



## 1. Project Data

**Project ID**

P149629

**Project Name**

Mozambique Lidar Surveys Limp. &amp; Zambeze

**Country**

Mozambique

**Practice Area(Lead)**

Water

**L/C/TF Number(s)**

TF-17383,TF-17384

**Closing Date (Original)**

30-Jun-2016

**Total Project Cost (USD)**

6,540,000.00

**Bank Approval Date**

05-Jun-2014

**Closing Date (Actual)**

31-Dec-2016

**IBRD/IDA (USD)**
**Grants (USD)**

Original Commitment

8,955,223.88

8,955,223.88

Revised Commitment

7,140,156.77

8,941,928.65

Actual

7,243,271.49

7,243,271.49

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## 2. Project Objectives and Components

### a. Objectives

The Project Development Objective (PDO) as stated in the Project Appraisal Document (PAD, page 4) and in the Grant agreements (page 3) was:

**"To increase the capacity of Mozambique to prepare for and manage flood events in the Limpopo and Zambezi River Basins."**



**b. Were the project objectives/key associated outcome targets revised during implementation?**

No

**c. Will a split evaluation be undertaken?**

No

**d. Components**

There were two components with similar activities.

**Component A. Limpopo River Lidar Survey and Applications.** (Appraisal estimate US\$4.90 million. Actual cost at closure US\$3.72 million).

**Component B. Zambezi River Lidar Survey and Applications.** (Appraisal estimate US\$4.05 million. Actual cost at closure US\$3.08 million).

Each of the components aimed at supporting the acquisition of high-resolution spatial and topographic data through airborne light detection and ranging through Lidar (a remote sensing technology), the subsequent production of derived products, application of those products into hydrologic and hydraulic models and decision support systems and application of those models for flood and natural Disaster risk management. Activities included: (i) technical assistance for implementing Lidar: (ii) determining priority survey areas: (iii) completion of Lidar surveys: (iv) processing and quality assurance review of Lidar point data: (v) integrating Lidar data into existing models and decision support systems and establishing new ones: (vi) training and capacity building for technical staff in Regional Water Authorities (ANAs in Portuguese), National Directorate for Water (DNA), the National Institute for Disaster Management (INGC) and associated agencies working in surveyed basin: (vii) effective data management systems and solutions for ensuring that Lidar and derivative projects are openly accessible: and, (viii) investments in physical information management systems to ensure the long-term accessibility and use of Lidar data.

**e. Comments on Project Cost, Financing, Borrower Contribution, and Dates**

**Project cost.** Appraisal estimate US\$8.95 million. Actual cost at closure US\$6.80 million.

**Project financing.** The project was financed by two separate grants for activities in the Limpopo and Zambezi River Basins from the Multi Donor Trust Fund Global Facility on Disaster Reduction and Recovery (GDFRR) administered by the Bank. Total appraisal estimate of the two grants US\$8.95 million. Amount disbursed of the two grants at closure US\$6.80 million.

**Borrower Contribution.** None was planned.

**Dates.** The following changes were made through a one level 2 restructuring on June 20, 2016: (i) Two crucial key outcomes indicators (improved flood preparedness through updated and contingency plan in the two provinces and reduced flood risk through using the new geospatial data) were dropped, (ii) activities associated with integrating Lidar into existing models were cancelled as these activities were implemented through other on-going Bank financed projects. Funds allocated to activities were used for expanding the surveyed area to other critical areas in Limpopo: and, (iii) the closing date was extended by six months from June 2016 to December 2016 for completing the activities associated with preparing additional surveys. The project closed on 12/31/2016.



### 3. Relevance of Objectives & Design

#### a. Relevance of Objectives

The PDO was highly relevant to the Government strategy and the Bank strategy for Mozambique. Mozambique is chronically vulnerable to the impacts of natural hazards such as floods, cyclones and droughts as shown by the major floods in 2000, 2001, 2007 and in 2013, the year before appraisal. The Mozambique coastline of 2,740 kilometers, where roughly 70% of the population lives, is downstream from nine trans boundary rivers and exposed to recurrent extreme climate-related events, which result in widespread flooding. Estimates in the years before appraisal suggested that over half of the population (58%) remained vulnerable to natural disasters and that annual economic growth was 1.1 percentage points lower than it otherwise would be, due to water-related shocks.

