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National data collection and statistical monitoring system for small-scale tuna fishing in Madagascar: *progress and challenges*

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Purpose, expectation and action intended (select one or more and include corresponding text)

Discussions (for information and open discussion):

[The paper is to inform meeting members that…, as set out in Section X]

The goal of this article is to give an overview of the national data collection system for small-scale tuna fisheries in Madagascar, with a view to improving it, so as to achieve reliable statistical monitoring on the same level as all IOTC member countries, for sustainable management of tuna resources.

Feedback (to collect input and suggestions)

[The paper is to request review and comments on…, as set out in Section X]

Conclusion (to record a concluded position or summary)

[The paper is to seek confirmation that…, as set out in Section X]

The challenges in the small-scale fisheries of Madagascar can be overcome through integrated solutions tailored to local realities

Recommendation (to ask the meeting to endorse a recommendation)

[The paper is to seek endorsement on…, as set out in Section X]

To overcome the barriers of geographic isolation and reduce transmission delays, Madagascar must accelerate the digital transition of its monitoring system, this will eliminate all risks associated with using manual format, including administrative work involve.

Decisions (to request formal approval of actions)

[The paper is to seek approval on…, as set out in Section X]

Abstract

This document describes the evolution and challenges of the data collection system for artisanal and small-scale tuna fishing in Madagascar from 2015 to the present. It highlights the significant progress made, especially thanks to digitalization and a participatory approach. It details the organization of the system, the stakeholders involved, the data collection methods, and the types of data gathered. Improvements have been made to the data collection tools, including the introduction of digital support and the standardization of forms, as well as better coordination between departments. This system is crucial for Madagascar to meet its international obligations to the Indian Ocean Tuna Commission (IOTC) and ensure sustainable management of its fishery resources. Small-scale fishing plays a vital role in food security, coastal employment, and the economy of coastal communities, often underestimated compared to industrial fishing. This document also identifies structural challenges that limit the performance and sustainability of the system. These challenges are technical, socio-economic, financial, and logistical in nature. In a nutshell, this document offers insights and recommendations to strengthen the system, such as speeding up digital transformation, securing long-term funding, boosting staff skills, making databases interoperable, and leveraging data for national and regional management plans.

NATIONAL DATA COLLECTION AND STATISTICAL MONITORING SYSTEM FOR SMALL-SCALE TUNA FISHING IN MADAGASCAR: *PROGRESS AND CHALLENGES*

22 nd WORKING PARTY ON DATA COLLECTION AND STATISTICS (WPDCS22)
San Sebastian, SPAIN, 24 th November to 28 th November 2026

Prepared by **: BETKOU Ghislain Thierry**

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INTRODUCTION

Madagascar is a large island located in the southwest Indian Ocean and east of the Mozambique Channel. With its 5,000 km of coastline, the fishing sector is one of the country's main economic drivers. Tuna fishing alone accounts for more than 75% of the national currency. Fishing is the most important activity in Madagascar's coastal towns. Artisanal and small-scale fisheries exploit pelagic species (tuna and related species) and sometimes nocturnal benthic species. Artisanal and small-scale production is generally intended to supply the local market and contributes to the population's protein intake.

To improve fishing statistics in Madagascar, the Ministry of Fisheries, through the Antsiranana Tuna Statistics Unit (USTA), launched in 2015 a monitoring system for artisanal and small-scale pelagic fish in northern Madagascar with two pilot villages: Ramena and Ambodivahibe.

In 2016, artisanal fishing catches in these two pilot villages reached 102 tonnes, including 59 tonnes of tuna and 43 tonnes of other catches. The average tuna catch is estimated at 5.3 tonnes per month. Since then, the Ministry in charge of fisheries has been continuously expanding the sites for collecting data on tuna fishing. In 2021, we recorded about thirty operational sites, all located in the northern half of Madagascar. This was a significant number, but the data collected was not technically reliable.

Although often underestimated and sometimes neglected, small-scale tuna fishing in Madagascar plays a vital role in food security, coastal employment, and the economy of Madagascar's coastal communities. While industrial tuna fishing, operated by foreign fleets, traditionally captures the attention of public policy and international agreements, artisanal and traditional fishing of these large pelagic fish provides an economic and nutritional safety net for thousands of households.

For a long time, data from this small-scale fishery remained largely invisible or confined to the informal sector, resulting in chronic underreporting of national catches. Yet, statistical monitoring of this sector has become a crucial issue for the Malagasy state. On the one hand, Madagascar must meet its international obligations as a member of the Indian Ocean Tuna Commission (IOTC), which requires the transmission of reliable data on fishing effort and catches from all fleets, including artisanal ones. On the other hand, sustainable and resilient management of national fisheries resources is impossible without accurate knowledge of the actual catches taken in waters under Malagasy jurisdiction.

