i) Regular internal audit missions will be conducted during the project implementation with a focus on fraud and corruption risk; (ii) update the work-program of the current Internal Audit Unit to reflect the new project specificities; and (iii) The current manual of procedures will be upgraded.	S



Funds Flow: MettelSat has no direct experiences with management of IDA funds; (i) Risk of misuse of funds allocated to the census, (ii) Weak capacity in IDA disbursement procedures which could affect the disbursement rate for the components under INS responsibility.	S	- Organize frequent controls in each involved actor in order to help to prevent and mitigate the risk of diversion of funds. - Payment requests will be approved by the Coordinator and the financial management specialist prior to disbursement of funds. - Require of the FM team to ensure monthly submission of the withdrawal application. - Perform external audit.	S
Financial Reporting: Delay in the submission of Interim Un-audited Financial Reports (IFRs) to IDA due to weak capacity of the FM team.	M	Computerized accounting system- Purchase appropriate accounting software and customized to generate the financial reports of the project.	M
Auditing: External audit arrangements are not defined and lack of capacity of public institutions of control to assure the external audit of the project.	M	Recruitment of independent external auditor based on agreed ToR developed in line with International Accounting Standards (including fraud and corruption).	M
<i>Overall Control Risk</i>	<i>S</i>		<i>S</i>
Overall FM Risk	S		S
The overall risk rating is deemed Substantial.			

15. **Governance and anticorruption considerations.** The country political situation has weakened the governance and corruption environment. In the context of the project, the following governance and anti-corruption measures will contribute to enhance transparency and accountability during the project implementation : (i) an effective implementation of the fiduciary mitigation measures should contribute to strengthen the control environment, (ii) the TOR of both internal audit unit and external auditor will comprise a specific chapter on corruption auditing, (iii) the FM manual of procedures will include anti-corruption measures with a specific safety mechanism that will enable individual persons and NGOs to denounce abuses or irregularities, (iv) measures to improve transparency such as providing information on the project status to the public and to encourage participation of civil society and other stakeholders will be strengthened during project implementation and (v) finally, an Anti-corruption action plan will be prepared in addition to the robust FM arrangements designed to mitigate the fiduciary risks.
16. **Staffing and Training.** The current financial management staffing arrangement under MettelSat will be reinforced to implement the project. In the perspective that the project generates a workload, this FM team should be reinforced through the recruitment of a chief financial officer, an accountant, and an internal auditor. The work-program of the Internal Audit Unit will be revised



within three months after the project effectiveness to take into consideration the new project specificities. The team will have the overall FM responsibility over, budgeting, accounting, reporting, disbursement, internal control and auditing. The project will recruit two financial management consultants that will be responsible for financial management and accounting in the first year of the project. These consultants will also be responsible for training MettelSat staff in the PIC, who will progressively take over this function as they become more familiar with World Bank Financial Management procedures and standards.

17. **Budgeting.** The budgeting arrangements will include an annual work plan and budget to be prepared for each year. The project FM Manual of Procedures will define the arrangements for budgeting, budgetary control and the requirements for budgeting revisions. Annual detailed disbursement forecasts and budgets will be required. IFRs will provide information on budgetary control and analysis of variances between actual and budget. Current budget mechanisms will be revised to incorporate the new project specifics.
18. **Accounting Policies and Procedures.** The accounting systems, policies, and administrative and financial procedures designed for the project will be drafted by an independent consultant and reviewed before approval. This manual of procedures will be revised to include the new project's specifics. PRINS's accounting software will be used after its configuration for reflecting the new project specificities. Appropriate accounting procedures will be implemented for the bookkeeping of the transactions such as advances and fixed assets. The members of the financial team to be recruited, must have experiences and qualifications acceptable to the Bank.
19. **Internal Control and Internal Auditing.** The work-program of MettelSat's internal audit Unit will be revised to take into account the new project specificities. The internal auditor to be recruited will report directly to the Coordinator (and/or Steering Committee). He will undertake periodic assessments on the strengths and weaknesses of the internal control system at all levels. All control deficiencies or circumvented practices identified will be communicated in a timely manner to the overall senior management of the project for immediate corrective action as appropriate. One of each such report will also be communicated to the Bank. He will prepare relevant manuals and guidelines. In line with the DRC Use of Country System Report to fully rely on General Finance Authority (IGF) for project's internal audit, the current project's internal control system could be strengthened by establishing a channel of collaboration between IGF and the current project's internal audit unit to agree on project's risk mapping and work program.

20. Key Weaknesses and Action Plan to Reinforce the Control Environment

Issue	Remedial action recommended	Entity Responsible	Deadline for Completion	Effectiveness conditions
1	Open a designated account in a financial institution acceptable to the Bank	MettelSat/ DRC Government	Not later than one month after effectiveness	N
2	Implement a customized Excel spreadsheet for bookkeeping in line with the minimum disclosure requirements	MettelSat/ DRC Government	Not later than one month after effectiveness	N



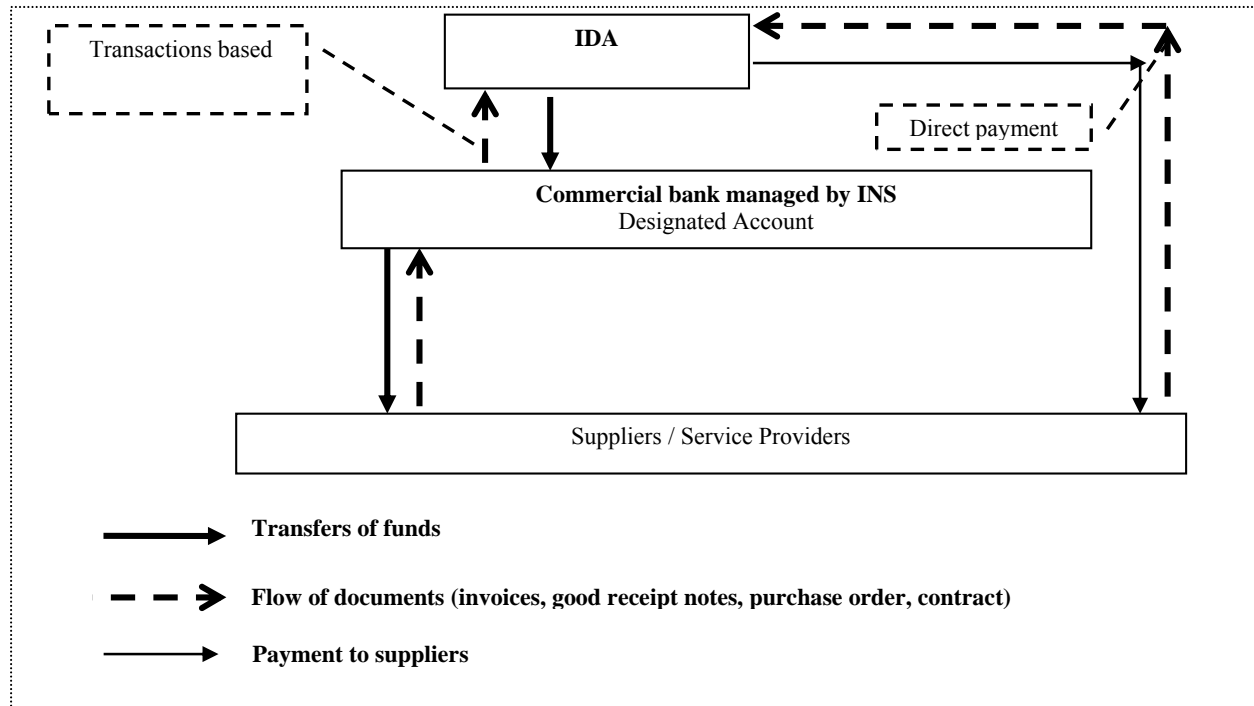
	necessary to accompany satisfactory manual book keeping.			
3	Current financial procedure guidelines must be upgraded into a full manual so as to take into account the grant specificities, as well as the Bank's Financial Management guidelines.	MettelSat/ DRC Government	Not later than two months after effectiveness	N
4	Recruit a Chief Financial Officer,	MettelSat/ DRC Government	Not later than two months after effectiveness	N
5	Recruit an Accountant,	MettelSat/ DRC Government	Not later than two months after effectiveness	N
6	Recruit an internal auditor	MettelSat/ DRC Government	Not later than two months after effectiveness	N
7	Recruit an external auditor	MettelSat/ DRC Government	Not later than two months after effectiveness	N

Disbursements

21. **Funds Flow and Disbursement Arrangements.** One Designated Account (DA) will be opened in a reputable commercial bank. This account will be held in USD. The Designated Accounts will receive cash advances to pay project expenses eligible for IDA financing. Any interest earned on funds deposited in the Designated Account shall be deposited into the project account. Payments will be made in accordance with the provisions of the manual of procedures (i.e. joint signatures by the METELSAT Director General and Chief Financial Officer).
22. **Disbursement arrangements.** The transaction-based disbursement method will be applied for the Designated Account (DA) which will receive an initial advance of US\$XXX. The DA will be used for all payments inferior to twenty percent of the ceiling (US\$XXX) and replenishment will be submitted as often as possible. Funds flows for the DA are as follows:
23. **Disbursement of Funds to other Service Providers and Suppliers:** MettelSat will make disbursements to service providers and suppliers of goods and services in accordance with the payment modalities, as specified in the respective contracts/conventions as well as the procedures described in the project's Manual of Administrative, Accounting, and Financial. In addition to these supporting documents, the Project will consider the findings of the internal audit unit while approving the payments. MettelSat, with the support of its internal audit unit, will reserve the right to verify the expenditures ex-post, and refunds might be requested for non-respect of contractual clauses. Misappropriated activities could result in the suspension of financing for a given entity.



Flow of Funds and Disbursement Arrangements



24. **Disbursements by category:** Expenditure categories to be financed by of the Grant take into account the prevailing country financing parameters for DRC in setting out the financing levels except for local expenditures which will be financed at 100 percent excluding local taxes. In accordance with Bank standard procurement requirements, contracts will continue to be approved “all taxes included” for local expenditures. The project will however, claim invoiced amounts excluding taxes. The Government will take appropriate steps to cover the tax portion of contracts signed by the project with contractors and suppliers of goods and services.
25. **Financial Reporting and Monitoring:** The manual of procedures will indicate provisions for quarterly and yearly financial reporting, including physical progress. The quarterly reports will include a table on budget execution. The format of this report will include (i) the statements of sources and used funds, and utilization of funds per category, (ii) an updated procurement plan, (iii) the physical progress and, (iv) the summary of missions of internal audit, as well as implementation status of the recommendations of internal or external audit and supervision missions.
26. **External Auditing:** The project financial statements and internal control system managed by MettelSat will be subject to annual audits by an independent external auditor which will be renewed every two years. The audit will include the activities under implementation by the private firm. The Bank will pursue the policy dialogue with MettelSat with the view of having the project external auditors as MettelSat contractual auditor. This will strengthen the existing weak external auditing arrangements in place at MettelSat. The external auditor will give an opinion on the annual financial statements in accordance with auditing standards of the International Federation of Accountants (IFAC). In addition to audit reports, external auditor will also produce a management letter on internal control to improve accounting controls and compliance with financial covenants



under the financing agreement. The project will be required to submit, not later than June 30 of each fiscal year, the annual audited financial statements. In line with the new access to information policy, the project will comply with the disclosure policy of the Bank of audit reports (for instance making available to the public without delay after receipt of all reports final financial audit, including audit reports qualified) and place the information on its official website within one month after acceptance of final report by IDA. The project will be required to produce a final audit report no later than six months after closing of project. In compliance with the DRC Use of Country Systems Report, the DRC's Supreme Audit Institution (Cour des Comptes) could start being involved in the process of the external auditors' selection and their reports reviewing. In line with the new access to information policy, the project will comply with the disclosure policy of the Bank of audit reports (for instance making available to the public without delay after receipt of all reports final financial audit, including audit reports qualified) and place the information on its official website within one month after acceptance of final report by IDA.

27. **Implementation support Plan:** FM implementation support missions will be consistent with a risk-based approach, and will involve a collaborative approach with the project team. A first implementation support mission will be performed six months after project effectiveness. Afterwards, the missions will be scheduled by using the risk based approach model and will include the following: (i) monitoring of the financial management arrangements during the supervision process at intervals determined by the risk rating assigned to the overall FM Assessment at entry and subsequently at each Implementation Status and Results (ISR) report; (ii) integrated fiduciary review on key contracts, (iii) review the IFRs; (iv) review the audit reports and management letters from the external auditors and follow-up on material accountability issues by engaging with the task team leader, Client, and/or Auditors; the quality of the audit (internal and external) also is to be monitored closely to ensure that it covers all relevant aspects and provide enough confidence on the appropriate use of funds by recipients; and, (v) physical supervision on the ground; and (vi) assistance to build or maintain appropriate financial management capacity.

28.

29. **Conclusions of the FM Assessment:** The overall residual FM risk at preparation is considered Substantial. The proposed financial management arrangements for this project are considered adequate to meet the Bank's minimum fiduciary requirements under OP/BP10.00.

Procurement

30. **Applicable guidelines:** Procurement for the proposed project would be carried out in accordance with the World Bank's "Guidelines including: (i) Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits" dated January 2011, revised July 2014; (ii) Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011, revised July 2014; (iii) Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants (October 15, 2006 and revised in January 2011); and (iv) the provisions stipulated in the Financing Agreement. The various items under different expenditure categories are described in general below. For each contract to be financed by the Grant and Credit, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements and time frame are agreed between the Borrower and the Bank in the Procurement



Plan. The procurement plan would be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

31. **Reference to the National Procurement Regulatory Framework:** For all contracts awarded through NCB method, the Bank may authorize the use of the national institutions and regulations that comprise the law including its texts of application, the institutions set up for the control and regulation and the institutions responsible for procurement activities implementation. The NCB procedures currently in force in DRC deviate slightly from the World Bank Procurement Guidelines NCB procedures for procurement of Works, Goods and services (other than consultants services); thus, they have been already reviewed and appropriate modifications have been proposed to assure economy, efficiency, transparency, and broad consistency with the provisions included in Section I and paragraphs 3.3 and 3.4 of the Bank Procurement Guidelines (refer to the paragraph below).
32. **Requirements for National Competitive Bidding (NCB):** The procedures to be followed for NCB shall be those set forth in the Recipient's Procurement Code of April 27, 2010, as revised from time to time in a manner deemed acceptable to the Association, subject, however, to the modifications described in the following paragraphs required for compliance with the Procurement Guidelines:
 - a. **Standard Bidding Documents:** All standard bidding documents to be used for the Project under NCB shall be found acceptable to the World Bank before their use during the implementation of Project;
 - b. **Eligibility:** Eligibility of bidders and acceptability of their goods and services shall not be based on their nationality and/or their origin; and association with a national firm shall not be a condition for participation in a bidding process. Therefore, except for the ineligibility situations referred to in paragraphs 1.10(a) (i) and 1.10(a) (ii) of the Procurement Guidelines, the eligibility of bidders must be based solely on their qualification, experience and capacity to carry out the contract related to the specific bidding process ;
 - c. **Advertising and Bid Preparation Time:** Bidding opportunities shall be advertised at least in a national newspaper of wide circulation and on the website of the Recipient's Procurement Regulator (Autorité de Régulation des Marchés Publics) and bidders should be given at least 30 days from the date of invitation to bid or the date of availability of the bidding documents, whichever is later;
 - d. **Criteria for Qualification of Bidders:** Qualification criteria shall only concern the bidder's capability and resources to perform the contract taking into account objective and measurable factors. Such criteria for qualification of bidders shall be clearly specified in the bidding documents;
 - e. **Bid Evaluation and Contract Award:** A contract shall be awarded to the substantially responsive and lowest evaluated bidder provided that such bidder meets the qualification criteria specified in the bidding documents. No scoring system shall be allowed for the evaluation of bids, and no "blanket" limitation to the number of lots which can be awarded to a bidder shall apply. The criteria for bid evaluation and the contract award conditions shall be clearly specified in the bidding documents;
 - f. **Preferences:** No preference shall be given to domestic/regional bidders; to



domestically/regionally manufactured goods; and to bidders forming a joint venture with a national firm or proposing national sub-contractors or carrying out economic activities in the territory of the Recipient.

- g. Publication of Contract Award: Information on all contract awards shall be published in at least a national newspaper of wide circulation or in the Recipient's Procurement Regulator (Autorité de Régulation des Marchés Publics) web-site;
- h. Fraud and Corruption: In accordance with the Procurement Guidelines, each bidding document and contract shall include provisions stating the World Bank's policy to sanction firms or individuals found to have engaged in fraud and corruption as set forth in the Procurement Guidelines;
- i. Inspection and Audit Rights: In accordance with the Procurement Guidelines, each bidding document and contract shall include provisions stating the World Bank's policy with respect to inspection and audit of accounts, records and other documents relating to the bid submission and contract performance;
- j. Requirement for administrative documents and/or tax clearance certificate: The bidding documents shall not require foreign bidders to produce any administrative or tax related certificates prior to confirmation of awarding a contract;
- k. Modifications of a Signed Contract: Any change in the contract amount which, singly or combined with all previous changes, increases the original contract amount by fifteen (15) percent or more must be done through an amendment to the signed contract instead of signing a new contract.

Items to be procured and the methods to be used

- 33. **Advertisement:** General Procurement Notice (GPN), Specific Procurement Notices (SPN), Requests for Expression of Interest, and results of the evaluation and contracts award should be published in accordance with advertising provisions in the following guidelines: "Guidelines: Procurement under IBRD Loans and IDA Credits" dated January 2011, revised July 2014; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated January 2011, revised July 2014. For this purpose, the MettelSat will prepare and submit to the Bank a General Procurement Notice (GPN). Specific Procurement Notice (SPN) for all goods, non-consulting services and works to be procured under International Competitive Bidding (ICB) and Requests for Expressions of Interests for all consulting services costing the equivalent of US\$200,000 and above will be published in "Dg Market", on the Bank's external website, and in the national press, in addition to other media with wide circulation. All other specific procurement notices and other requests for expression of interest shall be published at a minimum in the national press with wide circulation.
- 34. **Procurement of goods, and non-consultancy services:** goods and non-consultancy services procured under this project will be done either under ICB using Bank procurement rules that include the related SBD or under NCB using National Standard Bidding Documents agreed with or satisfactory to the Bank. Small value goods may be procured under shopping procedures. Direct contracting may be used where necessary if agreed in the procurement plan in accordance with the provisions of paragraph 3.7 to 3.8 of the Procurement Guidelines.



35. **Procurement of works:** works procured under this project will be done under NCB using National Standard Bidding Documents agreed with or satisfactory to the Bank. Small value works may be procured under shopping procedures. Direct contracting may be used where necessary if agreed in the procurement plan in accordance with the provisions of paragraph 3.7 to 3.8 of the Procurement Guidelines.
36. **Selection and employment of Consultants:** consultancy services required for the project will be procured using the selection method Quality and Cost Based Selection (QCBS) whenever possible. Contracts for specialized assignments estimated to cost less than US\$200,000 equivalent may be contracted through Consultant Qualification (CQ). The following additional methods may be used where appropriate: Quality Based Selection (QBS); Selection under a Fixed Budget (FB); and Least-Cost Selection (LCS). Short lists of consultants for services estimated to cost less than the equivalent of US\$100,000 per contract for ordinary services and US\$200,000 for design and contract supervision may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. However, if foreign firms express interest, they will not be excluded from consideration. Single Source Selection (SSS) may be employed with prior approval of the Bank and will be in accordance with paragraphs 3.8 to 3.11 of the Consultant Guidelines. All services of Individual Consultants (IC) will be procured under contracts in accordance with the provisions of paragraphs 5.1 to 5.6 of the Guidelines.
37. **Operating Costs:** Operating costs shall consist of operations and maintenance costs for vehicles, office supplies, communication charges, equipment, utility charges, travel expenses, per diem and travels costs, training costs, workshops and seminar and associated costs, among others. Operating costs will not include salaries of civil servants.
38. **Training and Workshops.** Training and workshops will be based on capacity needs assessment. Detailed training plans and workshops activities will be developed during project implementation, and included in the project annual plan and budget for Bank's review and approval.

Procurement Implementation Arrangements

39. **Guiding principles of the implementation of the procurement:** The Government and the World Bank agreed to mainstream the implementation of the project into the existing legal entity and structure and will be framed by the following principles: (i) MettelSat will be made more responsible and accountable in project implementation with a focus on strengthening country systems; (ii) equity; and (iii) performance-based agreements which make providers accountable for delivering specific results. Procurement activities of the project will be carried out by the procurement unit (Cellule de Gestion des Projets et des Marchés Publics – CGPMP) within MettelSat that will report to the General Director of the said institution. Since its creation by the decree N°12/040 on October 2, 2012 MettelSat didn't put in place its CGPMP according to the procurement law. In addition to this MettelSat didn't carry out procurement activities. Therefore it has no capacity and experience to carry out procurement activities for this project. As a contracting authority MettelSat has to carry out its procurement activities according to the decree N°12/040 on October 2, 2012 of its creation and to the procurement law. This is why MettelSat will urgently liaise with ARMP to officially set up its CGPMP.