The Government's Poverty Reduction Strategy for the 2011-2014 period underscored the need for broad-based and inclusive growth through, among other things, reducing vulnerability to natural disasters and addressing climate change threats. One of the five priorities of the Government's Five-Year Program (PQG) was securing the sustainable and transparent management of natural resources and the environment through reducing the vulnerability of communities, economy and infrastructures to climate risks and natural disasters.

The PDO was well-aligned with the second pillar of the Bank's Country Partnership Strategy (CPS) for the 2012-2015 period. This pillar highlighted the need for reducing vulnerability and increasing resilience through improving resilience to natural disasters and the impact of climate change. The PDO remained relevant at the project's close as it was also relevant to the Country Partnership Framework (CPF) for the 2017-2021 period. This policy framework recognized that while Mozambique had to take long-term actions to reduce its vulnerability to climate change, such actions needed to be complemented by: (a) short term measures to address weather related risks by ensuring that robust systems would be in place for disaster preparedness and management: and, (ii) by integrating climate risk assessments into planning and infrastructure development. One of the 11 CPF objectives aimed at improving management of climate risk and natural resources. The PDO was also aligned with the World Bank's Country Water Resources Assistance Strategy (CWRAS) issued in 2007 which identified the need for enhancing geomorphological, hydrological and meteorological data for water resources planning and Disaster Risk Management (DRM).

#### Rating

High

#### b. Relevance of Design

The statement of the PDO and the results framework was clear. The causal links between the project activities, their outputs and outcomes were logical. The outputs associated with component one and two activities in the Limpopo and Zambezi provinces (such as technical assistance for implementing Lidar, Lidar surveys, integrating Lidar data into existing models, long term training and capacity building in conjunction with investments in physical information management systems to ensure the long term accessibility and use of data), could be expected to increase the capacity of Mozambique to prepare and manage flood events in



the river basins .

However, there were also significant shortcomings in design. The project design was over ambitious regarding its activities and an unnecessarily large number of intermediate outcome indicators. The implementation of some project activities was contingent on the existence of good hydraulic models in areas, where Lidar data would be incorporated (ICR, page 4). Given that these models were still being developed under on-going Bank-financed parallel projects (National Water Resources Development Project (NWRDP) and the Pilot Program for Climate Resilience- Climate Resilience: Transforming Hydrological and Meteorological Services Project), it is not clear how the activities of this project could be completed within the scheduled time frame. Consequently, some project activities (such as increased capacity to manage flood events) could not be completed and this resulted in a reduced scope of project activities during implementation (ICR, page 11).

The focus of the project was on improving the accuracy and spatial and topographic data to increase preparedness and capacity to manage flood events by the Regional Water Authorities (ARAs) which were the key institutions for water resources and river basin management. However, the design did not include capacity building activities for other integral institutions, such as the agencies such as the National Center for Cartography and Remote Sensing (CENACARTA - the key institution responsible for storage and dissemination of the raw Lidar data) and the National Institute for Disaster Management (INGC) which was the direct beneficiary institution (ICR, page 5). This shortcoming contributed to the non-completion of outcomes associated with the objective of improving flood preparedness through an updated Contingency Plan by INGC in Zambezi and Limpopo.

**Rating**  
Modest

#### 4. Achievement of Objectives (Efficacy)

##### **Objective 1** **Objective**

To increase the capacity of Mozambique to prepare for and manage flood events in the Limpopo and Zambezi River Basins.

##### **Rationale** **Outputs.**

*For Limpopo:*

- Higher resolution airborne survey data (including for the additional surveyed areas) was collected as planned (ICR, datasheet, Intermediate Indicator Number One, Two and Three). The ICR (page 11) noted that the data could not be transformed into flood management tools at project closure, as some project



activities were not incomplete at project closure.