The goal of this paper is to provide an overview of the national data collection system for small-scale tuna fisheries in Madagascar from 2015 to the present day. It will analyze the

significant progress made in recent years, particularly through digitalization and a participatory approach, while rigorously identifying the structural challenges that still limit the performance and sustainability of this statistical system.

I. CONTEXT AND IMPORTANCE OF SMALL-SCALE TUNA FISHING

1. Definition and characteristics of small-scale tuna fishing

- Types of boats (sailing canoes or canoes without sails, motorized canoes, handcrafted boats).
- Main fishing areas: 05 regions in the northern half of Madagascar and 01 region in the southern half.
- Target species: This activity targets both large tunas (albacore, bigeye, skipjack) and smaller tunas and related species (Kawakawa, Bullet tuna, Frigate tuna and Kingfish, Spanish mackerel…), in other words, tropical tuna and neritic tuna.

2. Socio-economic importance

- Contribution to coastal employment.
- Role in food security.
- Integration into local value chains.

3. Institutional and regulatory framework

- Ministry of Fisheries and the Blue Economy.
- Reporting obligations to regional organizations (e.g., CTOI).

II. ORGANIZATION OF THE NATIONAL DATA COLLECTION SYSTEM

(Institutional and Organizational Framework for Statistical Monitoring)

2.1 Actors involved

- Decentralized services of the ministry.
- Observers, investigators, port agents.
- Community-based fishing organizations.

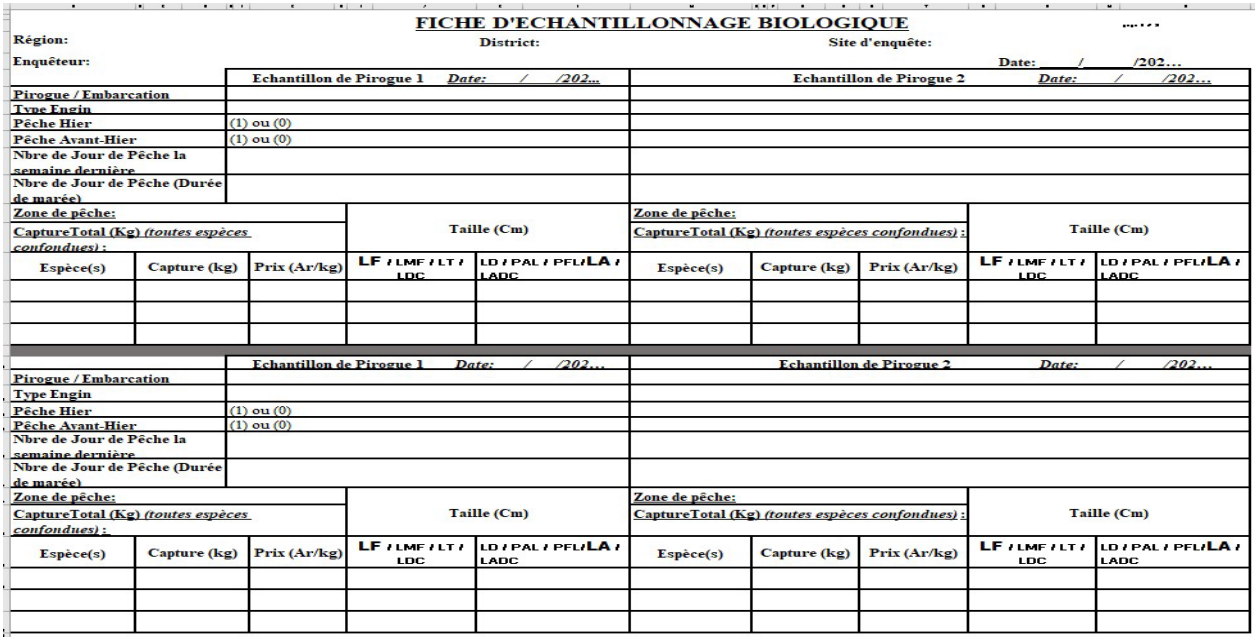
2.2 Collection Methods

- Investigations into the landings.
- Participatory monitoring with communities.
- Pilot initiatives for digitalization (use of a suitable application on tablets).

2.3 Types of data collected

All the information necessary for data collection in the field is recorded in the tables below:

Table 1 : Biological Sampling Form



FICHE D'ECHANTILLONNAGE BIOLOGIQUE

Région: District: Site d'enquête:

Enquêteur: Date: / /202...