Assessments of the Procurement risks and the related mitigation measures

40. An assessment of the capacity of MettelSat to implement procurement actions for the project was carried out by a World Bank procurement team in April 2016. The assessment found that MettelSat has no procurement unit and no capacity and experience to implement procurement activities for this project. The Work Bank procurement team recommended MettelSat as a contracting authority to set up urgently its CGPMP according to the procurement law. The project will recruit a procurement consultant that will be responsible for procurement in the first year and gradually transfer responsibilities to a selected procurement officer within MettelSat. The consultant will be responsible for both carrying out the necessary procurement procedures, but also to train the designated MettelSat procurement staff.
41. The key issues and risks concerning procurement for implementation of the project have been identified and include:
- The administrative system as it operates in practice creates opportunities for informal interference in the procurement process by senior officials – creating opportunities for waste, mismanagement, corruption, collusion and fraud;
 - Government officials likely to be involved in project procurement through tender committees and the national control system ensuring that the rules are respected and able to handle complaints from bidders may not be familiar with procurement procedures according to World Bank guidelines and rules;
 - Control and regulation mechanism according to the provisions of the Country procurement law and its application procedures could delay the procurement process if mandatory reviews are required;
 - MettelSat does not have a formal established procurement unit according to the procurement law. It will set up a CGPMP with no experience to implement procurement activities for this project;
42. **The overall unmitigated risk for procurement is High.** Proposed corrective measures which have been agreed to mitigate the risk are summarized in the following table.

43. Action plan corrective measures

Ref	Tasks	Responsibility	Due date
1	Set up a formal procurement unit (CGPMP) within MettelSat	MettelSat	By effectiveness
2	Prepare a management guide that will include procurement methods to be used in the project along with their step by step explanation as well as the standard and sample documents to be used for each method.	MettelSat	By effectiveness
3	Recruit a procurement consultant with strong experience in World Bank procurement procedures who will provide technical assistance to the CGPMPs. His/her main role will be to support, train and coach the CGPMP.	MettelSat	3 months after effectiveness
4	Organize a launch workshop involving all	MettelSat	3 months after



	stakeholders		effectiveness
5	Identify the root cause of procurement delays at national level and propose appropriate solutions (global)	MettelSat	At project mid-term review

44. **Frequency of Procurement Supervision:** In addition to the prior procurement review carried out by the Bank, the procurement specialist recommends at least one mission every six months for the first two years and one mission every year for the next years to provide support to the implementation of procurement activities. This support will include not only the organization and functioning of the procurement unit but also the implementation of procurement activities listed in the procurement plan. One post-review of procurement activities will be carried out every year. As agreed with the Government, contracts will be published on the web. Annual compliance verification monitoring will also be carried out by an independent consultant and would aim to: (a) verify that the procurement and contracting procedures and processes followed for the project were in accordance with the Financing Agreement; (b) verify technical compliance, physical completion and price competitiveness of each contract in the selected representative sample; (c) review and comment on contract administration and management issues as dealt with by the implementation entity; (d) review capacity of the implementation entity in handling procurement efficiently; and (e) identify improvements in the procurement process in the light of any identified deficiencies.
45. **Contract Management and Expenditure Reports:** As part of the Procurement Management Reports (PMR), MettelSat will submit contract management and expenditure information in quarterly reports to the World Bank for the project. The procurement management report will consist of information on procurement of goods, works and consultants' services and compliance with agreed procurement methods. The report will compare procurement's performance against the plan agreed at negotiations and as appropriately updated at the end of each quarter. The report will also provide any information on complaints by bidders, unsatisfactory performance by contractors and any information on contractual disputes if any. These contract management reports will also provide details on payments under each contract, and will use these to ensure no contract over-payments are made or no payments are made to sanctioned entities.
46. **Procurement planning:** The borrower has prepared a Procurement Plan for the first 18 months of the project implementation which provides the basis for the procurement methods. This plan was agreed between the Client and the Bank during negotiations. It will also be available in the project's database and in Bank's external website. The Procurement Plan will be updated in agreement with the Project Team annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

47. Thresholds for procurement methods and prior review

Expenditure Category	Contract Value Threshold (US\$)	Procurement Method	Contracts Subject to Prior Review (US\$)
1. Works	≥10,000,000	ICB	All
	<10,000,000	NCB	All contracts ≥ 5.000.000



	<200,000	At least three quotations	None	
	All amount	Direct contracting	All \geq 100.000	
2. Goods	\geq 1,000,000	ICB	All	
	<1,000,000	NCB	All contracts \geq 500,000	
	<500,000	Shopping from all major brands of vehicles dealers or distributors of petroleum products	Shortlist of: (i) vehicles dealers; and (ii) distributors of petroleum products. The technical specifications of vehicles.	
	<100,000	Shopping	None	
	All amount	Direct contracting	All \geq 100.000	
2. Services	\geq 200,000		All	
	Firms	<200,000	CQ	None
		All amount	SSS	All \geq 100.000
Individual Cons.	\geq 200,000	IC	All	
	<200,000	IC	None	
	All amount	SSS	All \geq 100.000	

All TORs regardless of the value of the contract are subject to prior review. All justifications for Direct contracting/SSS included the estimated amount of contract are subject to prior review.

Note: (ICB: international competitive bidding; NCB: national competitive bidding; CQ: Consultants qualification; SSS: Single source selection; IC: individual consultant.

Environmental and Social (including safeguards)

48. At national level, the DRC has a legislative and regulatory framework which is conducive to good environmental and social management. In addition, the DRC has signed a number of international treaties and conventions. The Government of the DRC has experience with the Bank's Safeguard Policies due to Bank-funded projects across different sectors. However, implementation capacity is weak. Environmental policies and their compliance are governed by the Ministry of Environment, Conservation and Sustainable Development (*Ministère de l'Environnement, de la Conservation de la Nature et Développement Durable, MECNDD*). The MECNDD has three departments in charge of environmental monitoring and management: i) the national agency for the environment (*Agence Congolaise de l'Environnement, ACE*), the former *Groupe d'études environnementales du Congo (GEEC)*; ii) the *Centre National d'Information sur l'Environnement (CNIE)*; and iii) The *Cellule Réglementation et Contentieux Environnementaux (CRCE)*. The ACE is responsible for safeguards compliance of all projects in the country, but with emphasis on environmental category A project. This agency is also familiar with the safeguard instruments such



as the Environmental and Social Management Framework (ESMF), the Resettlement Policy Framework (RPF), and the Indigenous Peoples Policy Framework (IPPF). The ACE is understaffed and has limited capacity. Despite several donor-funded capacity building initiatives, the unit still largely relies on donor funds to carry out its field supervision duties. At the provincial level, government agencies (including those attached to the Ministry of Environment) often do not have the equipment necessary to monitor social and environmental impacts, their staff lacks training, and management capacity is very thin.

49. The Project Coordinator will ensure that the Project carries out the following duties and responsibilities such as:
- database design and tool development;
 - preventive and corrective measures that can help improve the environment;
 - the preparation of environmental testing protocols;
 - conduct an environmental audit of the equipment;
 - prepare the guidelines, procedures and methods to ensure the laws and rules of environmental protection are met.

Monitoring & Evaluation

50. The PIC will also be responsible for the overall coordination of M&E activities, their consolidation, and the preparation of periodic fiduciary and M&E reporting, including impact and output indicators as well as annual audit of project's financial statements. The project M&E system will be based on the agreed Results Framework and implementation arrangements. PIC will bear the responsibility of data collection on the ground for each component's agreed indicators following procedures and methods established within each involved Ministry. Under the M&E plan, units of measurement, baseline values, targets, frequency, data source/methodology and responsibility for data collection will be defined for each Project Development Objective (PDO) level outcome indicator and each intermediate level indicator. The data is expected to inform semi-annual implementation support missions to track project progress in terms of outcomes in the implementation status and results (ISRs) reports, and for the final evaluation of the project in the implementation completion and results (ICR) report. Reporting and use of M&E data as well as assessment of capacity will be described and rated in the ISRs, and will be reviewed at project mid-term. The additional staff to be recruited for PIC (procurement specialist, financial management specialist, environmental safeguard specialist, and monitoring and evaluation specialist) shall be recruited prior to effectiveness.
51. The PIC will take steps to build M&E capacity utilizing resources allocated under the project. This will include technology, equipment, training on data collection, content management, information updates and basic system troubleshooting and maintenance. The M&E specialist of the PIC may be supported with a consultant if necessary during the first year of the project. Efforts will be made to fully empower national institutions in the M&E of the project outcomes, ensuring that it is strongly linked to the national M&E system. The PIC will be responsible for producing timely and pertinent information that will become key management tool for decision makers.
52. The Results Framework (Annex 4) will be used to monitor achievement of the PDO and the outcome indicators. Project monitoring will take place on an annual and/or trimestral function and



will include reviews/audits, reporting of outputs, and maintaining progressive records. Broad thematic areas that will be supervised and monitored include:

1. **Indicators at the project level.** This includes monitoring the number of Quality Management Systems established, the installation of equipment to centralize data, operational forecasts, climatology and production, and the population benefitting from improved services and/or new services.
2. **Strengthening of institutional and governance capacities.** This includes monitoring the number of professionals having participated to trainings and the number of MoUs having been developed or revised with other institutions using and/or providing hydro meteorological services.
3. **Modernization of observation, forecast, alert and response infrastructures.** This includes monitoring the number of stations feeding the central online data platform on time and the number of stations rehabilitated or improved by the project.
4. **Improvement of service delivery to users.** This includes monitoring the number of views on the online data platform, the number of hazards for which warning or monitoring forecasts bulletins have been produced, and the number of user groups having shared their needs and a resulting action plan to address them.
5. **Project Management.** This includes monitoring the number of on time submission of procurement, financial management, and technical reports including monitoring and evaluation (M&E).



Annex 3: Implementation Support Plan

Strategy and Approach for Implementation Support

1. The Project Implementation Manual (PIM) will present the main implementation modalities and institutional arrangements to support those modalities. The PIM and its adoption is considered as standard operating procedures for the project. The strategy of the Implementation Support Plan (ISP) has been developed according to the nature and the characteristics of the project, as well as its risk profile. The strategy focuses on the principal risks identified and the agreed risk mitigation measures described in the SORT. It will also provide the technical advice necessary to facilitate achieving the PDO. The ISP also identifies the minimum requirements to meet the Bank's fiduciary obligations.

Implementation Support Plan

2. Collaboration with other key stakeholders and the government is a central factor for Project implementation. The Government has developed several key policies and has created and/or strengthened national institutions that are directly linked to decentralization, poverty reduction, and local development planning. The main elements of the Implementation Strategy are as follows:
3. **Technical support:** Technical support will be provided to the participating agencies, in general, and the PIC, in particular. This will ensure compliance with different agreed modalities and procedures. On the other hand, experts of the PIC will provide regular inputs to the agencies in each of these activities.
4. The Bank will provide continuous extensive technical support through participating in the supervision missions, Mid Term Review (MTR) and ad hoc advisory services. This support will be crucial to the identification of the main factors that may hinder the proper implementation of the activities. The support will include a continuous assessment of risks (outlined in the SORT), fiduciary requirements and inputs, and safeguards. The Bank team will also support the implementation of the agreed Governance and Anti-corruption Plan, and provide guidance in resolving any issues identified.
5. **Procurement:** Implementation support will include the following elements: (a) providing training; (b) reviewing procurement documents and providing timely feedback to the Procurement staff; and (c) providing detailed guidance on the Bank's Procurement Guidelines to the Procurement Committee; and (d) monitoring procurement progress against the detailed Procurement Plan.
6. **Financial Management.** Support will include the provision of training to the concerned financial management consultants, and reviewing the project financial management system (on a semi-annual basis), including accounting, reporting, and internal controls. The current



financial management staffing arrangement under MettelSat will be reinforced to implement the project. In the perspective that the project generates a workload, this FM team should be reinforced through the recruitment of a chief financial officer, an accountant, and an internal auditor. The work-program of the Internal Audit Unit will be revised within three months after the project effectiveness to take into consideration the new project specificities. The team will have the overall FM responsibility over, budgeting, accounting, reporting, disbursement, internal control and auditing. The project will recruit two financial management consultants that will be responsible for financial management and accounting in the first year of the project. These consultants will also be responsible for training MettelSat staff in the PIC, who will progressively take over this function as they become more familiar with World Bank Financial Management procedures and standards.

7. FM Implementation support missions will be consistent with a risk-based approach, and will involve a collaborative approach with the project team. A first implementation support mission will be performed six months after project effectiveness. Afterwards, the missions will be scheduled by using the risk based approach model and will include the following: (i) monitoring of the financial management arrangements during the supervision process at intervals determined by the risk rating assigned to the overall FM Assessment at entry and subsequently during Implementation (ISR); (ii) integrated fiduciary review on key contracts, (iii) review the IFRs; (iv) review the audit reports and management letters from the external auditors and follow-up on material accountability issues by engaging with the task team leader, Client, and/or Auditors; the quality of the audit (internal and external) also is to be monitored closely to ensure that it covers all relevant aspects and provide enough confidence on the appropriate use of funds by recipients; and, (v) physical supervision on the ground; and (vi) assistance to build or maintain appropriate financial management capacity.
8. **Procurement:** In addition to the prior procurement review carried out by the Bank, the procurement specialist recommends at least one mission every six months for the first two years and one mission every year for the next years to provide support to the implementation of procurement activities. This support will include not only the organization and functioning of the procurement unit but also the implementation of procurement activities listed in the procurement plan. One post-review of procurement activities will be carried out every year. As agreed with the Government, contracts will be published on the web. Annual compliance verification monitoring will also be carried out by an independent consultant and would aim to:(a) verify that the procurement and contracting procedures and processes followed for the project were in accordance with the Financing Agreement; (b) verify technical compliance, physical completion and price competitiveness of each contract in the selected representative sample; (c) review and comment on contract administration and management issues as dealt with by the implementation entity; (d) review capacity of the implementation entity in handling procurement efficiently; and (e) identify improvements in the procurement process in the light of any identified deficiencies.
9. **Safeguards:** Support to environmental and social safeguards will need staffed missions to project sites twice a year. Support will include capacity building on safeguards requirements, and Environmental and Social Management Plan (ESMP) implementation. Implementation



support for safeguards team in the immediate term will include recruiting a part-time an Environmental and Social Safeguards consultant for approximately one year, to support the preparation and implementation of the project, assist with training and capacity building for the PIC, help the establishment of a partnership with the Ministry of Environment through the ACE (for the approval of studies and external monitoring). The consultant will support the performance of the PIC, to ensure that full environmental and social functions are carried out in a timely and effective manner, including:

- Ensure the PIC takes ownership over the implementation of the environment and social management;
 - Ensure that companies respect the environmental commitments laid out in the ESMF;
 - Carry out site visits of construction sites to ensure social and environmental measures are addressed;
 - Intervene urgently to any incident or accident that requires verification and monitoring;
 - Notify any breach of the commitments to environmental and social management;
 - Inform affected communities and NGOs of their right and obligation regarding the implementation of the project;
 - Ensure that the complaints of the population are identified and properly addressed;
 - Ensure that national regulations and safeguard policies of the World Bank are respected in the phases of preparation and during the work.
10. The project should make provisions to ensure consultants are available to complete the Environment and Social Management Plan and make sufficient budget allocations. In addition, it is suggested to carry out technical inspections of the safety of the infrastructure through the regular monitoring, supervision and evaluation of the project. Support will also be provided to strengthen the environmental and social capacities of members of the Project Steering Committee by organizing awareness sessions and training on environmental and social safeguard documents.
11. To ensure documents are shared and backed-up as necessary, the project will organize a training workshop and capacity building of stakeholders involved in environmental and social management of the project. Furthermore, the workshop will help participants understand the environmental and social challenges of the project and potential impacts, environmental regulations applicable to the project; guidelines and backup tools from the World Bank; the provisions of ESMF, the procedure for selection and environmental responsibilities in the implementation of good environmental and social practices; environmental monitoring of construction sites and environmental monitoring.
12. **Monitoring and Evaluation:** Adequate support to M&E activities will need staffed missions to project sites at least twice a year. The PIC will be responsible for the overall coordination of M&E activities, their consolidation, and the preparation of periodic fiduciary and M&E reporting, including impact and output indicators as well as annual audit of project's financial statements. Under the M&E plan, units of measurement, baseline values, targets, frequency, data source/methodology and responsibility for data collection will be defined for each outcome indicator and each intermediate level indicator. The data is expected to inform semi-



annual implementation support missions to track project progress in terms of outcomes in the implementation status and results (ISRs) reports, and for the final evaluation of the project in the implementation completion and results (ICR) report. Reporting and use of M&E data as well as assessment of capacity will be described and rated in the ISRs, and will be reviewed at project mid-term. The additional staff to be recruited for PIC (procurement specialist, financial management specialist, environmental safeguard specialist, and monitoring and evaluation specialist) shall be recruited prior to effectiveness.

13. M&E capacity support under the project will include technology, equipment, training on data collection, content management, information updates and basic system troubleshooting and maintenance. The M&E specialist of the PIC may be supported with a consultant if necessary during the first year of the project. Efforts will be made to fully empower national institutions in the M&E of the project outcomes, ensuring that it is strongly linked to the national M&E system. The PIC will be responsible for producing timely and pertinent information that will become key management tool for decision makers.
14. **Overall project management:** The Task Team Leader (TTL), with the support of the Country Office, will provide regular supervision of all operational aspects, as well as coordination with the client and among Bank team members. It is projected that a total of 3 supervision missions will be required the first year of implementation, and 2 supervision missions per year thereafter over the project period. The PIC will undertake mid-term independent audits. The ISP will be reviewed at least once a year to ensure that it continues to meet the implementation support needs of the project.

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First twelve months	Preparation of detailed specification for procurement packages			
12-48 months	Monitoring of works and acquisitions; training of staff			
Other				
Skills Mix Required				
Skills Needed	Number of Staff Weeks	Number of Trips	Comments	
Partners				
Name	Institution/Country		Role	



Annex 4: Results Framework and Monitoring

The Project Development Objective (PDO) is to improve the quality of the Government of the DRC’s hydro-meteorological and climate services in selected sectors.

Project Development Objective Indicators							
		Cumulative Target Values					
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Number of operational Quality Management Systems (QMS) (number of systems)	0	0	0	1	1	2	3
Index reflecting the number of operational observing stations and equipment for data centralization, operational forecast, climatology and production	1	1	1	2	2	3	4
Direct project beneficiaries (number), of which female (percentage)	0 (0%)	0 (0%)	355,000 (35%)	847,900 (38%)	2,707,900 (42%)	2,978,690 (43%)	2978690 (43%)

Intermediate Results Indicators							
		Cumulative Target Values					
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Number of professionals having participated in trainings	0	20	60	120	20	360	360



Number of memorandums of understanding (MoUs) having been developed or revised	0	4	4	6	8	8	8
Number of stations feeding the central online data platform on time	0	0	0	10	60	80	80
Number of stations rehabilitated or improved by the project	0	0	20	30	40	40	40
Number of views on the online data platform	0	0	0	500	2,000	5,000	5,000
Number of hazards for which warning or monitoring forecast bulletins have been produced with sufficient lead-time for preparedness and early response	1	1	1	2	3	4	
Number of user groups having expressed their needs and developed a resulting action plan to address them	0	2	4	4	4	4	4



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
Indicators at the project level			
1. Improved hydromet service delivery to key user groups.	<p>This will be measured by the number of operational Quality Management Systems (QMS). A QMS is a collection of business processes focused on consistently meeting customer requirements and enhancing their satisfaction. It is the organizational structure, policies, procedures, processes and resources needed to implement quality management. With enhanced QMSs in place MettelSat, RVA, RVF, CVM, and INERA's capacities to provide hydromet services to the key sectors will be improved. The main sectors considered are:</p> <ul style="list-style-type: none"> - aviation - civil protection - agriculture and food security 	Annual	Verification of the systems' existence and of their operational implementation MettelSat
2. Operational forecast and climate modelling capacity improved (levels 1 to 4)	<p>This will be measured using an 4-level index based system to accurately measure the improvement of MettelSat technical capacities to provide basic services:</p> <ul style="list-style-type: none"> - Level 1: operational forecast is produced on paper on a daily basis for 24 hours 	Annual	MettelSat annual report reflecting equipment for data centralization, operational forecast, climatology and production, as well as for access to data from secondary networks



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
	<ul style="list-style-type: none">- Level 2 : strengthened use of remote sensing; forecast bulletins are updated every 6 hours to deal with extreme weather- Level 3 : operational forecast is performed numerically and experimentally by crosscutting data from other stations, from remote-sensing and from other global and regional models- Level 4 : operational forecast is performed numerically and systematically by crosscutting data from other stations, from remote sensing and from other global and regional models.		
3. Direct project beneficiaries (number), of which female (percentage)	<p>The following beneficiary groups were considered:</p> <ul style="list-style-type: none">- Internet users as MettelSat's data is centralised and website is improved.- Aviation passengers, as MettelSat aviation service delivery is enhanced.- Television users, as MettelSat broadcasting capacity is enhanced and the accuracy of forecasting is improved. Since the number of beneficiaries in this category is very broad and the benefit is	Annual	During the project this indicator will be calculated based on surveys undertaken each year by MettelSat. The assumptions were used in calculating the targets for each user group are further explained in Annex 6 on project beneficiary considerations.