- 90% of geospatial data was stored and managed at project closure. This was short of the target. Consequently, the new geospatial data were not yet available to the public at project closure as planned (ICR, Datasheet, Indicator Number Five and Six).
- Multi-sector use of Lidar data for applications other than Water Resources Management (WRM) and Disaster Risk Management) were not yet completed as planned at project closure (ICR, Datasheet, Indicator Number Seven).
- As part of the capacity building effort, 29 staff members in the National Directorate of Water Resources Management involved with Lidar processing and data management were trained. This exceeded the original target of 25 (ICR, Datasheet, Intermediate Indicator Number Eight). Eight of the staff members were women as compared to the target of 11 (ICR, Datasheet, Intermediate Indicator Number Nine).
- None of the DNGRH staff were trained in activities pertaining to hydraulic and hydrological modelling as planned as this indicator was dropped at restructuring (ICR, Intermediate Indicator Number 21).

*For Zambezi.*

- Higher resolution airborne survey data were collected and transferred from contractor to client as targeted (ICR, Datasheet, Intermediate Indicator Number 12, 13 and 14). The data were not yet transformed into flood management tools as targeted.
- 75% of geospatial data were stored and managed at project closure. This was short of the target of 75%. Therefore, these data were not available to the public as targeted (ICR, Datasheet, Intermediate Indicator Number 15 and 16).
- Multi-sector use of Zambezi Lidar data for applications other than Water Resources Management (WRM) and Disaster Risk Management) was not yet completed as planned at project closure (ICR, Datasheet, Indicator Number 18).
- As part of the capacity building effort, 14 staff members in the National Directorate for Water Resources Management involved with Lidar processing and data management were trained. This exceeded the original target of 10 (ICR, Datasheet, Intermediate Indicator Number 19). One woman staff member was trained as compared to the target of four (ICR, Datasheet, Indicator Number 20).
- None of the DNGRH staff were trained in activities pertaining to hydraulic and hydrological modelling as planned because this indicator was dropped at restructuring (ICR, Intermediate Indicator Number 21).

*For both Limpopo and Zambezi.*

- Probabilistic flood risk hazard maps were developed as planned (ICR, Datasheet, Key Outcome Indicator Number 2).

**Outcomes.**

- The outcome indicators for the project were mainly output-oriented.
- The Lidar data were not yet transformed into flood management tools, as the only PDO outcome indicator which aimed at increasing the capacity for managing flood preparedness was dropped at



restructuring six months before the completion date.

- There was no mention in the ICR of an assessment of the impact of the training programs on increasing the capacity of Mozambique to prepare for and manage flood events in the Limpopo and Zambezi river basins.
- However, the ICR (Datasheet, Key Outcome Indicators Number Five and Six) reported that 2,063,286 people benefitted from the project compared to the target of 320,800 and that 1,100,920 of the beneficiaries were women as compared to the target of 192,480. The ICR however provides no details on the methodology followed in identifying beneficiaries. It is also not clear how the beneficiaries were identified, given that flood modelling and flood preparedness activities remained incomplete when the project closed.

**Rating**  
Modest

## 5. Efficiency

**Economic Analysis.** At appraisal, the economic benefits from Lidar-based flood management tools in the Limpopo and Zambezi river basins were estimated to amount to US\$1.94 billion. The potential benefits were assumed to come from reduced damage, due to more accurate and timely warning of flood risk and impact. There was however no ex-post economic analysis for the benefits associated with the project.

**Operational and Administrative Issues.** There was a saving in implementation cost as the same Project Administration and Monitoring Team (PAMT) from an ongoing Bank-financed project (National Water Resources Development Project) assisted in the preparation of this project, without additional operational and staff cost. Implementation progress was slow initially, due to delays associated with hiring a Lidar survey firm and a much longer than expected procurement process due to complaint presented in August 2015, which was eventually resolved. These factors contributed to the slow disbursements in the initial years of the project and eventually reduction in the scope of the project. The unit costs of delivering the Lidar project at US\$253.24 per kilometer (km) was higher than the estimated cost at appraisal (US\$240 per km).