	Echantillon de Pirogue 1 Date: / /202...	Echantillon de Pirogue 2 Date: / /202...
Pirogue / Embarcation		
Type Engin		
Pêche Hier	(1) ou (0)	
Pêche Avant-Hier	(1) ou (0)	
Nbre de Jour de Pêche la semaine dernière		
Nbre de Jour de Pêche (Durée de marée)		

Zone de pêche: / CaptureTotal (Kg) *(toutes espèces confondues)* :			Taille (Cm)		Zone de pêche: / CaptureTotal (Kg) *(toutes espèces confondues)* :			Taille (Cm)	
Espèce(s)	Capture (kg)	Prix (Ar/kg)	LF / LMF / LT / LDC	LD / PAL / PFL/LA / LADC	Espèce(s)	Capture (kg)	Prix (Ar/kg)	LF / LMF / LT / LDC	LD / PAL / PFL/LA / LADC

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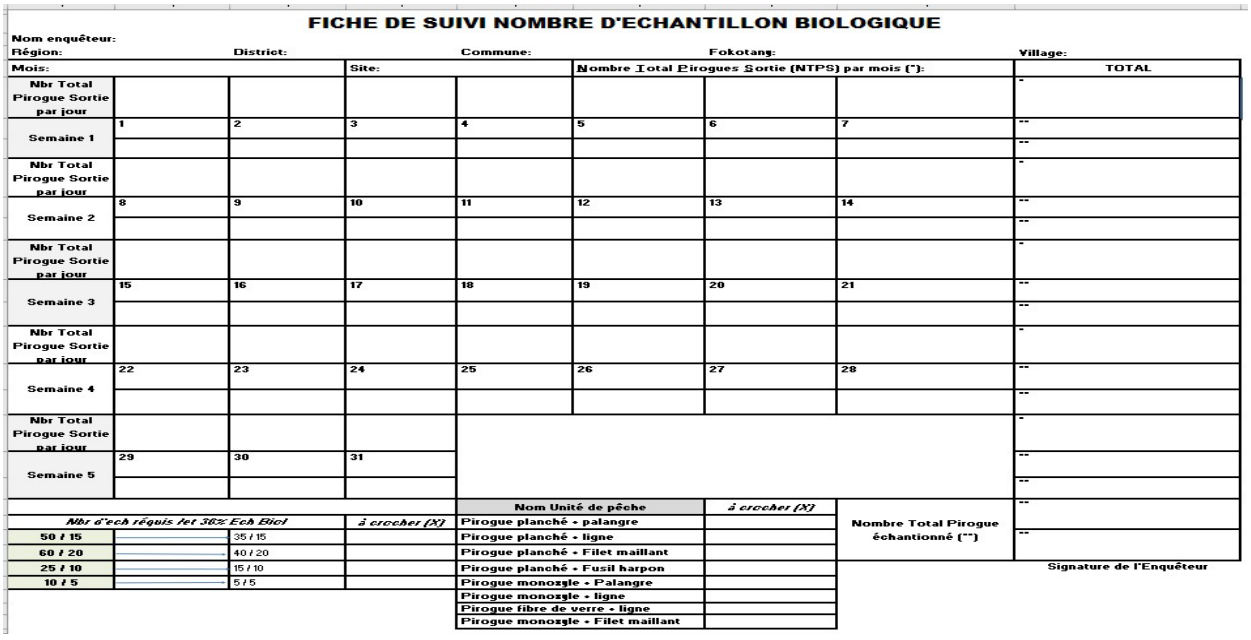
Espèce(s)	Capture (kg)	Prix (Ar/kg)	LF / LMF / LT / LDC	LD / PAL / PFL/LA / LADC	Espèce(s)	Capture (kg)	Prix (Ar/kg)	LF / LMF / LT / LDC	LD / PAL / PFL/LA / LADC

Table 2 : Monitoring sheet for active canoes



FICHE DE SUIVI NOMBRE D'ECHANTILLON BIOLOGIQUE

Nom enquêteur:

Région: District: Commune: Fokotany: Village:

Mois: Site: Nombre Total Pirogues Sortie (NTPS) par mois (*): TOTAL

Nbr Total Pirogue Sortie par jour								-
Semaine 1	1	2	3	4	5	6	7	--
								--
Nbr Total Pirogue Sortie par jour								-
Semaine 2	8	9	10	11	12	13	14	--
								--
Nbr Total Pirogue Sortie par jour								-
Semaine 3	15	16	17	18	19	20	21	--
								--
Nbr Total Pirogue Sortie par jour								-
Semaine 4	22	23	24	25	26	27	28	--
								--
Nbr Total Pirogue Sortie par jour								-
Semaine 5	29	30	31					--
								--