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
	<p>substantially less significant than for air-traffic safety, improved farming decisions, or flash flood warnings, the number of beneficiaries is divided by a factor of 10.</p> <ul style="list-style-type: none"> - Population in pilot provinces: Extreme weather bulletins will be broadcast by MettelSat to 2-4 pilot urban municipalities, therefore the population of these municipalities will benefit from such warnings. - Farmers in 3 pilot rural areas will benefit from improved information services allowing them to make decisions accordingly 		
<p>Intermediary indicators COMPONENT 1: Strengthening of institutional and governance capacities</p>			
<p>4. Number of professionals having participated in trainings</p>	<p>Improvement of the staff capacities of MettelSat, RVF, RVA and other institutions producing hydro meteorological services to contribute to:</p> <ul style="list-style-type: none"> - instruments and observation networks maintenance - early warnings 	<p>Annual</p>	<p>Total number of professionals having passed the training courses (some courses are delivered each year; verification: signature and instructor validation on the presence sheet) MettelSat</p>



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
	<ul style="list-style-type: none">- information and communication technologies- operational hydrology- climatology- agro-meteorology- aviation forecasts- meteorological forecasts- delivery of climatic services		
5. Number of MoUs having been developed or revised	<p>Institutional capacity of MettelSat to collaborate in the long-term with producers and users of hydro meteorological services:</p> <ul style="list-style-type: none">- Régie des Voies Aériennes (RVA)- Régie des Voies Fluviales (RVF)- Congolaise des Voies Maritime (CVM)- Centre de Recherche en Géophysique (CRG)- Institut Supérieur des Techniques Appliquée (ISTA)- Commission Internationale du bassin Congo-Oubangui-Sangha (CICOS)- Civil Protection- Agriculture Ministry- Société Nationale d'Electricité (SNEL)	Annual	Number of implemented MoUs reported by the Board (Conseil d'Administration) MettelSat



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
	<ul style="list-style-type: none"> - Institut National pour l'Etude et la Recherche Agronomiques (INERA) - Régie de distribution d'eau (REGIDESO) - Centre Africain pour les Applications de la Météorologie pour le Développement (ACMAD) - Ministère de l'Environnement 		
<p>Intermediary indicators COMPONENT 2: Modernization of observation, forecast, alert and response infrastructures</p>			
<p>6. Number of stations feeding the central online data platform on time</p>	<p>Increase in</p> <ul style="list-style-type: none"> - Operational network density - Quality of telecommunication for data centralization - Number of easily accessible data - Secured data storage 	<p>Trimestral</p>	<p>Automatic count integrated to the online central data platform MettelSat</p>
<p>7. Number of stations rehabilitated or improved by the project</p>	<p>Repair of existing equipment to reach back to original equipment purposes or to bring additional functionalities (e.g. telemetry) on existing stations</p>	<p>Annual</p>	<p>MettelSat annual report reflecting on the state of the observation network MettelSat</p>



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
<p>Intermediary indicators COMPONENT 3: Improvement of service delivery to users</p>			
8. Number of views on the online data platform	Increase in usage of MettelSat products by institutions and the general population	Trimestral	Automatic count by the internet provider for online visitors to the website. MettelSat
9. Number of hazards for which warning or monitoring forecast bulletins have been produced with sufficient lead-time for preparedness and early response	Improvement of MettelSat capacities to anticipate <ul style="list-style-type: none"> - droughts - winds - rains - flash floods - river floods 	Annual	Verification of the existence of operational procedures and their implementation. River flood may not be possible. MettelSat
10. Number of user groups having expressed their needs and developed a resulting action plan to address	Improvement of MettelSat capacities to adapt its production under the form of a national framework for climate services. Proposed user groups are: <ul style="list-style-type: none"> - aviation (with RVA) - civil protection 	Annual	Annual report of MettelSat reflecting the needs of user groups MettelSat



Indicator	Description (what the indicator indirectly measures)	Frequency	Methodology
them	<ul style="list-style-type: none">- agriculture- food security- hydrology (with RVF)- energy- health		



Annex 5: Detailed Economic Analysis

Hydromet modernization, early-warning and disaster preparedness in Congo DRC

1. An economic analysis estimating both costs and benefits of the proposed project has been undertaken to estimate the value of strengthening DRC's hydro-meteorological services. The objective of the benefit-cost analysis (BCA) is to verify the economic justification for the proposed project, position the value of DRC's hydromet services in a wider sociopolitical context, and create a baseline against which progress can be compared.
2. The hydro-meteorological value chain, represented in Figure 1, shows that the economic and social values lay at the end of a process that starts with the observation of climate through to decision-making and outcomes. As such, the value of an accurate, timely and relevant forecast can only be realized if a beneficial value is achieved at the end of the process.



Figure 3: Simplified hydro-meteorological value chain. Source: WMO 2015.

3. As hydro-meteorological products and services are public goods, they are generally not bought and sold in markets and thus there is no direct information on the economic value of these services. For this reason, specific approaches need to be employed to determine the economic benefits resulting from hydro-meteorological systems' improvement projects, such as benchmarking and benefit transfer methods.
4. In this analysis the assumed benefits derived by different economic sectors are estimated through benefit transfers methods. The analysis follows the overall structure of the "Triple Dividend of Resilience" framework¹⁵. The framework suggests to consider the three dividends of resilience when estimating projects' benefits: i) First dividend: saving lives and avoiding damage and losses. That is, whereby an improved forecasting and extreme weather early warning system reduces loss of assets and livelihoods; ii) Second dividend: unlocking economic potential. Increased risk awareness and forecasting accuracy increases economic productivity, supporting long-term investments in productive assets and development opportunities; iii) Third dividend: generating development co-benefits. Investing in hydromet can serve multiple purposes that are not solely designed to reduce disaster impacts. For example, enhancing forecast accuracy and timeliness can produce co-benefits to a number of actors, including households.
5. The costs in the BCA calculation are those associated with the proposed project's investments.

¹⁵ Tanner, T.M., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J.E., and Rajput, S. (2015) The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. www.odi.org/tripledividend.



The BCA includes sensitivity analysis of a number of key parameters (including discount rates, benefits realization and degrading of benefits due to lack of maintenance) and explication of reasonable and identifiable omissions, biases and uncertainties. Although the implementation period for the project is estimated at five years, the benefits can in theory be derived far beyond 2022 provided adequate repair, upgrade and maintenance. Therefore, the analysis considers a timeline of 15 years from project starting (2032).

6. In addition to the proposed project's BCA, the analysis investigates the benefits and costs of improving Mettelsat's weather observation and forecast, with a specific focus on the DRC's aviation sector and its potential for cost-recovery of Mettelsat activities.

Proposed Project's benefits

7. The proposed project's benefits are estimated for each dividend of resilience. The selection of sectoral benefits is limited by data availability and reliability constrains. Therefore, the total benefit is reasonably assumed a conservative figure of its real value.
8. In this analysis, the first dividend considers how improved forecasting and EWSs reduce national asset and livelihood losses. The second dividend includes how increased risk awareness and forecasting accuracy increases agriculture productivity, through efficiency gains; for example, in knowing better when the optimal planting and harvesting period is. It also includes the benefits of reducing weather related risk for the aviation sector, through route optimization and landing. The third dividend includes the co-benefits to households through a WTP study transferred from Mozambique.
9. In order to build confidence and robustness of this cost-benefit analysis, a transparent and "conservative" approach is undertaken¹⁶. All assumptions and their supporting analysis are here reported. Further, where a range of potential assumptions are generated, the most conservative values are taken, meaning that for a range of potential benefits the lowest value is used. This results in the analyzed net present value and benefit/cost ratio representing the lowest threshold of expected economic effectiveness; most likely the truly realized economic efficiency will be greater than what is herein reported.
10. Because of project's characteristics and baseline conditions of NMHS in the DRC, project's benefits are considered as 10% of the total benefits assigned to improved hydro-meteorological services. This is a conservative assumption in line with the approach of this analysis. It is assumed that the marginal benefits of the project follow a concave curve up to the maximum value (i.e. 10% after 5 years). The time frame of the analysis is 15 years from the project's start and the analysis assumes that project's benefits are constant after project completion.
11. **Benefits transfer analysis on the reduction of flood economic impacts derived an annual average national value of improved forecast and warning of US\$1.73 million at project completion.** According to the EM-DAT database, the most frequent disaster in the DRC is flooding. During the period 1960-2016, flood events also caused the largest number of fatalities (407). Currently, the only product related to flood hazards provided by Mettelsat is a daily weather forecast, disseminated within Governmental Agencies. No Early Warning Systems against flooding are currently in place and Mettelsat does not provide any specific service or

¹⁶ Kull, D., Mechler R. and Hochrainer, S. (2013). "Probabilistic Cost-Benefit Analysis of Disaster Risk Management in the Context of Development Assistance." *Disasters*, 37(3) (2013): 374-400.

targeted information to the Civil Protection. Considering the stochastic nature of disasters, common practice for cost-benefit analysis of disaster risk management project is to determine the reduction in average annual losses from natural hazards. This represents the averaging of potential losses over time to quantify the expected economic burden per year. Average Annual Loss (AAL) is calculated as the area under the loss frequency curve, which is a common metric indicating the Exceedance Probability of the full potential range of losses per year. The Aqueduct Global Flood Analyzer (WRI)¹⁷ provides EP curves for urban damages and affected GDP in the DRC. The tool is able to provide current and future (2030) AAL and Average Annual Population affected (AAP) (Table 2). Future estimates include increased impacts due to socio-economic development and climate change.

	Population affected (thousand)	Urban Damage (mil US\$)	GDP (mil US\$)
Current AAP – AAL	240.3	43	83.8
<i>Increase due to socio-econ dev</i>	<i>150.9</i>	<i>206.4</i>	<i>389</i>
<i>Increase due to climate change</i>	<i>110.9</i>	<i>48.6</i>	<i>88.5</i>
2030 AAP – AAL	502	298	561.3

Table 3: Current and future (2030) Annual Average affected Population (AAP) and Annual Average Loss (AAL). The table includes the contribution of socio-economic development and climate change to the increase of impacts. Source: Aqueduct - Global Flood Analyzer, WRI.

12. Improved extreme weather forecast capacity and alert through Early Warning Systems (EWS) can consistently reduce flood impacts. Global experience indicates a conservative overall range of 5-8% potential reduction of impacts. For example, a reduction of 8.5% was estimated in Russia¹⁸ and 10% for flooding in southeastern Europe¹⁹, while Subbiah et al (2009)²⁰ reported an overall potential reduction due to early warning of 3.6% of total damages. In line with the conservative approach set out for this analysis, the lower end of the range of global experience is considered (5%). The proposed project's contribution to the reduction of impacts is 10%, i.e. 0.5%. The benefits of the project are considered both in terms of avoided annual average flood urban damages and GDP losses. To avoid double counting and overlapping, the total loss considers 100% of the urban damage plus 60% of GDP loss. Under the assumptions considered in this analysis, the proposed project's cumulative benefits in terms of avoided flood economic impacts amount to 30.93 million US\$ over 15 years and 3.71 million US\$ over project time (5 years) (undiscounted values). The project reduces cumulative affected population by 27.09 thousand people over 15 years and 4.17 thousand people over project time (5 years).
- 13. Benefits transfer analysis of agriculture output improvement attributable to weather and climate information derived an annual total national sector value of improved forecasts**

¹⁷ World Resource Institute, The Aqueduct Global Flood Analyze (<http://floods.wri.org/>).

¹⁸ World Bank (2005). Russian Federation Hydromet Modernization Project. Project Appraisal Document, Report No. 3 1465-RU, Washington, D.C.

¹⁹ World Bank, UNISDR, WMO & FMI (2008). Strengthening the Hydrometeorological Services in South Eastern Europe. South Eastern Europe Disaster Risk Mitigation and Adaptation Programme.

²⁰ Subbiah, A.R., Bildan, L., Narasimhan, R. (2009). Background Paper on Assessment of the Economics of Early Warning Systems for Disaster Risk Reduction. World Bank-UN Project on the Economics of Disaster Risk Reduction, GFDRR, Washington.



of US\$19.90 million at project completion. Globally, modern hydro-meteorological services provide useful information and product to the agriculture sector. In the DRC, the agriculture sectors accounts for 21.2% of total GDP (World Bank, 2104). It is estimated that the enhancement of early warning and weather forecast services could benefit the 70% of the Congolese population living in rural areas and working in the small-scale agriculture sector. Currently, the support of Mettelsat to the agriculture sector is quite limited. Mettelsat produces a 10 days and a seasonal forecast and agrometeorological bulletin in four selected areas that are part of the Project PANA²¹ (in the sites of Gimbi, Kiyaka, Ngandajika and Kipopo). The information is delivered to the farmers, typically for crop selection. Based on the value added of the agriculture sector in the country, and an annual average growth rate of 3% (World Bank) the benefits of improved hydro-meteorological services are estimated. According to other experiences and the current conditions of agrometeorological products, it is assumed that the total benefits of improved hydromet services in the DRC could reach 1% of total value added (0.1% attributable to the proposed project). Under the assumptions considered in this analysis, the proposed project's cumulative benefits in terms of increased agriculture production amount to US\$59.78 million over 15 years and US\$9.95 million over project time (5 years) (undiscounted values).

14. **Benefits transfer analysis of air traffic route optimization and landing attributable to improved weather and climate information derived an annual total national sector value of improved forecasts of US\$0.98 million at project completion.** The aviation industry, and airlines specifically, rely heavily on weather observation and forecast for their operations. In particular, they use meteorological information to optimize daily operations, flight routes and flight planning. In addition, meteorological information is important for the security and safety of ground and air operations. In the DRC, the products provided by NMHS to the aviation sector are quite limited compared to safety standard requirements, both in terms of quality and quantity. According to the National Statistics annual report the sector carries a total of around 1.3 million passengers per year (2013), almost equally divided between international and domestic. Von Grueningen et al. (2014)²² analyzed the impact of weather forecast on the amount of extra fuel carried on inbound flights in Switzerland. The amount of extra fuel is larger if adverse weather is forecasted at the airport of destination, to better deal with weather-related extensions of flight time. Without this additional fuel, the risk that the flight has to deviate or land at another airport is higher. Von Grueningen estimated the benefits of improved meteorological information in terms of trade-off between the cost of carrying additional fuel and the cost of deviation. The study found that the average economic benefits of improved forecast capacity amount to US\$78 to US\$1906 depending of flight duration (from 3h to more than 10h). To estimate the benefit of improved forecast to the aviation sector, Swiss estimations are transfer to the DRC. In line with the conservative approach, the lower end of the range is considered (78 US\$) for each flight movement. The proposed project's contribution is assumed as 10% of the overall benefit, i.e. US\$7.8 per movement. A total number of movements is estimated at around 104,000, based on 2009 figures and an annual growth rate of 4.7% per year (IATA). The total cumulative benefits of the project are estimated at around US\$2.2 million

²¹ Programme d'Action National d'Adaptation (PANA) au changement climatique en République Démocratique du Congo. Project funded by the GEF, UNDP and Congolese Government (<http://www.pana.cd/tag/Mettelsat/>).

²² Von Grueningen et al. (2014). Economic value of meteorological services to Switzerland's airlines: the case of TAF at Zurich Airport. *Weather, Climate and Society*. Vol6.



after 5 years and US\$15 million after 15 years from project starting.

15. **Benefits transfer analysis of value for households shows that the annual benefits of moderately improved forecasts and warning are approximately US\$0.12 million at project completion.** In the DRC, households receive very limited weather and climate information. The information provided is limited to a 24h precipitation and temperature forecast. State preferences methods can provide an estimation of the economic value of improved services for households. Lazo (2015) carried out a state preference survey on Mozambique households' willingness-to-pay (WTP). In his survey, Lazo employed both a stated choice method with discrete choices and a contingent valuation method (Lazo, 2015). The discrete choice experiments identified the value of the actual service provided in Mozambique as US\$8.33 per household, while the households' willingness to pay for significantly improved forecasts was estimated at US\$0.09 per household. The contingent valuation experiment (based on single improvements compared to discrete choices) highlighted a WTP of US\$1.16 per household for improved forecast. To estimate the economic value to households, Lazo's study is transferred to the DRC context, assuming a 10% contribution of the proposed project to the overall benefit. The outcomes show that the cumulative benefits of the proposed project reach approximately US\$1.70 million using the stated choices method and US\$21.43 million using the contingent valuation method after 15 years from project start.

Proposed Project's Costs

16. **The costs associated with the proposed project amount to a total of around US\$8 million.** During and beyond implementation, costs will be incurred for operation and maintenance (O&M) and repair at an assumed 10% of total project investment for modernization of equipment and new installations (i.e., around 50% of the investment, US\$4 million) for the time period of the analysis, which is 15 years. Costs also includes the O&M of the additional infrastructure (value US\$6 million) provided by the Government of China to the DRC for the purchase of networks infrastructure equipment. A present value of US\$17.65 million of costs is estimated using a 3% rate of discount.

Aggregated Costs and Benefits of the proposed project

17. Table 9 below summarizes the key variable for the benefit-cost analysis including timing of benefits and costs and the discount rate. For all calculations, real values were applied that do not factor in inflation or potential changes in exchange rates. A discount rate of 3% was applied as a lower discount rate will give more weight to the social benefits side (the sensitivity analysis was re-run with 1-10%).

Key Variables	Value
First year of costs	2017
Annual cost of initial investment (Million US\$)	1.64
Timeline of initial investment (Years)	5
Annual maintenance and repair (% of initial investment plus Gov of China investment of US\$6 mil)	10%
Timeline of increasing operation and maintenance costs (start after investment	5

starts) (Years)	
First year of benefits	2017
Last year of benefits with ongoing support (5 years)	2022
Last year of benefits without ongoing support (15 years in total)	2032
Assumptions	
Contribution of the proposed project to the overall benefits from improved hydromet	10%
Discount rate	3%
Discount rate - range for sensitivity analysis	1-10%

Table 4: key variables of the analysis.

18. A present value of total projects' costs of US\$17.65 million is estimated using the 15-year timeline, the basic assumptions, and a 3% rate of discount.

19. The net present value of the proposed project of US\$112.27 million is estimated, with a benefit-cost ration of 7.36 to-1 using the baseline assumptions and a 3% rate of discount. Table 10 shows the results of the benefits cost analysis with a discount rate of 3%. A benefits' present value of over US\$129.92 million is estimated, as the sum of the dividends of resilience provided by the project. The table also shows an overall benefit-cost ratio (BCR) of 2.39 after project completion.

Summary table BCA		Present value (mil US\$)	Net Present Value (mil US\$)	BCR 5yrs	BCR 15 yrs
Costs (million US\$)		17.65			
Benefits - First Dividend	Avoided flood losses	30.93			
Benefits - Second Dividend	Agriculture production	119.56			
	Aviation – optimization of operations	14.99			
Benefits - Third Dividend	Household benefits	1.69			
Total benefits		129.92	112.27	2.39	7.36

Table 5: Summary table of the proposed project BCA.