**Efficiency Rating**  
Modest

- a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:



	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal		0	0 <input type="checkbox"/> Not Applicable
ICR Estimate		0	0 <input type="checkbox"/> Not Applicable

\* Refers to percent of total project cost for which ERR/FRR was calculated.

## 6. Outcome

The PDO was and continued to be highly relevant to the Government and Bank development strategies for Mozambique. However, the relevance of design was rated Modest it was over ambitious. Consequently the reach of the project's design was considerably reduced which in turn contributed to a reduction in scope of project activities and hence its inability to achieve its core objective. Efficacy of the objective - to increase the capacity of Mozambique to prepare for and manage flood events in the Limpopo and Zambezi River Basins - was rated Modest because the indicators were mainly outputs. Efficiency was rated as Modest because there was no ex post analysis of economic net benefits and there were administrative and operational inefficiencies. The project's overall outcome was rated Unsatisfactory reflecting major shortcomings in the extent to which the project's objective was achieved.

### a. Outcome Rating

Unsatisfactory

## 7. Rationale for Risk to Development Outcome Rating

**Government Commitment/ownership.** The Government commitment remained high at preparation as demonstrated by its participation in the project design and later in the approval and signing of the final agreement (ICR, page 17). Given that the Government made provision for the operation and maintenance budget for equipment and investment in data use for various applications including hydraulic and hydrological modelling during implementation (ICR, page 15), the risk to development outcome due to Government commitment/ownership was rated as Low.

**Stakeholder ownership and Technical Risk.** It is apparent from the ICR that beneficiary institutions would be able to use the Lidar data collected through this project. While these institutions interacted and shared Lidar data with other stakeholders, it is not clear if all stakeholders have either the financial resources or the technical capacity to enable the in-house use of the Lidar data unless additional training is provided (ICR, page 15). Overall the risk that the data collected would not be used for future hydraulic and hydrological modelling and other less sophisticated purposes is rated Modest.

### a. Risk to Development Outcome Rating





Modest

## 8. Assessment of Bank Performance

### a. Quality-at-Entry

The project was prepared based on the lessons from past Lidar initiatives supported by the Bank in Mozambique (Programmatic Support to Disaster Risk Management Phase 1 (P124755) and the Mozambique Roads and Bridges Management and Maintenance Project (P146402). Key lessons incorporated in this project included focus on technical assistance component, inclusive training, capacity building and activities aimed at maximizing the use of the Lidar data by beneficiary institutions and stakeholders. Appropriate arrangements were made for fiduciary compliance (discussed in section 11). However, there were significant shortcomings in Quality-at-Entry.

As indicated in Section 3b, the project components were over ambitious and included activities that were dependent on existence of technologies (such as good hydraulic and hydrological models) which were not ready at preparation nor during implementation.

The design underestimated the risks associated with stakeholder's ownership of the project, especially as they did not have the required capacity, and project activities did not adequately address the capacity building needs of the various stakeholders.

There were also shortcomings in M&E design including a high number of indicators and inclusion of indicators that could not realistically be achieved within the scope of the project (discussed in Section 10a).

### Quality-at-Entry Rating

Moderately Unsatisfactory

### b. Quality of supervision

Supervision missions were carried out regularly, with five Implementation Status Reports (ISRs) filed over a three-year period. The ICR suggested supervision missions were pro-active in identifying actions to reverse the slow progress of project implementation during its first year and this helped achieve a high rate of disbursements in the latter years of the project. In the wake of the cancellation of some project activities, the team appropriately used the funds from cancelled activities to fund additional surveys in the project areas. The ICR stated that the Bank team's supervision aided in fiduciary and safeguards compliance (ICR, paragraph 58).