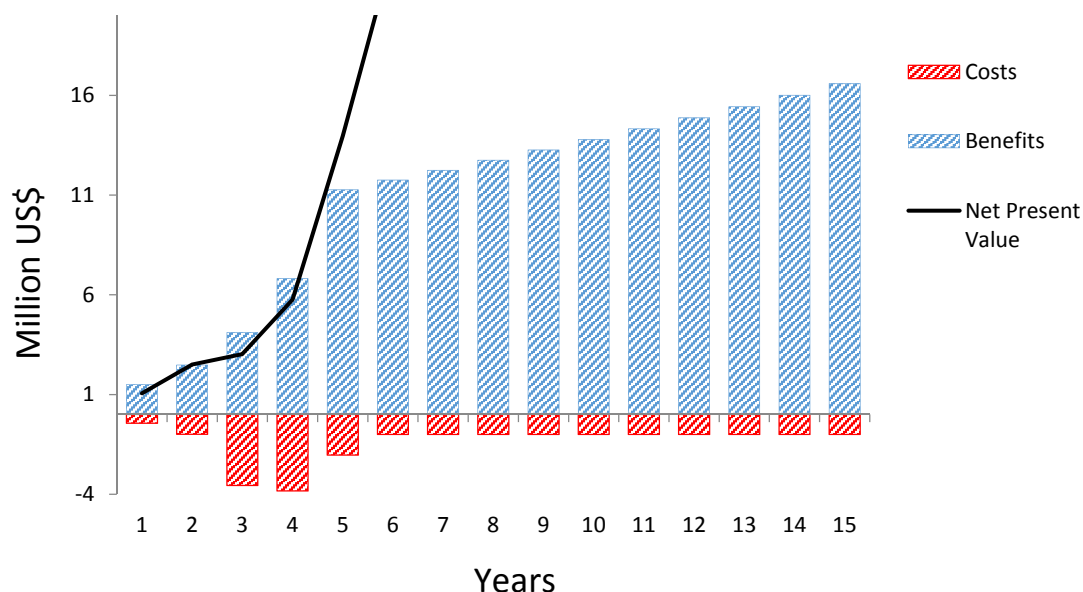


Figure 4: Cumulative costs and benefits of the proposed project, including the NPV curve over the time duration of the analysis.

Sensitivity analysis on key parameters

20. **The sensitivity analysis suggests the need for better evaluation of parameters for project evaluation.** A basic sensitivity analysis is done with respect to assumptions on the discount rate, potential improvements in forecast quality and ongoing support from the DRC Government or other unidentified agencies to Mettelsat. Results are relatively insensitive to the discount rate and the same policy recommendation emerges whether using a 1%, 3% or 10% rate of discount.

21. If the improvements in forecasts are less than assumed in the baseline BCA, a significant reduction in NPV is expected. Assuming only 5% rather than 10% of project's contribution to the potential benefits of improved hydromet services, the overall NPV falls by more than 50% and the BCR to 3.81. Finally, if there is no budget increase for the relevant agencies to support project operation and maintenance, the NPV estimates fall precipitously. In this case, while potentially having a positive NPV due to the short term benefits, it is assumed to generate no benefits after the system degrades again to pre-project levels within a few years.

Sensitivity Analysis	Parameter Value	Overall NPV	BCR 5 yrs	BCR 15 yrs
Baseline	3.00%	112.27	2.39	7.36
Discount Rate	1.00%	133.69	2.40	7.79
Discount Rate	10.00%	64.66	2.34	6.07
Percent improvement in forecast ¹	See Footnote 1	49.57	1.42	3.81
Failure to support budget for long-term operation, maintenance, and repair ²	See Footnote 2	25.28	2.39	2.43

¹The benefit of the project are assumed 5% (instead of 10%) of the potential overall benefit of



improved hydro-meteorological systems.

² *Assumes that there is no spending on operations maintenance and repair above and beyond the initial investment. Assumes that the benefits realized in the first five years then degrade proportionally over the following 5 years as the system returns to current (prep-project) status.*

Table 6 – Sensitivity analysis of the proposed project BCA.

Omission, biases and uncertainties

22. Few economic studies can consider all of the potential benefits and costs of a specific project, especially with respect to all of the potential indirect effects and co-benefits. This analysis only considers few sectoral benefits; hence the proposed estimates should be considered on the conservative side.

23. The potential value of climate information from longer and more reliable climate record for the DRC as a result of the project would benefit longer term planning for infrastructure such as dams and water resources, energy and transportation facilities, and critical uses of climate information to build resilience against climate extremes. In particular, given DRC's potential for hydropower production and the foreseen investments in the sector (e.g. the Gran Inga dam project) long term planning could consistently benefit from more accurate climate records and prediction.

24. The potential value of increased in-country capacity from the project's investment into development of human capital, improved training and education, and improved management systems among other anticipated outcomes, may all have secondary and tertiary benefits to the agencies as well as to the country as a whole.

25. The potential value of contribution to global weather forecasting data would help strengthen global forecasting models as they are based on data input from all areas of the globe at a range of spatial and temporal scales across all measures of hydro-meteorological characteristics. The skill and value of global forecast models is presumably a non-decreasing function of the quality of the data inputs. As DRC has been a data sparse area, the project will potentially provide useful data to global data modeling efforts. Benefits could be accrued both globally and eventually back to the DRC.

BCA analysis of Mettelsat improvement in relation to the aviation sector

26. To estimate the value of improving Mettelsat operations, a basic and Mettelsat specific BCA is performed. Given the direct relation between the aviation sector and weather services, the analysis estimates the NPV and BCR of improving Mettelsat capacity to deliver products to the aviation sector.

27. The current budget of Mettelsat operations is estimated at around US\$600,000 on salaries and US\$200,000 on operations. RVA budget for weather services is estimated at US\$240,000. The current levies to the aviation sector in the DRC is assumed at around US\$40 million. An almost negligible part of this revenue is delivered to Mettelsat. The analysis assumes that the value of weather services is around 10% of the value paid by aviation sector to national aviation authorities. The time-frame of the analysis is 15 years.

28. The analysis considers two benefits and cost scenarios: i) with Mettelsat improvement of weather forecast and, ii) without Mettelsat improvement.

29. The first scenario assumes that Mettelsat will reach a total budget of US\$4.2 in 5 years (2022).



This figure is based on local expert elicitation and it is considered a reasonable overall budget compared to the size, economy and population of the country. The main items of the assumed annual budget include: US\$600,000 of investments, US\$1.2 million of operations and maintenance, US\$2.4 of salaries. It is expected that the improvement of the service will deliver expected benefits up to 10% of the actual value of weather services to the aviation sector (i.e. currently US\$4 million) in 5 years (2022). From the 6th year benefits will remain constant, with an annual growth rate of the sector of 4.7% (IATA). Costs will increase linearly up to US\$4.2 million in 5 years and then remain constant.

30. There is the possibility that from 2017 on, the DRC aviation infrastructure will fall under ICAO sanctions on deficiencies of air and land operations safety, unless immediate improvements are put in place in weather monitoring and forecast. Therefore, the second scenario investigates a reduction in air traffic. The scenario assumes that a 20% drop in the value of weather forecast for the aviation sector will occur in 2017. Afterwards, a yearly 2% drop is assumed for the remaining period of analysis. This scenario assumes a constant US\$1 million cost of the service, associated to an initial US\$1 million benefit, which reduces according to the assumptions mentioned above.

31. **A present value of the costs to improve Mettelsat weather forecast capacities is estimated at US\$15.15 million**, using the 15-year timeline, the analysis assumptions, and a 3% rate of discount.

32. **A net present value of Mettelsat improvement of US\$74.90 million is estimated, with a benefit-cost ratio of 2.59 to-1** using the baseline assumptions and a 3% rate of discount. Given the incremental approach considered, the benefit-cost ratio is 1.08 after 5 years.

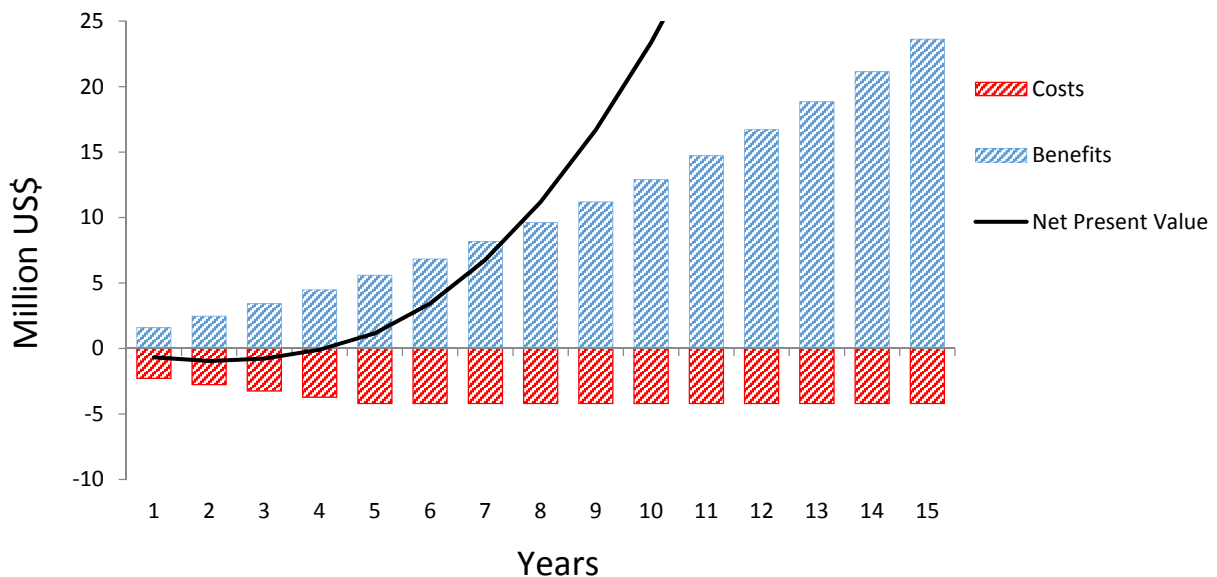


Figure 5: Cumulative costs and benefits of Mettelsat improvement (only for the aviation sector), including the NPV curve over the time duration of the analysis.

33. **A present value of the costs to maintain Mettelsat weather forecast capabilities at current levels is estimated at US\$12.29 million**, using the 15-year timeline, the basic assumptions, and a 3% rate of discount.



34. **A net present value of maintaining Mettelsat's performances of US\$-7.32 million is estimated, with a benefit-cost ration of 0.4 to-1** using the baseline assumptions and a 3% rate of discount. The benefit-cost ration is estimated at 0.63 after 5 years.

35. This analysis only considers the sectoral benefits to aviation; hence the proposed estimates should be considered on the conservative side. It is clearly evident that investing in Mettelsat operations produces a positive Economic Return of Investment.

36. **Benefits transfer analysis on the reduction of air accidents due to weather conditions and forecast derived an annual total national value of statistical lives (VSL) saved (1 statistical lives per year) of US\$2.45 million.** DRC is considered one of the most dangerous countries to fly in the world, because of its poorly maintained infrastructure and air safety conditions. The total fatalities for air accidents in the period 1984-2014 amounted to 1,074 persons, i.e. 36 fatalities per year. Based on the literature, the cause of accidents normally attributed to weather related pilot errors and weather conditions account to around 28% of the total, i.e. 10 fatalities per year. The value of improved weather services and forecast is assumed to contribute by 10% to this figure. From an extensive body of literature, a common point estimate is a US\$6 million VSL. For DRC, the VSL (i.e., value or reducing risk of loss of one life) was scaled to US\$2.45 million. This value was then multiplied by the expected reduction in loss of life (1) for an annual benefit of US\$2.45 million.



Annex 6: Overview of Benefits and Beneficiaries from Hydrometeorological Services in the DRC

The following document is a qualitative analysis of sectors and individuals identified as direct and indirect beneficiaries of hydrometeorological services i) in a general context and ii) in the specific context of the DRC. Given the current limited number of direct hydromet services to the sectors and populations of the DRC, it is used to identify the vast array of potential beneficiaries of the Strengthening Hydro-Meteorological and Climate Services in the Democratic Republic of Congo Project (P159217), over the project duration and beyond, as a result of the strengthening of MettelSat’s capacities. The description of the impacts of weather-related hazards and climate on these sectors and individuals is meant to inform of the pressing need for enhanced hydrometeorological services and of the gaps that the project could fill, in the long-term.

Improvement of MettelSat technical capacities:	Corresponding estimation of beneficiaries:
Level 1: around 20 synoptic stations centralize their data, and operational forecast is produced on paper on a daily basis for 24 hours. Anticipated by year 2 of the project.	Level 1: MettelSat’s data is centralised and website is improved, therefore internet users in the country would benefit from enhanced services. In addition MettelSat aviation service delivery will enhance, thereby benefitting aviation passengers.
Level 2: around 30 synoptic stations centralize their data; strengthened use of remote sensing; forecast bulletins are updated every 6 hours to deal with extreme weather. Anticipated by year 3 of the project.	Level 2: MettelSat broadcasting capacity will be enhanced and the accuracy of forecasting will be improved, therefore benefitting households that have access to televisions. Since the number of beneficiaries in this category is very broad and the benefit is substantially less significant than for air-traffic safety, improved farming decisions, or flash flood warnings, the number of beneficiaries is divided by a factor of 10.
Level 3: around 70 synoptic and limnometric stations centralize their data; operational forecast is performed numerically and experimentally by crosscutting data from other stations, from remote-sensing and from other global and regional models. Anticipated by year 4 of the project.	Level 3: Extreme weather bulletins will be broadcast by MettelSat to 2 to 4 pilot urban municipalities, therefore the population of these municipalities will benefit from such warnings. Farmers in 3 pilot rural areas will benefit from improved information services allowing them to make decisions accordingly.



Level 4: around 80 limnimetric and synoptic stations centralize their data, operational forecast is performed numerically and systematically by crosscutting data from other stations, from remote sensing and from other global and regional models. Anticipated by year 5 of the project.	Level 4: The beneficiaries of the consolidation and strengthening of the hydromet network will likely continue to increase once this level of hydromet capacity is reached. This may be also be reflected in the number of internet users increasing after a number of years, and air transport passengers using aviation services, since it is safer and more reliable.
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Table 7: Estimate of direct project beneficiaries based on gradual improvement of MettelSat technical capacities

GENERAL SOCIOECONOMIC BENEFITS OF ENHANCED HYDROMET SERVICES

Users' identification

1. According to the World Meteorological Organization, users of met/hydro services embrace virtually every individual, organization and community sector whose activities are sensitive to the impacts of weather, climate and water.²³ The user community is normally regarded as consisting of the general public, as the users of basic services, and all the various economic and social sectors and organizations as the users of what are often referred to as special services. In the case of tailored (special) services provided on a commercial basis, it is now usual, in many countries, to refer to the users of the services as clients or customers. The table below indicates sector utilization of met/hydro services.

Economic sectors		Public safety	Natural resources
-Services	-Agriculture	-Defense	-Water supply
-Manufacturing	-Transportation	-Emergency management	-Natural resources management (forests, coasts, terrestrial and marine ecosystems)
-Energy	-Construction	-Health	
-Insurance and finance	-Mining	Transportation safety	
-Tourism			

Figure 6: Sector utilization of met/hydro services.

Beneficial outcomes

2. The results of decisions taken or not taken by the user community, with or without the benefit of met/hydro services, are outcomes -the critical pieces that link met/hydro services to value. Beneficial outcomes may include losses avoided (typically reported as injuries, fatalities, displaced populations, property damage, environmental impact and various measures of costs, income and productivity) or additional profits realized due to improved decisions for weather events. Outcomes less commonly acknowledged and analyzed, but no less important, include aspects of time (for example, delay), inconvenience and feelings or emotions (pleasure, stress, dissatisfaction, sadness, sense of place/community, and the like).

²³ "Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services", WMO-No. 1153, World Meteorological Organization, 2015. Page 20



Basic hydromet services as public goods

3. Basic hydromet services are different from most goods and services; they can be provided at the same cost of production to a thousand or a million users. Unlike most goods and services, one person’s consumption/use of hydromet services does not reduce the availability of the services to others. This is important from the perspective of justifying met/hydro service provision because benefits increase with the number of users, whereas costs of production remain constant.

Examples of social, environmental and economic benefits

4. The following table illustrates some social, environmental and economic benefits of hydromet services:

Social	<ul style="list-style-type: none"> -Avoidance of loss of life and/or injuries/illnesses from natural disasters -Safety and security of the travelling public -Contribution to the day-to-day safety, comfort, enjoyment and general convenience of citizens, including: <ul style="list-style-type: none"> -Recreation -Travelling and commuting -Preparation for severe weather -Home improvement decisions -Avoided climate-related illnesses
Environmental	<ul style="list-style-type: none"> -Long-term monitoring of basic indicators of the state of the environment -Minimization of release of toxic substances and other pollutants -Management of local environment quality -Water savings -Reduced runoff from fertilizer application, resulting in improved water quality
Economic	<ul style="list-style-type: none"> -Avoidance of crop losses from frost, hail or drought -Increased farm production and sales -More efficient scheduling of the use of agriculture machinery -Reduced transportation fuel consumption through route planning -Improved scheduling of flight arrivals and departures -Minimization of airline costs from aircraft diversion -Minimization of search and rescue costs -Minimization of drought-relief costs -Avoidance of weather damage to personal property -More efficient planning of energy production and delivery

Figure 7: Examples of social, environmental and economic benefits of hydromet services Source: Adapted from Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services”, WMO-No. 1153, World Meteorological Organization, 2015

TABLE SUMMARY OF BENEFICIARIES IN THE DRC (DURING & BEYOND PROJECT DURATION)

5. The table below provides a summary of beneficiaries of hydromet services in the DRC, i) “within the project’s scope”, and ii) “beyond the project’s implementation period”, the latter being based on the assumption that MettelSat’s strengthened capacities as a result of the project could lead it to develop additional services to the populations in need.



Beneficiaries	Climate Sensitivity	Decisions likely to be taken on the basis of improved hydro-met products and services	Type of products and services required	Gaps likely to be filled by the project, and beyond
Rain fed crop producers	Crop yields and pests are highly sensitive to variations in precipitation, evapotranspiration, and temperature;	More targeted (date and quantities) application of pesticides, use of enhanced crop varieties, decisions related to the date of sowing and harvesting and post-harvest processing	Seasonal climate outlooks; Weather forecasts guiding sowing, application of pesticides, harvest and post-harvest	<u>Within the project's scope:</u> Production and delivery by MettelSat of agrometeorological bulletins directly to farmers and stakeholders on selected pilot sites; Feedback mechanism with farmers; Seasonal climate outlooks
Irrigated crop producers	Availability of surface water resources for irrigation (surface and groundwater); Irrigation management depend highly on precipitation, ET and temperature forecasts;	Water efficient irrigation management based on accurate forecast of precipitation, ET and temperature and water levels;	Seasonal climate outlooks; Hydrological forecasts (for flood prevention to avoid damage to infrastructure and pumps; and water level modelling to optimize irrigation) Advisory services to water user associations;	<u>Within the project's scope:</u> Production and delivery by MettelSat's of agrometeorological bulletins directly to farmers and stakeholders on selected pilot sites; Feedback mechanism with farmers; Seasonal climate outlooks
Livestock herders	Climate sensitive fodder and water supply; risks of competition with farmers to access water once supply decreases; Weather and climate related livestock diseases;	Stocking of fodder reserves; Provision of additional water supply; Efficient vaccination campaigns;	Livestock sector targeted weather forecasts and climate and climate-health outlooks,	<u>Beyond the project's implementation period:</u> Livestock sector based information; Application web and cell phone based services; Combined weather, climate and



				veterinary service applications;
Fishermen	Dependency on water quality; Fish stock impacted by droughts (low water levels, low oxygen) and floods (sediment);	Fishing operations and day-to-day management of stocks; Water quality improvements;	Relevant information on water levels, flood and low water level forecasting, sediment information; Relevant information on water quality	<u>Beyond the project's implementation period:</u> Sediment monitoring, Combined weather, climate and fishing extension service applications; Water quality monitoring
Hydropower operators	Water level and precipitation information is critical for a successful operation (water release, spilling, IDT curve)	Water releases from dam (spilling); Day to day operations maximizing hydro-power output;	Water level forecast for Congo River; Precipitation and forecast and seasonal climate outlooks;	<u>Within the project's scope:</u> A Protocol between MettelSat and the National Electricity Company (SNEL) will create direct linkages between MettelSat & the hydro-power operator
Aviation and other transport related sectors	Flight operation is dependent on accurate weather information for starts, landing	Flight operations adhering to ICAO standards	Aviation meteorology	<u>Within the project's scope:</u> Global standard aviation meteorology is provided by MettelSat and RVA; enhanced cooperation between the 2 institutions
Small and medium enterprises	Extreme weather and climate events impacting commercial operations, potential damages to stocks	Targeting of products and services	Small enterprise related information	<u>Beyond the project's implementation period:</u> Weather and climate information and applications for enterprises
Extractive Industries	Small mine operation dependent on ground water levels	Improved day-to-day operations and environmental protection;	Mining related information; Ground water observation network;	<u>Beyond the project's implementation period:</u> Industry specific services; Improved ground water monitoring; Env. monitoring
Local government	Population at risk to flood, droughts to be protected and provided with relief	Timely evacuation of population; Flood risk	Flood early warning systems and community	<u>Within the project's scope:</u> MettelSat provides end-to-end communication of



	items	zoning in spatial planning;	communication;	early warning information in selected pilot sites common to the Urban Development Project FY13 (P129713)
Urban and infrastructure designers and planners	Bridges, roads, building sensitive to floods;	Proper evidence based design of infrastructure	Long term time series and information on return periods for flash and river floods	<u>Beyond the project's implementation period:</u> Well managed databases and time series
Public health	Climate-related illnesses (for example, heat-related illnesses, vector-borne diseases that are worsened by climate such as malaria)			<u>Beyond the project's implementation period:</u> Water quality monitoring

Figure 8: Summary of beneficiaries in the DRC (during & beyond project duration). Source: author

AGRICULTURE SECTOR AND BENEFICIARIES

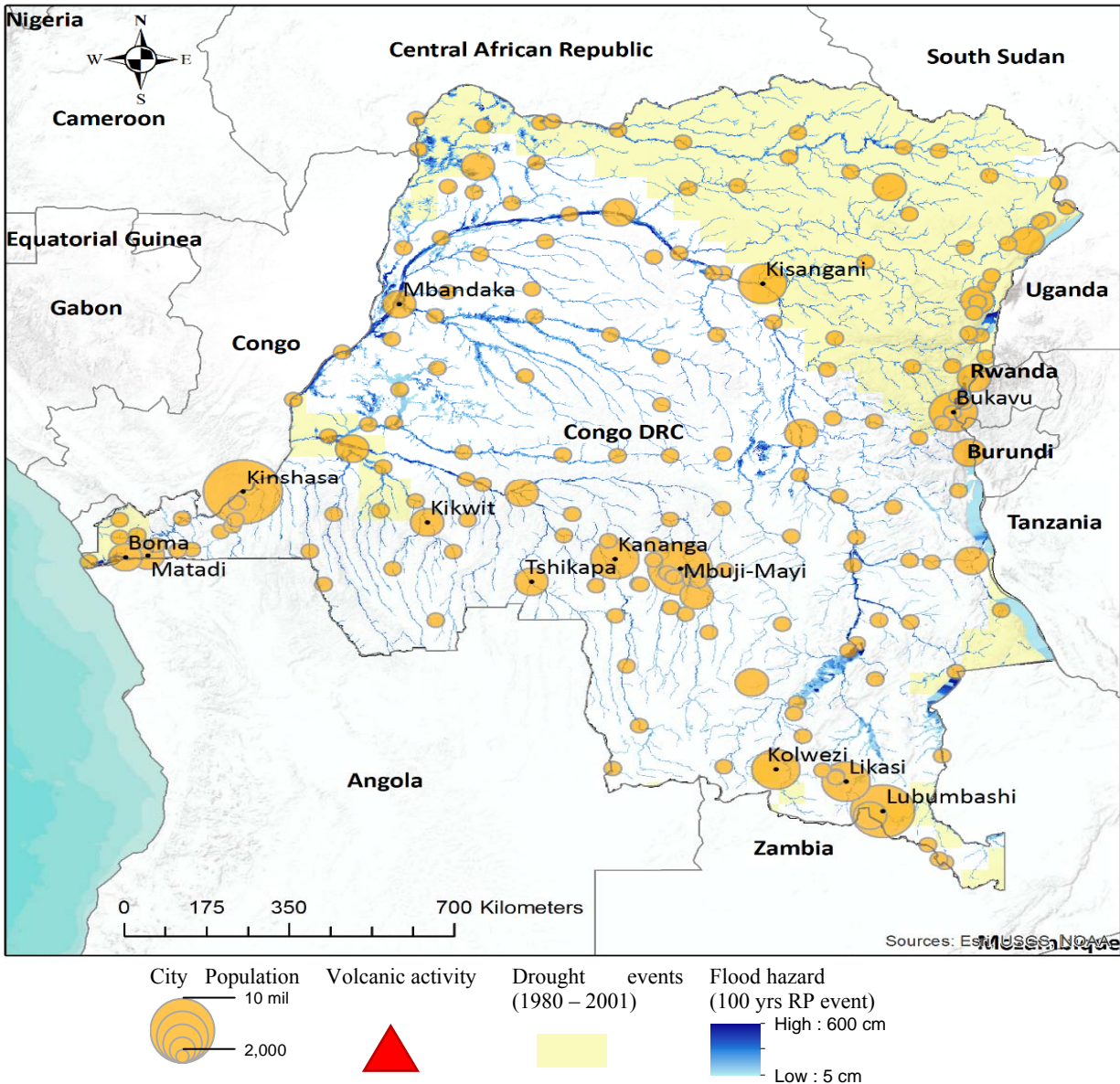
DRC agriculture sector's vulnerability to climate change

6. The enhancement of early warning services and weather forecasts and monitoring has the potential to benefit, in the long-run, among the 70% of the Congolese population living in rural areas and working in the small-scale agriculture sector. Agriculture employs 84 percent of women and 62 percent of men. Most of these jobs are informal and poorly paid, and only provide for subsistence. In 2014, agriculture, forestry, fishing and hunting represented altogether 23.3% of the GDP.²⁴
7. Although the DRC has an exceptional potential for agriculture and agribusiness development, with the largest reserve of arable land in Africa (80 million hectares out of which only 10 percent is used), favorable climate, and abundant water throughout most of the country and the year, climate change is expected to increase overall precipitation levels and will likely change the seasonal distribution of rainfall, both of which will result in ecological changes. This could increase desertification and the incidence of bush fires. There is also a possibility of an increase in heat waves and intense rains, the combined effects of which can include flooding, soil erosion, reduced agricultural productivity, and damage to infrastructure. The map below provides an overview of natural hazards in the DRC (volcanic activity, droughts and floods) from 1980-2011 (droughts) and for the past 100 years (floods).

²⁴ « République Démocratique du Congo, Perspectives Economiques en Afrique », BAfD, OCDE, PNUD, 2015



Figure 9: DRC natural hazards map: flooding (100 year return period event), drought events and volcanic activity.
Source: own elaboration from UNEP/GRID-EUROPE data.



8. During extended dry periods, crop failure and diseases occurs. Chronic household food insecurity is widely spread, affecting 70 per cent of the population, due to limited access to appropriate agricultural supplies, crop pests and overall agriculture land management. The table below provides an overview of the total damages caused by flood, volcanic activity or earthquakes in the DRC, based on the years in which the selected hazards occurred:

Type	Date	Total damage ('000 US\$)
Flood	25/10/2014	15,000



Volcanic activity	17/01/2002	9,000
Earthquake	03/02/2008	7,000
Earthquake	20/03/1966	200

Figure 10: Top disaster in DRC 1960-2016. Source: EM-DAT, accessed March 2016

9. According to the EM-DAT database, during the period 1960-2016, flood events were recorded 24 times, while storms and landslides 5 times, earthquakes, wildfires, volcanic activities 3 times, droughts 2 times. Although drought events affect the largest number of people (800,000 people), during the period 1960-2016 the largest numbers of fatalities were recorded for flood events (407 fatalities and 546,000 affected), followed by volcanic activities (347 fatalities and 170,000 affected) and landslide (223 fatalities and 2,083 affected). EM-DAT does not provide the number of fatalities caused by drought, for which accounting is not available.
10. There is currently a limited amount of data available on the impact of climate change on DRC's agricultural production, yet, impacts are serious and observable, with for instance in the past years an increase of droughts and water scarcity in the Katanga province, putting stress on food security. Small farmers and the urban poor tend to be most vulnerable to the effects of climate change. Although the Congo basin seems to be less exposed than dryer parts of Africa, Congolese farmers are particularly poor and isolated, therefore vulnerable to climate impacts and other external shocks.²⁵ This calls for an enhancement of early warning services and weather forecasts as a way to support the agriculture production.

Traditional and modern agriculture

11. Traditional self-sufficient farming amounts to 80% of the national production,²⁶ with small-scale traditional farmers estimated to amount to approximately 6 million households, for a total of 6 to 8 million hectares throughout the country. Small-scale lots, rudimentary tools and labor by family members characterize their farming. They grow diverse crops like manioc, maize, rice, vegetables and fruits, and rely on rain-fed production, which makes them vulnerable to climate hazards, mostly drought or heavy rains. In some provinces, small traditional farmers also raise cattle, predominantly sheep and goats, and sometimes pigs and poultry. Small family structure farmers are also behind 80% of the national fish production.
12. Modern agriculture in the DRC accounts with coffee, rubber and palm oil production as well as sugar cane, cotton and tobacco, and large livestock. These production systems rely on irrigation and drainage and are therefore in need of quality hydro-meteorological services. Modern agriculture is not developed to its full potential, as the political instability in the 1990s led to the withdrawal of investors and corporations. The few provinces where modern agriculture takes place are the Équateur and Kinshasa provinces for the rice production, and the Bas-Congo, Équateur and Nord-Kivu for the production of coffee, cacao, rubber, and palm oil.

Food security

²⁵ Strategic Country Diagnostic for the Democratic Republic of Congo, Draft, World Bank

²⁶ « Plan National d'Investissement Agricole (PNIA) 2014 – 2020 », Ministère de L'Agriculture Et Du Développement Rural, République Démocratique du Congo, Septembre 2013



13. In spite of huge agriculture potential, DRC is unable to feed its population: agriculture production has fallen since 1990, and the country is a net food importer (corn, rice, wheat, meat, and fish). Food prices in urban areas are among the highest in Africa, taking a toll from poor people. Chronic household food insecurity is widely spread, affecting 70 per cent of the population, due to limited access to appropriate agricultural supplies, crop pests and overall agriculture land management.

Anticipated project's benefits and beneficiaries in the agriculture sector

14. MettelSat currently provides decadal and seasonal bulletins to the Ministry of Agriculture, but the information does not reach farmers or local authorities directly. To address these needs, the project will involve the design, implementation and evaluation of pilot information for weather forecasts (seasonal, medium and short term) in 3 pilot sites potentially common to those of the World Bank Western Growth Pole Project (P124720). A user interface for agriculture will be specified and developed, and training sessions for users will be organized. The action will be implemented in relation with the Ministry of Agriculture and the national and local radio stations. In addition to the decadal bulletins, some capacities to develop 3-5 days forecast could assist with optimal use of inputs and pesticides and reduce post-harvest. Some rolling seminars on agro-meteorology could be customized to the needs of DRC. The quantitative analysis of project beneficiaries (see section "Project Beneficiaries") has led to the estimate that 750,000 farmers in three pilot rural areas will benefit from the project.

Potential benefits past the project implementation period

15. The enhancement of MettelSat's capacities could lead to the development of new hydromet services for various sub-sectors of the agriculture sector, beyond the scope and duration of the project, based on possible additional support. For instance, MettelSat could develop specific services to support the herding and fishery sub-sectors mentioned above, that rely on weather and climate conditions for their production. It could also develop early-warning services to produce alerts in food insecure contexts, befitting to some of the over 6 million people that are severely food insecure, and the 43 percent of children under five affected by malnutrition. In general, the agriculture sector has limited coping capacity against seasonal and inter annual climate variability. At the national level, there are wide disparities between provinces in terms of vulnerability, as well as within the provinces themselves. For example, in 2010, the provinces of Bandundu, Bas-Congo, Equateur, Kasai and Province Orientale were the most affected, with over 10% of high severe malnutrition. Early warning services in the agriculture sector would help better anticipate food security risks, and farmers to take preventive and mitigation measures that will make the country overall more resilient to food crisis. It would also help the government and humanitarian aid community to plan ahead and address more effectively the needs in the event of a food crisis.

Possible channels to communicate agro met information to farmers and populations

16. In parallel to identifying the project's beneficiaries, it is key to identify the channels to which the weather information will be conveyed, as this constitutes a key element of success to ensure



that the available information reaches the appropriate user groups and at a wide enough scale. As there is currently no existing agro-meteorological program in place that communicates directly the information to farmers, and as agreed between the respective projects' teams, the Hydromet Project could rely on the cooperatives, farmer networks, and multi-services platforms of the Western Growth Pole Project (P124720) to identify local needs for hydromet and climate information as well as the existing structures most suited to communicate the agro met information. Compared to other African countries, the rural sector is not very well structured in the DRC, in that its organization relies on informal groups and associations. The network of NGOs involved in food security programs under the World Food Program umbrella could be used to convey agro met information to farmers. In a post project's implementation duration phase, these NGOs could also help deliver early warning services information addressing food insecurity.

TRANSPORTATION SECTOR AND BENEFICIARIES

D) AIR TRANSPORTATION SECTOR AND BENEFICIARIES

Overview of the air transportation sector in the DRC and hydromet services needs

17. Enhanced weather forecasts and monitoring services would contribute to improving the security conditions of air transportation in the DRC, which are currently poor. For example, the latest audit by the International Civil Aviation Organization of DRC's air transport safety found that only 27 percent of recommended international standards and practices in the field of civil aviation were complied with in DRC's airspace, which poses high air navigation risks. One of the consequences of this problem has been the diversion of a significant volume of domestic air transport outside of the country to avoid using domestic air services. In October 2015, Congo Airways started operations as the flag carrier of the Democratic Republic of Congo, using two Airbus A320 aircraft acquired from Alitalia. As of 2015, the company operates domestic routes from its hub at N'djili Airport in Kinshasa to Goma, Kindu, Kisangani, Lubumbashi and Mbuji-Mayi.

Anticipated project's benefits and beneficiaries in the aviation sector

18. Meteorological assistance to aviation works between Mettelsat and in relation with the Régie des Voies Aériennes (RVA). The project's first priority is to address the existing working arrangements of Mettelsat with the Régie des Voies Aériennes (RVA) in order to guarantee a fair and sustainable revenue for the services to aviation, and bring in return a reliable and quality assessed service. The contribution of the project to this field will be through the general reinforcement of the Quality Measurement Standards (QMS), of competencies and of the basic equipment of Mettelsat, assuming that the specific needs for aviation meteorology will be covered by the financial contributions from airport and air navigation levies. The project will



also benefit the entire country as well as the rest of the region by improving air safety in general.²⁷

19. There are 54 airports and aerodromes in the DRC, distributed across the territory. The country’s main airports will benefit in particular from the project, as a majority of air traffic takes place between these, which represent strategic locations from an economic standpoint. These airports are Kinshasa/N’Djili, Lubumbashi/Luano, Kisangani/Bangboka, Goma, Mbuji-Mayia, and Gbadolite. In 2013, all airports within the DRC recorded a number of 288,553 domestic arrivals and 413,898 domestic departures, based on the DRC Statistics Report for 2014²⁸. In 2009, these airports transported the following number of national and international passengers, as shown in the disaggregated table below:

Airport	Total passengers	Including international
Kinshasa-N’Djili	697 800	356 700
Lubumbashi-Luano	240 600	89 200
Goma	94 200	
Mbuji-Mayi	58 400	
Kisangani/Bangboka	26 500	
Kinshasa-N’Dolo	62 000	
Total	1 536 700	

Figure 11: Air passengers in the DRC, national and international, 2009. Source: Translated and adapted from: « Projet Prioritaire de Sécurité Aérienne (PPSA) », République Démocratique du Congo, Rapport d’Evaluation du Projet, Fonds Africain de Développement, 2 aout 2010

20. The project could also be beneficial to the aid sector, which is a user and in need of air services for its activities. Currently, the United Nations Organization Stabilization Mission in the DRC (MONUSCO), Doctors without Borders (MSF), and the Humanitarian Aid Department of the European Commission (ECHO) provide some air transport services, however these are restrictive and do not cover the needs of the humanitarian and donor community. In 2014, as part of MONUSCO draw down, they stopped flights to several locations, including Mbandaka, KIndu, Kananga, and MbujiMayi. During the period of January to December 2014, the United Nations Humanitarian Air Service (UNHAS) transported on average 3,540 passengers per month (being 2014 target’s 3,200 passengers/month) and 40.3MT of cargo per month (2014 target 20 MT/month). Both passenger/cargo movements have exceeded 2014 targets, showing the need for the aid community to be able to access safe regular air transportation. An improvement of DRC’s air transportation safety through enhanced weather monitoring services could therefore help address the growing air transportation needs of the humanitarian and aid sector.
21. The quantitative analysis of the project’s beneficiaries (see the section “Project Beneficiaries” in the main body of the PAD) found that the project will benefit 130,000 aviation passengers.

²⁷ « Projet Prioritaire de Sécurité Aérienne (PPSA) », République Démocratique du Congo, Rapport d’Evaluation du Projet, Fonds Africain de Développement, 2 aout 2010

²⁸ « Annuaire Statistique 2014 de la RDC », Service Statistique de la RVA



II) ROAD, RIVER & LAKE TRANSPORTATION SECTORS AND BENEFICIARIES

Overview of the road & river/lake transportation sectors in the DRC and hydromet services needs

22. The informal transportation system covers over 95% of the transportation travels in the country, which bears negative consequences on urban planning and makes it harder to organize the prevention, resilience and recovery efforts in case of flooding.²⁹ The road network of the DRC accounts with 152.400 km, among which only 2% is coated. The network is in an advanced state of dilapidation.³⁰ The priority roads spread over 30,786km among which 59% are in a state of deterioration. The farming roads are spread over 86.821 km, among which only 11% are in good condition. Roads are vulnerable to deterioration or destruction in case of heavy rains, with consequences on passengers' safety and economic activity. For instance, heavy rains in December 2015 in the Kalehe locality in the Sud-Kivu province resulted in the flooding of the roads, which cut Kalehe from the rest of the country and made it harder to provide humanitarian assistance for immediate relief. The national railroad network covers 5.033 km and is in bad condition due to lack of maintenance and rehabilitation.
23. The river and lacustrine transportation network is 16.238 km long but faces a lack of investment and of infrastructures. The port of Kinshasa accounts with 2 million tons transported per year, which represents three times the amount transported by the railroad network.³¹ The National Navy and River Transportation Directory (DMVN) own 18,646 registered boats across the country, however, only 23.57% of these are operational.³²

Anticipated project's benefits in the river and lake transportation sectors

24. The Régie des Voies Fluviales (RVF), which is the main institution measuring the level of rivers for navigation purposes, will benefit from the project's plan to support MettelSat's provision of observations and precipitation forecasts to model hydrology alerts for the weather, especially over lakes. Sedimentation patterns (for sedimentation depends heavily on rainfall patterns) could also benefit from MettelSat's data. RVF could help in disseminating warnings to anticipate river overflows, which affect municipalities and civil protection. The CVM (Congolaise des Voies Maritimes), which operates 33 gauging stations of which 5 with recorder on the navigable part of Congo between Banana and Matadi (6-8 hours of sailing), could also benefit from MettelSat's severe weather warnings, data and forecasts. CVM could cooperate with MettelSat to disseminate warnings to anticipate river floods.

MINING SECTOR AND BENEFICIARIES

²⁹ Democratic Republic of the Congo River and Urban Transport Review", Report No ACS9800, Transport Sector Africa Region, World Bank, June 25, 2014

³⁰ « Document De La Stratégie De Croissance et de Réduction de la Pauvreté de Seconde Génération », (D S C R P 2), Volume 1, Ministère Du Plan, République Démocratique Du Congo Octobre 2011

³¹ Democratic Republic of the Congo River and Urban Transport Review", Report No ACS9800, Transport Sector Africa Region, World Bank, June 25, 2014

³² Democratic Republic of the Congo River and Urban Transport Review", Report No ACS9800, Transport Sector Africa Region, World Bank, June 25, 2014



Overview of the mining sector in the DRC and hydromet services needs

25. The DRC has benefited over the last several years from a buoyant mining economy. Mineral production and related investments have represented up until 2014 roughly 30% of real GDP growth. Whereas overall GDP growth was 8.3% on average in 2011-2014, growth in the mining sector was 13.5% over the same period. Declining commodity prices in late 2015, specifically for copper, contributed to overall GDP decline in 2015 and most likely in 2016. A major copper project in southern Katanga revisited its production plans for 2016-onwards, based on the new commodity outlook. It should be noted that despite declining commodity prices for copper, substantial increases in the production of DRC's key minerals -such as coltan, gold and copper- may to some extent off-set further potential fiscal losses going forward.³³ The country has mining potential that covers 1,100 different minerals in all of the country's provinces.