On the other hand, delays and shortfalls in implementation were associated with frequent changes in team leadership, with three task team leaders in three years. This lack of continuity in the Bank's implementation support seriously undermined the project's achievements and the Bank project team sought to rescue the failures through a last-minute project restructuring which included dropping two PDO indicators, just days before the project's original closing date and 6 months before the extended closing date. One explanation in the ICR for dropping two key PDO indicators was they "were not well aligned to the actual scope of the project, which rendered them impossible to measure" (ICR page 2, paragraph 8) and that they "would be more efficiently addressed by other parallel projects within the Water Resources Development Program, where flood





modeling activities were being carried out as part of a more comprehensive river basin planning exercise” (ICR page 2, paragraph 8). The Data Sheet in the ICR makes a similar claim about the indicators stating that they were outside the scope of this project but adds that the indicators were “dependent on actions taken by third parties, outside the implementing agencies and beneficiary institutions mandate” (pages iii and iv). By agreeing to the removal of these two PDO indicators the Bank’s supervision team effectively rendered the PDO redundant and therefore changed the objective. This action should therefore have received prior approval from the Board.

### **Quality of Supervision Rating**

Unsatisfactory

### **Overall Bank Performance Rating**

Unsatisfactory

## **9. Assessment of Borrower Performance**

### **a. Government Performance**

The Government commitment through the National Directorate of Water (DNA) was demonstrated at preparation, through its active participation in preparing this project which had a tight time frame (ICR, page 5). The commitment of the Regional Water Authorities (ANA) of the Limpopo and Zambezi provinces was demonstrated by their definition of priority areas to be surveyed during project preparation and the competency of technicians in the ANAs who facilitated the identification of priority areas and interventions (ICR, page 5). The Government commitment to the PDO to the project activities remained strong, despite the change in Government in January 2015, following the October 2014 elections. The long waiting period for approval of the procurement package for the service providers to implement Lidar activities contributed to the delay in starting surveys and this in turn contributed to the reduced scope of project activities during implementation (ICR, page 17).

### **Government Performance Rating**

Moderately Satisfactory

### **b. Implementing Agency Performance**

The National Directorate of Water (DNA) was initially in charge of implementing the project with support from the Regional Water Authorities (ARAs). Following a restructuring of the Ministry of Public Works, Housing and Water Resources (MOPHRH) on July 17, 2015, the National Directorate of Water Resources Management (DNGRH) was placed in charge of implementing the project. DNGRH ensured consultation with the different stakeholders at preparation. Although project implementation was slow in the initial years due to the delays in hiring a Lidar survey firm, implementation picked up in the latter years and this aided completion of the restricted scope of project activities at closure. The Project Administration and Monitoring Team (PAMT) complied with the Grant Agreement requirements at preparation and compliance with the fiduciary requirements during implementation.



## **Implementing Agency Performance Rating**

Satisfactory

## **Overall Borrower Performance Rating**

Moderately Satisfactory

## **10. M&E Design, Implementation, & Utilization**

### **a. M&E Design**

A shortcoming in design was the high number of indicators (six key outcome indicators and 22 intermediate outcome indicators). Some crucial key outcome indicators were dropped and some indicators were clearly inappropriate. For instance, it is not clear that an updated contingency plan would be expected per se improve the capacity to prepare for floods as the indicator depended on actions taken by third parties, outside the mandate of the implementing agencies and beneficiary institutions. It is also not clear how the use of new geospatial data per se could be expected to reduce the incidence of floods (ICR, paragraph 43).

### **b. M&E Implementation**

According to the ICR (page 11), following project restructuring, two key outcome indicators (improved capacity to prepare for floods and reduced flood risk through use of new geospatial data) were dropped, as they were outside the scope of the project. However, the indicators were dropped just six months before the project closed and there was nothing put in its place to measure the achievement of the outcome of increasing the capacity of Mozambique to prepare for and manage flood events in the respective river basins. Six intermediate indicators relating to flood modelling were dropped following the cancellation of modelling activities, as these activities were to be implemented through other ongoing Bank financed projects in Mozambique (The National Water Resources Development Project (NWRDP) and the Pilot Program for Climate Resilience- Climate Resilience: Transforming Hydrological and Meteorological Services Project (PPCR - HYDROMET). During implementation, the Project Administration and Monitoring Team collected the relevant data on the revised outcome and intermediate indicators from various sources, including the Regional Water Authorities, the service provider, and the technical assistant hired to improve the capacity of the implementing agency.

### **c. M&E Utilization**

According to the ICR the collected data on indicators were used for monitoring project performance (ICR page 7, paragraph 29).



## M&E Quality Rating

Modest

## 11. Other Issues

### a. Safeguards

The project was classified as a Category C and did not trigger any safeguard policy at appraisal. The ICR (page 8) noted that no environmental or other safeguards issues were identified during implementation.

### b. Fiduciary Compliance

**Financial Management.** The ICR (page 8) noted that the project complied with the financial management requirements and there were no financial issues during implementation. Interim financial reports were submitted as specified in the Financing Agreements in a timely fashion. The external audit report relating to the fiscal year ending on December 31, 2015 did not identify any significant issue and an unqualified (clean) opinion on the financial statement was issued at closure.

**Procurement.** The ICR (page 8) noted that there was compliance with procurement management. However, there were delays in the approval of processes associated with the procurement of the Lidar survey services (the major contract for this project's implementation) within the Government. In addition, there was a complaint submitted by one of the bidders for the Lidar survey services in May 2015 which caused further delay. The complaint was considered to be unfounded but the cumulative delays slowed the project's progress.

### c. Unintended impacts (Positive or Negative)

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### d. Other

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## 12. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Moderately Unsatisfactory	Unsatisfactory	Although the PDO was highly relevant to the Government and Bank development strategies, relevance of design was rated Modest. Efficacy



			and Efficiency were also rated Modest.
Risk to Development Outcome	Modest	Modest	.
Bank Performance	Moderately Unsatisfactory	Unsatisfactory	Bank performance at supervision was rated as Unsatisfactory.
Borrower Performance	Moderately Satisfactory	Moderately Satisfactory	---
Quality of ICR		Modest	---

### Note

When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006.

The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

## 13. Lessons

The ICR draws the following main lessons from implementing this project, with some adaptation of language.

**(1) A careful assessment of indicators and targets for project activities is important for effective monitoring.** This project included indicators that were dependent on existence of tools under development in other projects, or would require external actions beyond the capacity of implementing and beneficiary institutions. This contributed to cancellation of project activities and indicators and the project's poor performance.

**(2) Project design needs to adequately address the capacity building needs of the relevant government agencies.** The activities in this project only addressed the capacity building needs of the primary implementing agency -the National Directorate for Water Resources Management (DNGRH) and did not address the capacity needs of the National Center for Cartography and Remote Sensing (CENACARTA) -the main institution for the storage of Lidar data. As implementation progressed, it was observed that lack of technical capacity within CENACARTA was a constraint in providing remote sensing data for all potential users. This necessitated capacity building activities for CENACARTA during implementation.

IEG adds the following lesson:

- **The deletion of a core PDO indicator can make the PDO redundant and hence change the PDO.** In the case of this project, deletion of the core indicator for the PDO just months before closure without a replacement effectively changed the PDO which should have received Board approval.

## 14. Assessment Recommended?

No

## 15. Comments on Quality of ICR



The ICR provided a detailed overview of the project's achievements which was reasonably clear.

However, the ICR was not candid, particularly when discussing the project's outcome following restructuring only a few days before the project was due to close and six months before the extended closing date.

While it was clear why the ICR chose to do a split rating to assess the project's outcome, the ICR failed to acknowledge that the PDO had been made redundant by the restructuring and therefore was not measurable. Hence the implementation of a split rating was moot.

**a. Quality of ICR Rating**

Modest