Potential beneficiaries in the mining sector beyond the project's implementation period

26. The mining sector employs 2.1% of the Congolese workforce. Based on a December 2014 World Bank report, 2.1% of the population that has a secondary employment has it in the mining sector.³⁴ However, in the municipalities that declared accounting with mining activities (14% of the total country's municipalities), these figures reached respectively 15% and 22%.³⁵ Rural municipalities with mining activities provide 19% of employment locally. Most of the mining sites and related employment in the DRC are located in the Katanga and Orientale provinces. The national service for assistance and supervision of small-scale mining (SAESSCAM) provided in 2014 the following figures of small-scale mining workers for 2013 by provinces where mining takes place, and it is expected that the actual number including informal workers is much higher:

Province	Number of workers in 2013
Bandundu	5,869
Bas-Congo	369
Equateur	2,438
Kasai Occidental	9,245
Kasai Oriental	43,026
Katanga	250,000
Maniema	9,012
Nord-Kivu	7,463
Sud-Kivu	46,000
Province Orientale	300,000
Total	673,422

³³ Strategic Country Diagnostic for the Democratic Republic of Congo, Draft, World Bank, 2016

³⁴ « Rapport de Suivi de la Situation Economique et Financière, Renforcer l'Etat et Transformer la Richesse Minière en Vecteur de Croissance, de Développement et de Cohésion Nationale », 2eme Edition, République Démocratique Du Congo, Groupe de la Banque Mondiale, Décembre 2014

³⁵ « Rapport de Suivi de la Situation Economique et Financière, Renforcer l'Etat et Transformer la Richesse Minière en Vecteur de Croissance, de Développement et de Cohésion Nationale », 2eme Edition, République Démocratique Du Congo, Groupe de la Banque Mondiale, Décembre 2014



Figure 12: Number of small-scale mining workers for 2013, by province. Source: Translated from: « Rapport de Suivi de la Situation Economique et Financière, Renforcer l'Etat et Transformer la Richesse Minière en Vecteur de Croissance, de Développement et de Cohésion Nationale », 2eme Edition, République Démocratique Du Congo, Groupe de la Banque Mondiale, Décembre 2014.

27. Beyond the scope and duration of this project, and based on figure 12 above, enhanced hydro meteorological services could benefit to over 673,422 minors and to the mining sector capacity to adapt its activities to the weather conditions, which can affect its workers' productivity and living conditions, as well as extractive capacities. Given the high projected level of informal mining activities, the number of beneficiaries may be far higher.

HYDROPOWER SECTOR AND BENEFICIARIES

Overview of the hydropower sector

28. 96% of the country's electricity sources come from the hydroelectricity production, located mostly on the Congo River, and known as the Inga dam, the rest of the electricity being produced from isolated thermal power plants.³⁶ With total potential capacity of 40GW, hydropower is the mainstay of the DRC's energy sector and has the potential to yield outside and transformative returns for the country's economic development and broader southern African region as a whole. Yet despite being abundant, resilient to seasonality, cheap, and clean, only 2.5 percent of this hydropower potential has been exploited. The country's growing access rate masks considerable disparities between relatively better served urban areas (35%) and rural areas (1% or less).³⁷ Nationwide, according to recent World Bank estimates, only 1 out of 10 person has access to electricity in the DRC.³⁸

Anticipated benefits of the project to the hydropower sector

29. As discussed with the team of the World Bank DRC Electricity Access & Services Expansion (EASE) (P156208) Project, currently in preparation in the DRC, there is the need to increase cooperation between the National Society for Electricity (SNEL) and MettelSat, in order to maximize the capacity to produce hydromet information that would help enhance hydroelectric production. Although the SNEL currently owns its own hydromet stations to help it plan its production, it is not able to maintain these and generate hydromet data on a systematic basis, due to insufficient financial resources. At the same time, MettelSat lacks an effective customer prospection and service capacity to address SNEL's requests. In that context, the hydromet project plans to strengthen MettelSat's institutional capacities, including via the creation of a memorandum of understanding with the SNEL, that would lead to more systematic cooperation and data sharing, for instance through the project's planned online data platform. Finally, the installation of up to 5 automatic hydraulic stations, along with the provision of measuring and maintenance equipment, should strengthen cooperation between the SNEL and MettelSat.

³⁶ <http://www.congo-tourisme.org/decouverte/economie-tourisme/principaux-secteurs-dactivite/>

³⁷ Strategic Country Diagnostic for the Democratic Republic of Congo, Draft, World Bank, 2016

³⁸ <http://www.banquemonde.org/fr/news/feature/2014/03/20/transformational-hydropower-development-project-paves-the-way-for-9-million-people-in-the-democratic-republic-of-congo-to-gain-access-to-electricity>



URBAN AREAS' RISKS AND BENEFICIARIES

Overview of DRC's urbanization trends

30. Enhanced early warning, weather forecasts and monitoring services have the potential to benefit the urban population of the DRC that represents up to 30 million people.³⁹ The urban population is growing fast -at an average annual rate of 4% in the last decade- and cities are large. Kinshasa has 9.7 million inhabitants and is the third largest city in Africa and the thirtieth in the world. Other three cities – Lubumbashi, Mjubi Mayi and Kananga- have more than 500 thousand inhabitants (UN, 2004)⁴⁰. By 2030, urbanization is expected to only reach 50.4% but urban population is expected to be almost three fourths bigger. Thus, in seventeen years 22 million people will arrive to urban centers (UN, 2014). The map below shows the country's cities and respective population range.

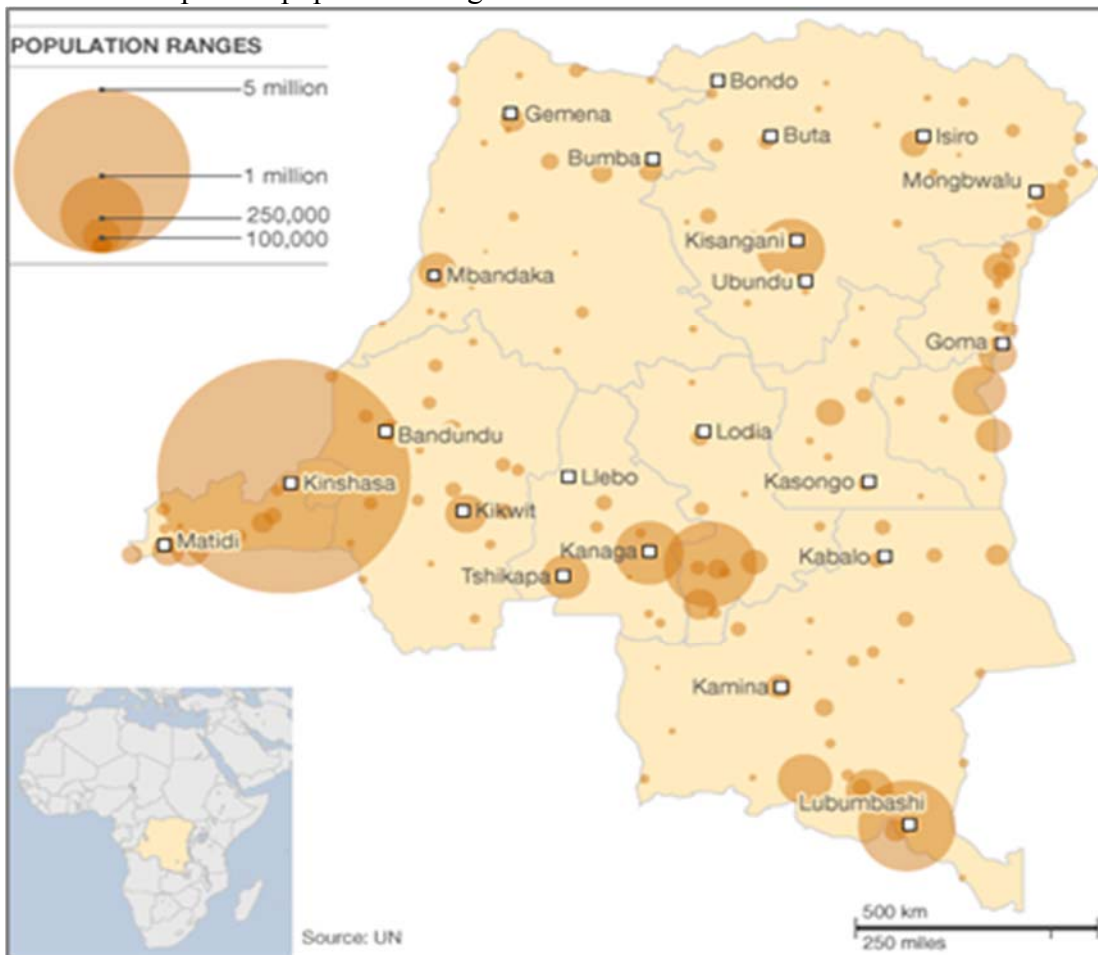


Figure 13: Cities of the DRC. Source: UN, 2004

³⁹ Strategic Country Diagnostic for the Democratic Republic of Congo, Draft, World Bank, 2016

⁴⁰ There are 20 small intermediate cities (population between 100 and 500 thousand); and 100 small cities (population between 10 and 100 thousand people).

⁴¹ It should be noted that the latest census was in 1984 and since this is the basis for all population projections they are therefore subject to substantial uncertainty (See Simkin (2013) for a discussion of the source of errors).



Main weather and climate-related risks to DRC's urban areas: a clear need for enhanced hydromet services

31. Cities in the DRC are not planned, the formal sector is unable to deliver housing, and land management practices contribute to making cities difficult to govern: this makes urban areas particularly vulnerable to floods. Flood hazard in the country has large economic implications. The Aqueduct Global Flood Analyzer (WRI)¹ below provides the Exceedance Probability (EP) Curve for urban damages and affected GDP (Figure 9 and 10). The curve represents the probability of exceeding various loss levels. In the figures the probability is expressed in terms of return period of flood events (i.e. 1/probability of occurrence).

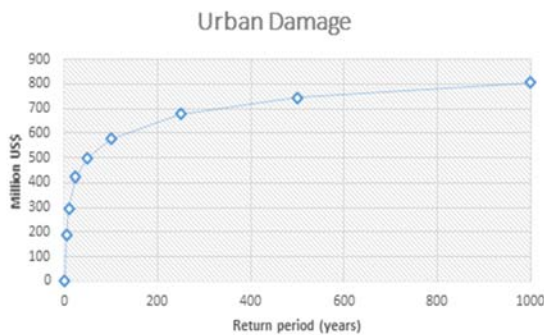


Figure 14: Urban Damage EP curve.

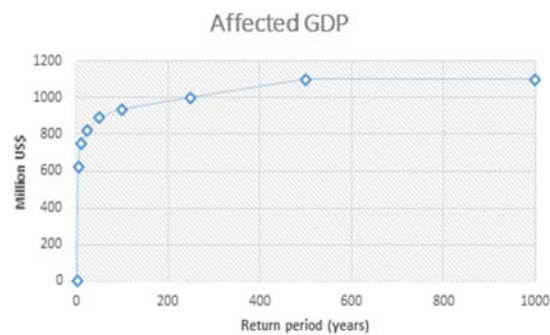


Figure 15: Affected GDP EP curve.

32. The same model estimates that under the IPCC RCP4.5 scenario (emission stabilization scenario) climate change could double the current Annual Average Loss (AAL) of urban damages (around 100 million US\$ assuming no or limited flood protection) due to increased flood hazard. Moreover, it is expected that socio-economic development, through increased exposure and vulnerability, will increase losses six fold by 2030. Similarly, the model estimates that the potential affected population will double by 2030, driven by climate change and socio-economic development (Aqueduct - Global Flood Analyzer, WRI). Overall, models confirm that increased exposure of assets in hazard-prone areas is driving the increase in risk estimates 2.5 times more compared to climate change.
33. In January 2016, half a million people in the DRC were affected by flooding hazards, in particular in the Tshopo, Haut Lomami and Tanganyika provinces, including over 50,000 internally displaced persons.⁴² In December 2015, the city of Bukavu in Sud-Kivu lost 17 persons in face of heavy rains. According to the local authorities, bad urban planning and lack of rehabilitation after a recent earthquake were responsible for these damages and losses and for the victims' electrocution and/or burying under their houses. The urban planning legislation from 1957 is outdated, and only a few cities dispose of updated urban master plans, including Kinshasa for which an urban master plan was developed in 2015. The housing deficit is estimated at approximately 1 million units and there is no organized housing sector in the DRC. This makes the unplanned settlements located on and/or near the river banks vulnerable to flooding.

⁴² Bulletin d'information sur la Sécurité Alimentaire", République Démocratique du Congo, Janvier 2016 N°1



34. Erosion and floods result in water-related hazards that impact Kinshasa and surrounding areas. In 2012 about 17,000 people were affected. Population at risk could increase due to high population growth and rapid increase in unplanned settlements on underserviced land, which are prone to flooding. Other cities (such as Bukavu and Kikwit) are constructed in hilly areas prone to erosion. Volcanic eruptions in Goma, a city of 1 million people, located at the foothill of active Niragongo volcano, have damaged the city twice in recent history. In addition to the physical destruction of assets, river flooding reduces the accessibility to many areas of the country and the functioning of critical infrastructures, inducing large social and economic impacts on human activities: In Kinshasa, the December 2015 heavy rains killed 31 persons in 3 weeks and affected over 20,000 families with the N'djili over flooding several parts of the city.⁴³ For several days, the majority of the city was deprived of safe drinking water as a result of the flood, since the Processing Centre of the Water Distribution Authority serving Kinshasa along the river N'djili was damaged, reducing the available safe water supply to the Capital. Some part of the Capital remained flooded for months, obliging the population to use canoes as means of transportation. Many roads were covered with high levels of water, which resulted in massive traffic jams throughout the city and delays in economic productivity. In Kisangani (Tshopo), over 42 schools collapsed and the airport could not be provided with fuel due to road damage that made transportation impossible over 10 km.⁴⁴ The floods also prevented over 19,000 students in the Tshopo province to go to school, based on estimates from the Ministry of Education.⁴⁵ In addition, the Bureau of Hygiene and Public Sanitation registered over 235,000 individuals directly affected by the flooding. For weeks, health offices that had been flooded were unable to operate.

Anticipated project's benefits to urban areas and populations

35. The project plans to support MettelSat's capacity to produce and deliver early warning alerts in 2 to 4 select urban areas that could be common to the pilot sites of the World Bank Urban Development FY13 Project (P129713). This would enable additional benefits for the populations of these sites, as the information delivered would help the municipalities be better prepared against the flash floods and erosion that may result from heavy rains. The Memorandum of Understanding (MoU) between MettelSat and the Civil Protection Services planned by the project, will entail the systematic sharing to the Civil Protection Services of the extreme weather alerts produced by MettelSat.

CALCULATION OF ANTICIPATED NUMBER OF PROJECT BENEFICIARIES

⁴³<http://www.radiookapi.net/2015/11/18/actualite/societe/eaux-de-pluies-de-lavenue-bypass-le-lac-se-transforme-en-mer-interieure>

⁴⁴ <http://www.radiookapi.net/2015/12/11/actualite/societe/inondations-en-rdc-des-dizaines-de-milliers-de-sans-abris-dans-tout-le>

⁴⁵ <http://www.radiookapi.net/2015/12/11/actualite/societe/inondations-en-rdc-des-dizaines-de-milliers-de-sans-abris-dans-tout-le>



36. As mentioned in Annex 4 on project results and beneficiaries, a set of assumptions were made to calculate the projected number of project beneficiaries in this project. This is described below, and related to each beneficiary group.
37. **Internet users** in DRC was estimated at 3% of the population in 2014, according to an estimate from the International Telecommunications Union (ITU). The population of DRC was estimated at 74.88 million in 2014 (World Bank). Of the population with internet access, it is estimated that 10% will benefit from enhanced online MettelSat presence.
38. **Aviation passengers:** In addition According to the National Statistics annual report the sector carries a total of around 1.3 million passengers per year (2013), almost equally divided between international and domestic. Since this is a national project focussing on DRC, only domestic passengers are considered as beneficiaries in this context, i.e. 50% of 1.3 million. Since domestic airline passengers will likely also have internet access, due to their income level, 20% of these aviation passenger will be considered as beneficiaries.
39. **Television users:** According to a 2008 media audience survey conducted by the French media research organisation IMMAR - Etude d'audience pour le projet Médias pour la Démocratie en RDC access to television in the big cities ranged from 61% in Kisangani to more than 90% in Kinshasa and Lubumbashi. Since it is likely that smaller cities will have lower rates of access, a 50% television access rate in urban areas is used, except for the 12 million people living in Kinshasa and Lubumbashi that have 90% access. According to the UN, Urban population was 42 % in 2014. IMMAR also estimated that access to television in the rural areas ranged from 10% to 48% of the population in the locations sampled. Therefore the median of 29% is used to calculate rural television access. Of the population with access to a television, it is assumed that 10% will benefit from weather forecasting services. The Internet and aviation users are subtracted from this number to avoid double counting, as it is assumed that those who have internet access and fly by airplane, will also have a television. Since the number of beneficiaries in this category is very broad and the benefit is substantially less significant than for air-traffic safety, improved farming decisions, or flash flood warnings, the number of beneficiaries is divided by a factor of 10.
40. **Urban pilot areas:** One of these municipalities is expected to be Kinshasa, with a population of around 10 million. The other three pilot provinces are anticipated to take place in smaller secondary cities, with a estimated average size of 350,000 people. Many of these urban population will have been counted in Level 2, due to the high rate of television access in cities, however, due to more engagement of local government in extreme hazard warning, especially related to flash floods, it is anticipated that the warning will benefit a higher number of people in flood prone areas of pilot



municipalities. Therefore it is assumed that an additional 10% of the population will benefit from such extreme weather forecasting.

41. **Farmers in three pilot rural areas** will benefit from improved information services allowing them to make decisions accordingly. Each province is anticipated to have a population of about 5 million on average, of which, 5 percent are expected to benefit from agro-meteorological services.
42. The beneficiaries of the consolidation and strengthening of the hydromet network will likely continue to increase once this level of hydromet capacity is reached. This may also be reflected in the number of internet users increasing after a number of years, and air transport passengers using aviation services, since it is safer and more reliable.



Annex 7: Synergies and linkages between the Hydro-Meteorological and Climate Services Project (P159217) and relevant Bank and donors' projects in the DRC

This annex examines possible synergies and linkages between the World Bank Hydro-Meteorological and Climate Services Project (P159217) and other Bank and donors' projects in the DRC. Synergies are understood as possible direct complementarities between projects, while linkages are understood as complementarity without necessarily entailing cooperation between projects. The Hydro-Meteorological and Climate Services Project, implemented and financed by the World Bank via the national hydromet agency MettelSat, proposes to improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors. The main expected results are the i) Strengthening of institutional and governance capacities of MettelSat, ii) Modernization of its observation, forecast, alert and response infrastructures, and iii) Improvement of MettelSat's service delivery to users. These results could benefit to a wide array of sectors and populations, in particular in the urban, agriculture, transport and energy sectors. Those sectors are already supported by parallel Bank and donors' projects in the DRC and as such, the enabling of synergies between projects would strengthen the cumulative positive effects of efforts undertaken by the respective projects. It would also favor the flow of information between projects' teams, and with beneficiaries on the field.

Synergies and linkages between the Hydro-Meteorological and Climate Services Project (P159217) and relevant Bank and donors' projects in the DRC:

a. Sector-disaggregated summary of direct synergies

Components of the Hydro-Meteorological and Climate Services Project (P159217): Component A: Institutional and regulatory strengthening, capacity building and implementation support; Component B: Modernization of equipment, facilities and infrastructure for basic observation and forecasting; Component C: Improvement of hydromet information service delivery; Component D: Project Management	
Synergies with the project(s) in the urban sector: -Urban Development Project FY13 (P129713, US\$100 million, 2013-2019, additional financing in pipeline)	As discussed between the Bank projects' teams: <ul style="list-style-type: none"> The activity planned by the hydromet project to support MettelSat's capacity to produce and deliver early-warning alerts in urban areas could be implemented in some of the pilot sites of the Urban Development Project. This would enable additional benefits for the populations of these sites, as the information would help municipalities to be better prepared against the flash floods and erosion that may result from heavy rains.
Synergies with the project(s) in the agriculture sector: -Agriculture Rehabilitation and Recovery Support	As discussed between the Bank projects' teams: <ul style="list-style-type: none"> There is the need to strengthen operational linkages between the agriculture and meteorological sectors, which the hydromet project will do by supporting MettelSat's capacity to produce and deliver agro meteorological bulletins directly to farmers and stakeholders in the agriculture sector. Although currently



<p>(P092724, US\$130 million, 2010-2017); -Western Growth Poles Project (P124720, US\$114.7 million, 2013-2019); -Regional Great Lakes Integrated Agriculture Development Project (P143307, currently in pipeline for an indicative amount of US\$154.79 millions); -PANA-AFE Project implemented by UNDP (US\$5.15 million, 2015-2020)</p>	<p>MettelSat provides decadal and seasonal bulletins to the Ministry of Agriculture, the information does not reach farmers nor local authorities directly. The teams agreed that the pilot sites for this activity could be common to those of the Western Growth Pole Project. This would provide additional benefits to the cooperatives, farmer networks, and multi-services platforms involved in this project: for instance agro meteorological information could have an impact on the seeding and harvest time frames (to limit losses linked to early seeding and inadequate post-harvest drying). Additionally, the hydromet project could rely on the established farmer networks of the Western Growth Pole Project to identify local needs for hydromet and climate information as well as the existing structures most suited to communicate the agro met information.</p> <ul style="list-style-type: none"> • The same way, the hydromet project could target the sites and network of farmers and agriculture workers already benefitting from the PANA-AFE project implemented by UNDP.
<p>Synergies with the project(s) in the transport sector: -Goma Airport Safety Improvement Project (P153085, US\$52 million, 2015-2020)</p>	<ul style="list-style-type: none"> • A discussion between the World Bank projects’ teams has led to the agreement to exchange information to clarify the respective cost recovery systems of RVA and MettelSat in the Lubumbashi and Goma airports, for the production of meteorological services. • The teams have also discussed the possibility to manage and implement the project preparation grant (PPG) for the hydromet project (\$US150,000) under the implementation unit of the Multimodal Transport Project (P092537), under the authority of the Ministry of Transportation and Communication.
<p>Synergies with the project(s) in the energy sector: -DRC Electricity Access & Services Expansion Project (EASE) (P156208, currently in pipeline)</p>	<p>As discussed between the World Bank projects’ teams:</p> <ul style="list-style-type: none"> • There is the need to increase cooperation between the National Society for Electricity (SNEL) and MettelSat, in order to maximize the capacity to produce hydromet information that would help to enhance hydroelectric production. Although the SNEL currently owns its own hydromet stations to help it plan its production, it is not able to maintain these and generate hydromet data on a systematic basis, due to insufficient financial resources. At the same time, MettelSat lacks an effective customer prospection and service capacity to address SNEL’s requests. • In that context, the hydromet project plans to strengthen MettelSat’s institutional capacities, including via the creation of a memorandum of understanding with the SNEL, that would lead to more systematic cooperation and data sharing, for instance through the project’s planned online data platform.



	<ul style="list-style-type: none"> The installation of up to 5 automatic hydraulic stations, along with the provision of measuring and maintenance equipment, should also strengthen the cooperation between the SNEL and MettelSat.
<p>Synergies with other projects supporting MettelSat directly: -UK-Met -Government of China</p>	<ul style="list-style-type: none"> The government of the UK via UK-Met has donated a studio to MettelSat in 2008, for preparing TV broadcasts, and is planning to renew the equipment in the future . The government of China has donated 20 weather stations, 8 automatic weather stations and a radio-sounding station to MettelSat, and will provide for their installation. The World Bank hydromet project will complement the Chinese initiative as it plans to provide and install about 20 hydromet stations that will further strengthen MettelSat’s forecast capacities over the national territory.

b) Detailed synergies and linkages, by sector

i. URBAN SECTOR PROJECTS AND PROGRAMS : LINKAGES AND SYNERGIES

- The World Bank Urban Development FY13 Project (P129713, US\$100 million, 2013-2019, additional financing in pipeline)⁴⁶** aims to (a) strengthen the institutional performance of 9 targeted cities and (b) increase access to basic infrastructure, services for the inhabitants of targeted cities.
- UNDP is currently preparing a project on disaster risk reduction** that will include i) a national strategy for disaster risk reduction and climate change adaptation, ii) a pilot project in Kinshasa for severe weather’s early warnings, and iii) a database on the impacts of disasters (Desinventar).
- Synergies.** As discussed between the two Bank projects’ teams, the activity planned by the hydromet project to support MettelSat’s capacity to produce and deliver early warning alerts in urban areas could be implemented in some of the pilot sites of the Urban Development Project. This would enable additional benefits for the populations of these sites, as the information delivered would help the municipalities to be better prepared against the flash floods and erosion that may result from heavy rains. The Memorandum of Understanding (MoU) between MettelSat and the Civil Protection Services planned by the project, will entail the systematic sharing to the Civil Protection Services of the extreme weather alerts produced by MettelSat.

ii. AGRICULTURE SECTOR PROJECTS & PROGRAMS: SYNERGIES

⁴⁶ For more information about the P129713 project, see the Project Appraisal Document at: <http://www.worldbank.org/projects/P129713/drc-urban-development-project-fy13?lang=en>



4. **The World Bank Agriculture Rehabilitation and Recovery Support Project⁴⁷ (P092724)** US\$130 million, 2010-2017) has the objective to increase agricultural productivity and improve marketing of crops, and animal products by smallholder farmers in targeted areas.
5. **The World Bank Western Growth Poles Project⁴⁸ (P124720)**, US\$114.7 million, 2013-2019) aims to increase productivity and employment in the selected value chains of targeted zones.
6. **The World Bank Regional Great Lakes Integrated Agriculture Development Project⁴⁹ (P143307)**, in pipeline for an indicative amount of US\$ 154.79 millions) aims to sustainably enhance the productivity of selected value chains in DRC and Burundi in targeted areas and to improve agricultural regional integration, targeting the Ruzizi and Imbo regions as well as along the Lake Tanganyika. In the DRC, the area covers the Bukavu-Uvira-Kalemie corridor.
7. **The «PANA projects⁵⁰ implemented by the United Nations Development Program (UNDP) and financed by the Global Environment Facility (GEF), the Government of the Democratic Republic of Congo, and UNDP**, target specific zones affected by climate change. The PANA-ASA project (US\$6.5 million, 2010-2014) had the aim of « Building the Capacity of the Agriculture Sector in DR Congo to Plan for and Respond to the Additional Threats Posed by Climate Change on Food Production and Security”. It involved the participation of MettelSat on the pilot sites, to deliver meteorological information to the National Institute for Agronomic Study (INERA), which used it to select crops most adapted to the climate conditions. PANA-ASA is continuing today as the PANA-AFE project (US\$5.15 million, 2015-2020), targeting women and children that rely on agriculture in the same initial pilot zones of i) Kipopo located in the Katanga Province, ii) Kiyaka in the Bandundu Province, iii) Ngandajika in the Kasai Oriental Province and iv) Ngimbi in the Bas-Congo Province. For these sites, MettelSat provides agro-meteorological newsletters every day, decade or quarter.
8. **Synergies.** As discussed between the Bank projects’ teams, there is currently a limited amount of data available on the impact of climate change on DRC’s agricultural production, yet, impacts are serious and observable, with for instance in the past years an increase of droughts and water scarcity in the Katanga province, putting stress on food security. There is therefore the need to strengthen operational linkages between the agriculture and meteorological sectors, which the hydromet project will do by supporting MettelSat’s capacity to produce and deliver agro meteorological bulletins directly to farmers and stakeholders in the agriculture sector. Indeed, although currently MettelSat provides decadal and seasonal bulletins to the Ministry of Agriculture, the information does not reach farmers or local authorities directly. The teams agreed that some of the 3 pilot sites for this activity could be

⁴⁷ For more information about the P092724 project, see the Project Appraisal Document at: <http://www.worldbank.org/projects/P092724/drc-agriculture-rehabilitation-recovery-support?lang=en>

⁴⁸ For more information about the P124720 project, see the Project Appraisal Document at: <http://www.worldbank.org/projects/P124720/dem-rep-congo-western-growth-poles?lang=en&tab=overview>

⁴⁹ For more information about the P143307 project in pipeline, see the Project Information Document at Appraisal Stage: <http://documents.worldbank.org/curated/en/2016/01/25799437/project-information-document-concept-stage-afcc2ri-regional-great-lakes-integrated-agriculture-development-project-p143307>

⁵⁰ For more information about the PANA-AFE project, see: <http://www.pana.cd/presentation-du-pana-afe/>



common to those of the Western Growth Pole Project. This would provide additional benefits to the cooperatives, farmer networks, and multi-services platforms that already benefit from that project: for instance agro meteorological information could have an impact on the seeding and harvest time frames (to limit losses linked to early seeding and inadequate post-harvest drying). Additionally, the hydromet project could rely on the established farmer networks of Western Growth Pole Project to identify local needs for hydromet and climate information and the existing structures most suited to communicate the agro met information. The same way, the hydromet project could target the sites and networks of farmers and agriculture workers that receive support from the PANA-AFE project.

iii. **AVIATION SECTOR PROJECTS & PROGRAMS : LINKAGES AND SYNERGIES**

9. **The World Bank Goma Airport Safety Improvement Project**⁵¹ (P153085, US\$52million, 2015-2020) aims to improve the safety, security, and operations of Goma International Airport.
10. **The African Development Bank is financing jointly with the African Development Fund and the Democratic Republic of Congo the “Priority Air Safety Project”**⁵² (US\$102 million, since 2010) with the aim to restore air transport and air navigation safety in the country by (i) rehabilitating airport infrastructure and air navigation equipment in three of the five major airports in the country, namely Kinshasa/N’Djili, Lubumbashi/Luano, and Kisangani/Bangboka; (ii) building the capacity of technical staff in charge of air traffic control and monitoring the sub-sector; and (iii) contributing to efforts to ensure the sustainability of the Régie des Voies Aériennes activities (RVA), which is the project’s executing agency.
11. **Synergies.** A discussion between the World Bank projects’ teams has led to the agreement to exchange information to clarify the respective cost recovery systems of RVA and MettelSat in the Lubumbashi and Goma airports, for the production of meteorological services. The teams have also discussed the possibility to manage and implement the project preparation grant (PPG) for the hydromet project (\$US150,000) under the implementation unit of the Multimodal Transport Project (P092537), under the authority of the Ministry of Transportation and Communication.

iv. **RIVER TRANSPORTATION SECTOR PROJECTS & PROGRAMS: LINKAGES**

12. **The European Union (EU), via the European Development Fund National Authorizing Officer Support Unit (COFED)** (60-million-euros) has launched in 2012 a project to support river and lake transportation in the Democratic Republic of Congo, associating the Régie des Voies Fluviales (RVF), the Commission for the Congo–Oubangui–Sangha Basin (CICOS), the Congo National Railway Company (SNCC), and the Congolese Company for Transportation and Ports (SCTP). The project, implemented in Kinshasa, Bandundu, Equateur, Province Orientale, Kasai Occidental, Sud-Kivu and Katanga provinces is made of 4 components,

⁵¹ For more information about the P153085 project, see the Project Appraisal Document at: <http://www.worldbank.org/projects/P153085/?lang=en&tab=overview>

⁵² For more information, see the Project Appraisal Document at: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/DRC_-_Priority_Air_Safety_Project_PPSA_-_Appraisal_Report_.pdf



namely i) hydrography and hydrology, ii) planning and maintenance of the roads for river transportation, iii) port infrastructures, and iv) training and institutional support.

13. **The International Commission of Congo-Oubangui-Sangha (CICOS)** has financed the recovery of hydrological data from the early twentieth century, recalibrated river flows and modelled the hydroelectric potential of the rivers. AFD has recently signed with CICOS a 500,000 euros project to improve the hydrological monitoring of the Congo River and an integrated management of water resources. CICOS is one (among 6 others) of the implementing centres of the Monitoring for Environment and Security in Africa (MESA), mandated by CEMAC (Communauté Économique et Monétaire des Etats de l'Afrique Centrale) for the Thematic Action ("THEMA") "Gestion des Ressources en Eau en Afrique Centrale". The MESA grant contract is of a value of 1,846,051.00 EUR. More specifically CICOS is in that scope developing the following services: i) Water level alert system for navigation, including in situ and satellite measurements (Oubangui sub-basin), low waters alert system (Oubangui sub-basin); and ii) Monitoring the water cycle in the main sub basins of the region (Rainfall, Evapotranspiration over Oubangui sub-basin) in order to issue Water cycle / Humid Forests monitoring bulletins, Oubangui sub-basin. The World Bank hydromet project will ensure complementarity and avoid risk of duplication with the CICOS projects by allowing dialogue and cooperation between MettelSat and RVF, through a MoU, and via constant dialogue between the Bank and the CEMAC/CICOS teams.

v. ENERGY SECTOR PROJECTS & PROGRAMS: LINKAGES AND SYNERGIES

14. **The World Bank DRC Electricity Access & Services Expansion (EASE) (P156208) Project**, (currently in pipeline) will aim to expand access to electricity in target areas and establish a functional institutional framework for electricity access scale-up.
15. **Synergies.** As discussed between the World Bank projects' teams, there is the need to increase cooperation between the National Society for Electricity (SNEL) and MettelSat, in order to maximize the capacity to produce hydromet information that would help enhance hydroelectric production. Although the SNEL currently owns its own hydromet stations to help it plan its production, it is not able to maintain these and generate hydromet data on a systematic basis, due to insufficient financial resources. At the same time, MettelSat lacks an effective customer prospection and service capacity to address SNEL's requests. In that context, the hydromet project plans to strengthen MettelSat's institutional capacities, including via the creation of a memorandum of understanding with the SNEL, that would lead to more systematic cooperation and data sharing, for instance through the project's planned online data platform. Finally, the installation of up to 5 automatic hydraulic stations, along with the provision of measuring and maintenance equipment, should strengthen cooperation between the SNEL and MettelSat.

vi. OTHER RELEVANT PROJECTS & PROGRAMS: LINKAGES AND SYNERGIES

16. **The government of China** has donated to MettelSat 20 weather stations, 8 automatic weather stations and a radio-sounding station and provides for their installation.



17. **The government of UK** has donated to MettelSat a studio for preparing TV broadcasts and will renew it shortly.
18. **The World Meteorological Organisation (WMO)** provides support for training in aviation meteorology, climatology and other fields like EWS. Together with the Southern African Development Community (SADC) in the framework of the HYCOS project, 3 DCP and 6 hydro-meteorological stations have also been provided, which still need to be installed.
19. **The Southern African Development Community (SADC)** supervises the Severe Weather Forecasting Demonstration Project (SWFDP) for which the DRC receives support from the South African Weather Service (SAWS) and UK meteorological service (UK-Met), and a close cooperation with the SADC meteorological services. This allows the country to use more optimally the global and regional forecast tools to improve its capacity to forecast severe weather.
20. **The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)**, based on EU financing, supports the DRC via the environmental and security monitoring in Africa Program (MESA), implemented by the African Centre of Meteorological Applications for Development (ACMAD) and the Southern African Development Community (SADC). The program equips ISTA, MettelSat and the Ministry of environment with PUMA and MESA stations for teledetection and data modelling. This initiative should continue under the GMES&Africa program in relation with Copernicus.
21. **Synergies.** The World Bank hydromet project will complement the Chinese initiative as it plans to provide and install about 20 hydromet stations that will further strengthen MettelSat's forecast capacities over the national territory.



Annex 8: LDCF Additional Cost Reasoning

Context

1. The Democratic Republic of Congo (DRC) is located in west equatorial Africa and is endowed with an abundance of natural, forest and water resources found across its 2.3 million square kilometers. DRC's climate is equatorial (warm and moist) in the center of the country, and tropical in the south and north. Despite its rich natural resources, the DRC has often been associated with political instability and poverty, and rebellions are presently ongoing in the east of the country. With a per capita Gross National Income of US\$380 (World Bank, 2014), DRC's population – estimated at about 74.88 million (World Bank, 2014) – is among the most vulnerable in the world. Food insecurity remains pervasive and a majority of people lack access to basic health. DRC's major vulnerabilities include a clear deficit in relation with its infrastructure, with a conjunction of geographic challenges, lack of investment and conflicts. Such deficit has repercussions on the country's capacity to address weather related hazards and climate change, leading to an increased vulnerability of economic sectors and populations to weather and climate related shocks. Rapid and unplanned urbanization process make urban areas increasingly vulnerable to flooding.

A. Key facts on vulnerability to climate change

2. Rising temperatures in the DRC are predicted to cause a surge in crop diseases such as cassava mosaic virus, and droughts will cause major disruption to the agricultural calendar, resulting in failure of both food and cash crops, and intensifying food insecurity and poverty. Climate simulations for the region indicate that rainfall will become more intense and more destructive over the coming years, bringing floods, landslides and soil erosion, especially in the region of the central Congo basin. Torrential rains are already causing loss of lives and damage to infrastructure in peripheral urban areas. By contrast, the rainy seasons will become shorter in the south, which is largely made up of the dry savannah belt and accounts for 80% of the rural population. These effects are already being felt, and it has been predicted that the Katanga region will see its rainy season shorten by at least two months by 2020 (DFID, DRC Talks Climate). DRC already experiences extreme weather and climate variability, resulting in high exposure to floods and droughts. The impacts of climate change are projected to increase both the frequency and severity of these events.
3. In this context of vulnerability to climate change, an effective capacity to monitor and forecast hydro-meteorological (hydromet) conditions and transfer improved knowledge into decision making and planning is critical to increasing the DRC's adaptation ability and resilience. For instance, systematic meteorological and hydrological data collection is needed to establish early warning systems for wind storms, floods, drought and other hazards, hence preventing losses of human lives, delivering reliable information to farmers, and increase accessibility and reliability of agriculture insurance products. Globally, recorded economic losses linked to extreme hydro-meteorological events have increased nearly 50 times over the past five decades, while the global loss of life has decreased significantly, by a factor of about 10. This can mainly be attributed to advancements in monitoring and forecasting, early warning, and emergency preparedness and response planning at the national and local levels.



B. Project Development objective

4. The Project Development Objective (PDO) is to improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors. This objective is fully consistent with the LDCF's focus on reducing the vulnerability of key sectors and resources that are central to development and livelihoods, by enhancing Government capacity to produce and deliver hydromet services tailored to sectors and users' needs; and developing Government capacity to better manage disaster risk reduction in urban areas via enhanced institutional cooperation.

C. Alignment with relevant national priorities for development and climate change adaptation

5. The project is aligned with and contributes to relevant DRC's national strategies, policies and plans, notably the Poverty Reduction Strategy Paper (PRSP-2) adopted in 2012, which, through Pillar Five entitled "Provide Balanced and Sustainable Development", calls for "Environmental Protection and Combatting Climate Change". In particular, the Government seeks to build resilience against the impact of climate change on agriculture, water resources and vector-borne diseases. In that perspective, understanding hydromet and climate risks would help assess social and economic impacts and develop adequate policy responses to support the country's sustained development. A number of economic sectors in the DRC could specifically benefit from more accurate, relevant and timely hydromet information, warning and services. In particular, these sectors include: (i) airfreight and aviation, (ii) early warning, disaster reduction and civil protection, and (iii) agriculture investment and food productivity. In line with the PRSP-2, greater understanding, monitoring and forecasting of severe weather and weather events could result in reduced loss of life and property, economic gains and prevention of losses, and most importantly, improved adaptation capacity within sectors having to adapt to the negative impacts of climate variability and change.
6. The proposed Project also aligns with the Country Assistance Strategy (CAS) for DRC (FY13-FY16), which calls for the essential need to build the capacity to monitor and forecast hydromet in the DRC and transfer this improved understanding of current and future climate to decision-making and planning as a way to build adaptation and resilience. The Project would especially support the CAS-principle of mainstreaming climate change as a cross-cutting theme and be beneficial to a range of sectors. The Project would align with future IDA priorities in the DRC, including food security and disaster risk reduction.
7. Furthermore, the Project is also a critical element of the UN-World Bank joint commitment of US\$1 billion, announced in May 2013, to the "Peace, Security and Cooperation Framework for the DRC and the Great Lakes Region" in collaboration with the region's governments, SADC and the African Union. Of relevance, this new framework includes financing for hydroelectric power plants, roads, and agricultural infrastructure that depend on adequate hydrological and meteorological information.



D. Linkages to the National Adaptation Program for Action (NAPA)

8. Improved weather and climate information is required from the national level down to the household level so that government, communities and the private sector can better plan for and adapt to these projected changes in climate. Hydromet and early warning services act as a key enabler for a broad range of adaptation decisions, ranging from the agriculture sector, urban development, infrastructure, disaster risk management, and others. In areas of infrastructure development, hydromet information will inform the resilient design of relevant works such as bridges, culverts, and erosion protection. In terms of agriculture and food security, reliable hydromet information assists farmers in deciding which agricultural technologies and adaptation mechanisms may be most useful in responding to weather variability and climate change. Private companies and businesses also need and rely on the hydromet data to make investment decisions related to climate risk mitigation for their operations.
9. Under the framework of the UNFCCC, the LDCF was established in recognition that Least Developed Countries (LDCs) do not have the means to deal with adaptation to climate change. In COP7 (2001), an LDC-work program was agreed, which specifically included: “Strengthening of the capacity of meteorological and hydrological services to collect, analyze, interpret and disseminate weather and climate information to support implementation of NAPAs”. The NAPA for the DRC was completed in 2006 and prioritizes strengthening the national meteorological services, management of reservoirs and navigable waterways as options for adaptation.

E. Linkages to the Intended Nationally Determined Contributions (INDC)

10. The project is fully aligned with DRC’s planned national contribution to the United Nations Framework Convention on Climate Change (UNFCCC) for the period 2021-2031. The contribution aims for a national reduction of 17% of CO₂, CH₄ and N₂O gasses altogether via both adaptation and reduction measures, targeting the agriculture, forest and energy sectors. The INDC document raises concerns towards the vulnerability of cultivated lands, water resources and coastal areas to climate change, resulting in food security and health risks. It also highlights DRC’s population vulnerability to heavy rains, coastal erosion, floods, heat waves, and seasonal droughts. To protect vulnerable populations from the consequences of these risks, ranging from destructions in urban areas to contracting water-borne related illnesses, the national contribution identifies three main priorities for adaptation, namely, i) securing subsistence and lifestyles of urban and rural communities; ii) rational management of forests, and iii) protecting and preserving vulnerable ecosystems in the coastal areas. The Project closely relates to the first priority, as it plans to i) provide farmers in pilot rural areas with improved agro meteorological information services allowing them to make decisions accordingly, and ii) provide populations of 2 to 4 pilot urban municipalities with extreme weather bulletins helping them to deal with heavy rains and resulting flooding, which is predicted to further intensify with climate change in the future. The Project also aligns with the INDC’s concern regarding the lack of climatic data availability at the national level, as it will improve MettelSat’s capacity to produce and deliver weather and climate forecasts. Finally, additional linkage to the INDC lies in the project’s plan to consider using pilot sites

common to those selected by the government for its national contributions to the UNFCCC - via the PANA projects implemented by UNDP.⁵³

F. Linkages to LDCF Strategies

11. This is a fully blended project where GFDRR and GEF/LDCF resources are being brought together cohesively to enable a set of activities that will improve DRC's resilience to natural hazards through i) Institutional and regulatory strengthening and capacity-building of MettelSat, the national agency in charge of producing hydrometeorological observation and forecasts; ii) Modernization of MettelSat's equipment, facilities and infrastructure for basic observation and forecasting; and iii) Improvement of MettelSat's capacity to deliver hydromet information services.
12. The added value of the LDCF funds will specifically be achieved through i) improving the implementing agency's physical, technical, and human capacity to produce and deliver weather and climate forecast services adapted to sectors and users' needs, and ii) improving the implementing agency's cooperation with other relevant institutions to improve data sharing and accessibility of information in a timely manner. The nexus between the project and the LDCF strategies is particularly evident in that with the knowledge gained from better weather and climate foresight, these institutions, sectors and users can provide information that can increase the adaptation capacity in key economic and social sectors – thereby adding value to baseline investments (e.g., for air and river-transport, agriculture, and urban development). In addition, flood risk management in urban areas will better integrate the likely impacts of climate change to improve the sustainability of short-term investments and the design of medium and long-term investments. The LDCF Grant will also support sustainable land management practices via crop selection based on climate information, contributing both to enhanced agricultural resilience in the rural areas and reduced flood risks in the urban areas. The project fully aligns with Objectives 1 and 2 of the GEF-6 LDCF Strategy (see Table 1 below).

Table 1: LDCF Objectives and Expected Outcomes relevant to the Project

LDCF Objectives	Expected Outcomes
Objective 1: Reduce the vulnerability of people, livelihoods, physical assets and natural systems to the adverse effects of climate change	Outcome 1.3: Climate-resilient technologies and practices adopted and scaled up
Objective 2: Strengthen institutional and technical capacities for effective climate change Adaptation	Outcome 2.3: Access to improved climate information and early-warning systems enhanced at regional, national, sub-national

⁵³ The document on DRC's national contribution to the United Nations Framework Convention on Climate Change (UNFCCC) indicates that government priorities have materialized via the PANA projects, implanted by UNDP. PANA-ASA, or « Building the Capacity of the Agriculture Sector in DR Congo to Plan for and Respond to the Additional Threats Posed by Climate Change on Food Production and Security », initiated in 2010 and closed in 2014, focused on the resilience of the agriculture sector. It is now continuing as PANA-AFE (2015-2020), supporting more specifically women and children in the same initial pilot zones. Another project, PANA-Costal Areas (2015-2020) aims to equip communities of the coastal areas to fight erosion and establish an early warning systems.



LDCF Objectives	Expected Outcomes
	and local levels

G. LDCF additional cost reasoning

Baseline Scenario

13. The baseline scenario considers a total baseline financing of US\$32.7 million through the Strengthening Hydro-Meteorological and Climate Services project (US\$2.7 million), the related DRC Urban Development project (P129713, US\$20 million) and the Western Growth Poles project (P124720, US\$10 million).
14. The Strengthening Hydro-Meteorological and Climate Services project aims to enhance the capacity of the Government of the DRC to produce and deliver hydromet observation and forecast services, focusing on priority target end-users involved in (a) agro-meteorological information services, (b) food security; (c) civil protection emergency and contingency plans; and (d) aviation. The ultimate aim is to reduce the increasing negative impacts of hydro-meteorological events, exacerbated by climate change and climate variability (particularly excessive rainfall, flashfloods and widespread flooding), on DRC's natural, urban, and agricultural lands and economic sectors.
15. The LDCF resources will complement GFDRR's funding for each component of the project and the overall adaptation benefits will be reflected in improved and more sustainable agriculture practices resulting in enhanced food security, as well as in resilience to extreme hydro-meteorological events such as floods and storms.
16. In relation to the baseline scenario, the additional resources from LDCF are fully justified, as the project will impose on the country 'additional costs' over 'business as usual-related costs' (or baseline costs). The project's Development Objective to improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors is fully consistent with the LDCF's focus on reducing vulnerability by promoting climate change adaptation interventions in key sectors.
17. The proposed LDCF project will further support the baseline development objectives of the project to improve the quality of the Government of the DRC's hydro-meteorological and climate services in selected sectors by adding significant resources. As such, it will increase the sustainability of the project, the resilience of the DRC's population in the face of climate change and will improve long term climate resilience practices in the targeted regions. The proposed funding has enabled this project to provide support to a range of different MetSat user groups that are particularly vulnerable to environmental stress and climate patterns. Overall, the added value of the LDCF funds is to assist the government cope with the poor quality of meteorological services to (i) aviation, (ii) maritime navigation, (iii) fluvial navigation, (iv) urban flood risk management, (v) agriculture and (vi) food security.
18. The Strengthening Hydro-Meteorological and Climate Services project has been designed based on the DRC's Poverty Reduction Strategy Paper (PRSP-2) adopted in 2012, which prioritizes Climate change as a development challenge and calls in Pillar Five entitled "Provide Balanced and



Sustainable Development”, for “Environmental Protection and Combatting Climate Change”. While GFDRR resources will support all activities of the project, LDCF’s funding will dominate for all components, making it essential to its implementation, on all aspects of the project. As such, the LDCF resources are expected to support institutional and regulatory strengthening and capacity-building of MettelSat; modernization of MettelSat’s equipment, facilities and infrastructure for basic observation and forecasting; and improvement of MettelSat’s capacity to deliver hydromet information services in select areas that will be common to those of existing Bank projects in the DRC, namely the Urban Development Project (P129713) and the Western Growth Poles Project (P124720).

19. LDCF funding to the Strengthening Hydro-Meteorological and Climate Services Project will allow to materialize complementarities with the DRC Urban Development Project (P129713) that the baseline only would not satisfy. The objectives of the Urban Development project (P129713) are to (a) strengthen institutional performance of targeted cities; and (b) increase access to basic infrastructure, services for the inhabitants of targeted cities. LDCF funding will allow the hydromet project to support MettelSat’s capacity to produce and deliver early warning alerts in some of the 9 cities already benefiting from the Urban Development project activities, via cooperation with the local governance institutions that will as such be strengthened to protect their populations from the effects of heavy rains, such as flash floods and erosion.
20. LDCF funding to the Strengthening Hydro-Meteorological and Climate Services Project will also allow to materialize complementarities with the Western Growth Poles project (P124720) that the baseline alone would not be able to satisfy. The project aims to increase agriculture productivity and employment in the selected value chains of targeted zones. MettelSat’s production and delivery of agrometeorological information in the areas of the Western Growth Pole project will benefit the cooperatives, farmer networks, and multi-services platforms there so that the agriculture production adapts to climate hazards and change. Agro-meteorological information is expected to have a positive impact on agricultural productivity, for instance on the seeding and harvest time frames to limit losses linked to early seeding and inadequate post-harvest drying.

LDCF Additionality: By Project Components

21. The baseline project has five inter-related components supporting the project development objective: (i) Institutional and regulatory strengthening, capacity building and implementation support; (ii) Modernization of equipment, facilities and infrastructure for basic observation and forecasting; (iii) Improvement of hydromet information service delivery, and (iv) Project Management. The LDCF funds provide financing to all the five components. The estimated cost of the Project is US\$8,029,452, including US\$2,700,000 from GFDRR and US\$5,329,452 from LDCF. LDCF’s total funding contribution to the project is over 65%, compared to GFDRR’s contribution. LDCF’s resources will therefore contribute as a whole to all aspects of the project development objectives. Table 2 below, “Project financing and LDCF support” provides an indicative overview of the funds allocated by GFDRR and LDCF to each of the project’s components and sub-components.
22. The selection of targeted vulnerable communities will take into account the communities already benefitting from the Urban Development Project (P129713) and the Western Growth Poles Project (P124720), funded by the LDCF to maximize the synergies between the respective projects. Some



of the 9 cities supported by the Urban Development Project could be used as the 2 to 4 urban pilot sites for the Strengthening Hydro-Meteorological and Climate Services Project's activity which aims to support MettelSat's capacity to produce and deliver early warning alerts that would help urban municipalities to be better prepared in the event of heavy rains and resulting flash floods. In addition, farmers and agriculture workers that are already benefitting from the Western Growth Poles Project (P124720) will be targeted in priority by the Strengthening Hydro-Meteorological and Climate Services Project's activity aiming to develop customized products and services. This will include the production and delivery of agro meteorological forecasts, development of an information platform and offer of weather and climate related trainings adapted to the needs of farmers.

23. Component A - Institutional and regulatory strengthening, capacity building and implementation support: This includes investing in the human and institutional resources that can implement and sustain hydromet observation and forecasting. The sub-components include:
24. Sub-component A.1 - Reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) for delivery of service: This will support an Institutional diagnosis, including a comparative review of the roles and mandates of the Régie des Voies Aériennes (RVA), the Régie des Voies Fluviales (RVF), the Congolaise des Voies Maritimes (CVM), the Civil Security and the Ministry of Agriculture. Efforts will be also made towards the Ministère des Transports et Voies de Communication (MTVC) and the Ministry of Finance with the objective of raising the level of the government financial contribution to MettelSat. A Strategy and an Action Plan will be defined for MettelSat, which will identify the main actions in order to increase cooperation and avoid overlap between agencies, ensuring an efficient development of hydrometeorology in DRC.
25. Sub-component A.2 - Strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions: A Quality Management System (QMS) will be designed and implemented by MettelSat which will be focused as a priority on the services which must be delivered to aviation. Building on this development, QMS will also be designed and implemented for EWS and Agriculture.
26. Sub-component A.3 - Implement a long-term and on-demand capacity development and training program for staff: Because human resources are a significant challenge to maintaining and expanding services, this subcomponent will look at ways to motivate staff and to upgrade its qualification. Building on collaborations with national universities and training institutes such as ISTA will be necessary because MettelSat is not entitled to give academic degrees which are required by ICAO. Some support to these institutions and to in house training facilities will be considered, for instance for equipping training facilities or inviting trainers. Collaboration will be pursued with international institutions such as WMO, ACMAD and SADC as well as twinning arrangements with other hydromet services.
27. Component B - Modernization of equipment, facilities and infrastructure for basic observation and forecasting: Component B will invest in the reinforcement and rebuilding of the basic networks for observation and forecasting, as well as in infrastructure needed for provision of services by MettelSat. A highly focused approach to investments is required in the DRC considering the current status of hydromet services, and allocation of investment will have to be made based on



priority sectors/user-groups being served, core-capacity for observation and forecasting and the long-term ability to operate and maintain the services. The sub-components include:

28. Sub-component B.1 - Hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors): This activity will finance the optimization of the hydro-meteorological observation network, targeting an overall operational system (i.e. observation- transmission- forecasting and service delivery) sustainable after the end of the project. At that time, it is expected that the data from 60 meteorological synoptic automatic stations, 20 hydro-meteorological automatic stations and one radio-sounding station (donated and to be installed at N'djili airport by the Government of China) are received on a reliable and regular basis at the central forecasting office of MettelSat in Kinshasa/Binza and posted in due time on the GTS.
29. Sub-component B.2 - Transmission, data management and data dissemination hardware: To improve the transmission of data coming in and out of MettelSat, this activity will finance data management improvements which include: ICT infrastructure to improve connectivity (such as reliable and hazard proof network internet/ GPRS/ fiberoptic connections to manage high volumes and fast data flows; as well as servers, licenses and soft/hardware); necessary ICT equipment including modems, routers, power supply and data collection systems; and tools to verify/clean data records. The observations Data Collection System which allows the reception of the information sent by the stations, whether they are automatic or manual, will be modernized. It should allow the reception of all the national hydromet data of interest for MettelSat and their handling so that they may be used by the central forecasting and the climate monitoring systems.
30. Sub-component B.3 - Refurbishment of facilities needed to support the services: Measures will be taken to renew the central infrastructure, beginning with a national expertise for determining the priorities in the MettelSat Hq buildings refurbishing. The specification of the refurbishment will then be defined and the Project will contribute to the refurbishing of Hq buildings of MettelSat, to the technical integration of the ICT equipment described in other activities and to the improvement of furniture and basic office equipment such as computers. Efforts will also be deployed to improve the infrastructures of the most critical hydro-meteorological stations and to provide up to 6 regional centers with improved buildings, the necessary means for transportation and for receiving and utilizing products from the central facility.
31. Sub-component B.4 - Technical systems and software for performing meteorological, hydrological and climate modelling and forecasting: Specification, procurement and installation processes will be implemented for a new central weather forecasting system, a new central climate monitoring system and a new central hydrological monitoring system. With access to the WMO Global Telecommunication System (GTS) and EUMETSAT EUMETCast, MettelSat will be able to use more optimally international numerical weather prediction models for improving forecasting capacities and for provision of early warning services.
32. Component C-Improvement of hydromet information service delivery: Component C will focus on the delivery of more accurate, timely and relevant information to users and decision-makers. The sub-components include:
 33. Sub-component C.1 - Define requirements, delivery and feedback mechanisms with different user groups (in line with the National Framework for Climate Services): In agreement with selected



users, and through pilot and tailored information for target audiences, MettelSat will trial, modify and develop appropriate formats and timings of hydromet information. The focus will be the definition of hydromet information requirements for end users. This component will target beneficiaries with a gender-disaggregated approach. Within this context, the delivery of information to the media (radios, TV, newspapers) should also be strengthened.

34. Sub-component C.2 - Develop customized products and services made available to user groups through dedicated interfaces: In order to assist the forecasters in making different products tailored to the users' needs, a Central Production System will be specified, procured and installed, using Numerical Weather Prediction and all available data to provide cutting edge products for public weather services, for early warning systems, as well as for climatology and other climate services. Climate data rescue, digitization and integration of non-electronic records will be also taken into account. Specific attention will be paid to develop services for flash flood warning and application to agriculture.
35. Component D - Project Management. The sub-components include:
36. Sub-component D.1 - Coordination and technical implementation support: This sub-component will finance the following activities:
 - Steering Committees
 - Preparation of the ToRs for the Management firm (design, monitoring and evaluation)
 - Preparation of the ToRs for the Observation, ICT and Logistical firms
 - Support to execution 2 months/year during 3 years including technical management of firms
 - Assistant to the coordinator
 - Monitoring and evaluation
 - Other operating costs
37. Sub-component D.2 - Fiduciary and safeguard aspects and audit. This sub-component will finance the following activities:
 - Financial management
 - Procurement
 - Accounting
 - Environmental and social management framework (ESMF)
 - Environmental and social safeguards
 - Operations manual
 - Internal audit
 - External audit

Table 2: Project financing and LDCF support

Component, Sub-Component and indicative budget (US\$)	LDCF	GFDRR	Total
Component A - Institutional and regulatory strengthening, capacity building and implementation support	905,000	450,000	1,355,000
A(i) - Reinforce the legal and regulatory framework of MettelSat in order to develop partnerships and Standard Operating Procedures (SOPs) for delivery of service	80,000	40,000	120,000

A(ii) - Strengthen the Quality Management Systems to raise standards and quality control/verification procedures across the institutions	165,000	85,000	250,000
A(iii) - Implement a long-term and on-demand capacity development and training program for staff	660,000	325,000	985,000
Component B - Modernization of equipment, facilities and infrastructure for basic observation and forecasting	3,080,000	1,488,000	4,568,000
B(i) - Hydrological and meteorological monitoring networks (small-scale rehabilitation of priority stations and installation of new sensors)	1,400,000	640,500	2,040,500
B(ii) - Transmission, data management and data dissemination hardware	300,000	137,500	437,500
B(iii) - Refurbishment of facilities needed to support the services	900,000	465,000	1,365,000
B(iv) - Technical systems and software for performing meteorological, hydrological and climate modelling and forecasting	480,000	245,000	725,000
Component C - Improvement of hydromet information service delivery	1,077,980	515,000	1,592,980
C(i) - Define requirements, delivery and feedback mechanisms with different user groups (in line with the National Framework for Climate Services)	80,000	45,000	125,000
C(ii) - Develop customized products and services made available to user groups through dedicated interfaces	997,980	470,000	1,467,980
Component D - Project Management	266,472	247,000	513,472
D(i) - Coordination and technical implementation support	190,452	111,000	300,452
D(ii) - Fiduciary and safeguard aspects and audit	76,020	136,000	212,020
Total	5,329,452	2,700,000	8,029,452

H. Coordination and complementarity with other projects

38. The National Steering Committee (NSC), chaired by a representative of the Minister of Transport and Means of Communication and composed of representatives of key ministries and institutions will ensure coordination and coherence between the project and i) national institutions having a stake in hydromet services, and ii) other relevant Bank-supported projects and programs funded by other development partners in the DRC. Annex 7 further elaborates on the project's insertion and contribution to the Government's disaster risk management and climate change adaptation goals, programs and activities, as well as to those of like-minded development partners working in the country.
39. The NSC will establish a mechanism, as part of its communication and outreach strategy, to promote coordination and complementarity among all relevant programs, projects and stakeholders, with the aim to avoid overlaps and duplication, facilitate data sharing across project coordinators and institution-beneficiaries, and maximize service delivery potentialities to users.
40. The project is directly complementary with two other Bank projects also co-funded by the LDCF, namely, the Urban Development (P129713) and the Western Growth Poles (P124720) project. LDCF resources will be used to increase the number of beneficiaries of these projects, as some of the 9 cities supported by the Urban Development Project and its additional financing could be used as some of the 2 to 4 pilot sites for early warning in urban municipalities in relation with heavy



rains and resulting flash floods. In addition, farmers and agriculture workers that are already benefitting from the Western Growth Poles Project will be targeted in priority by the project in relation with provision of customized agro-meteorological products and services. This will include the production and delivery of agro meteorological forecasts, development of an information platform and offer of weather and climate related trainings adapted to the needs of farmers.

I. Public Participation and Consultations

41. The success of any intervention requires the active involvement and participation of the different stakeholders. Key stakeholders for the project include (i) ministries, local governments and other public institutions implementing the project and/or benefiting from it, (ii) cooperating partners, NGOs, and Civil Society Organizations (CSOs) involved in direct support, and (iii) communities that are living in the targeted urban and rural areas, including the participation of potentially vulnerable groups such as women who may not have a voice in the decision-making processes. Stakeholder consultations are a necessary means to understand the views of the people who may be affected by a project or may have an interest in its outcome, as well as to inform them about changes that could affect them. Consultations are not only an important part of development process, but also a requirement of some Bank policies. In line with World Bank policies, broad-based community consultations as well as consultations with national, regional and local level authorities and CSOs were held for the project to identify potential environmental and social impacts, how such impacts could best be mitigated, whether there are design alternatives, and what could institutional arrangements look like, among other issues. The outcome of these consultations and resulting recommendations are reported in the project's Environmental and Social Management Framework (ESMF). A validation workshop of the ESMF was conducted to ensure ownership and support for the project and discuss program design. Participation of different stakeholders will continue throughout project implementation; as for instance affected communities and CSOs take part in the implementation and monitoring of the safeguards provisions.
42. Appropriate and transparent criteria will be established to promote public participation and for any activities requiring a selection process of organizations/groups/beneficiaries. The Project will implement a mechanism for addressing grievances and complaints starting at the local level to ensure quicker and pragmatic solutions to disputes.
43. The project promotes implementation of the National Policy on Gender aiming not only at implementing the constitutional principles of equity and respect of human rights, but also at activating the national and international government commitments for the promotion of equity and gender. Given the importance of the traditional participation of Congolese women in natural resource management and in assuring household food security during times of crises, rural and urban activities will explicitly support a gender-sensitive approach. To ensure compliance with these objectives the Project Implementation Units will have staff experienced in community participation and gender.



Annex 9: Map