Nbr d'ech requis /et 38% Ech Biol		à crocher (X)
50 / 15	35 / 15	
60 / 20	40 / 20	
25 / 10	15 / 10	
10 / 5	5 / 5	

Nom Unité de pêche	à crocher (X)
Pirogue planché + palangre	
Pirogue planché + ligne	
Pirogue planché + Filet maillant	
Pirogue planché + Fusil harpon	
Pirogue monoxyle + Palangre	
Pirogue monoxyle + ligne	
Pirogue fibre de verre + ligne	
Pirogue monoxyle + Filet maillant	

Nombre Total Pirogue échantionné (**) --

Signature de l'Enquêteur

In summary, the variables collected in these two survey forms are as follows:

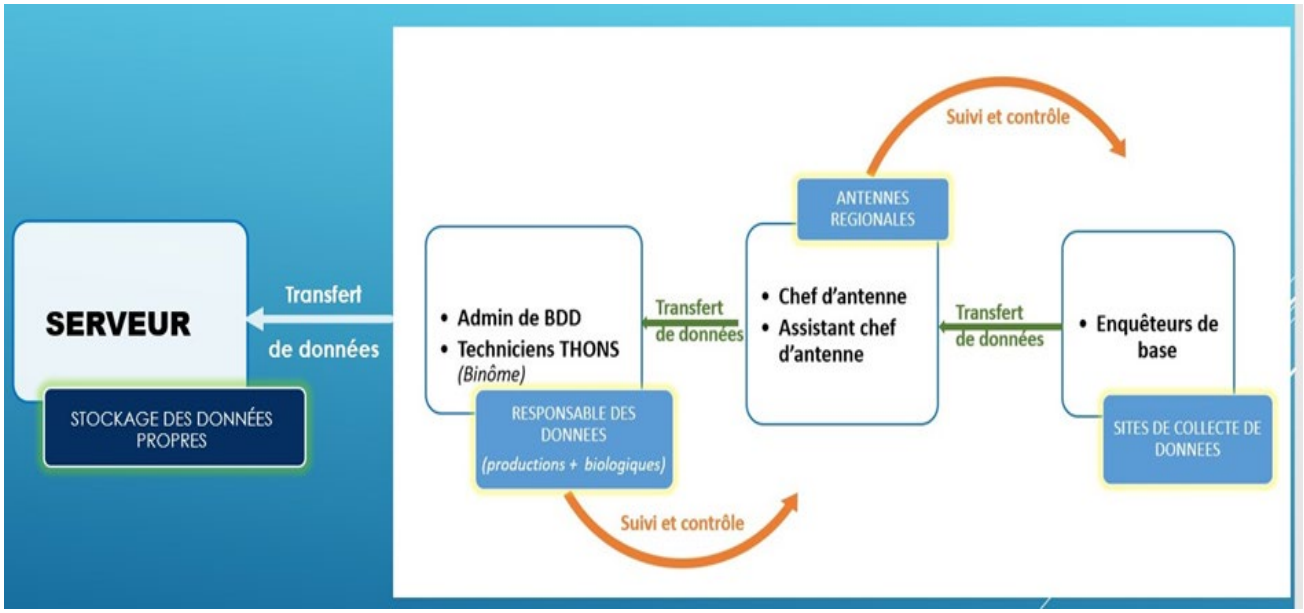
- Fishing effort (departure of canoes, gear).
- Catches per species per canoe / Total catch per canoe (all species combined)
- CPUE: indicator of the health status of the resource; Socio-economic data (prices,

incomes).

- Biological data (size, weight): assessment of fishing pressure on juveniles
- Fishing areas

2.4 Processing and validation

The chain of information transmission: from the investigator's field survey forms or sheets to the national centralized database.



Key players:

- The Ministry of Fisheries and the Blue Economy (MPEB).
- Research centers (e.g., IH.SM , National Center for Oceanographic Research CNRO).
- International partners and NGOs (e.g., IOC, FAO, WWF, WCS).

The regulatory framework: National obligations and alignment with the requirements of regional fisheries management organizations (e.g., Indian Ocean Tuna Commission - IOTC).

Data collection structures: Fisheries survey network.

Choice of collection site:

- Number of fishing gear capable of catching tuna and related species

Example: Hook reference (HC size < 4, mesh size > 03 fingers such as ZZ and JARIFA…)

Collection sites:

- Spatial stratification according to fishery types for good representation of areas (*grouping of adjacent sites having the same fishing technique*).

Data sources:

- All data collected comes from sampling at the point of landing of canoes or other boats

Others:

- Accessibility (All collection sites should be accessible throughout the year to facilitate checks and monitoring.

SAMPLING TECHNIQUE

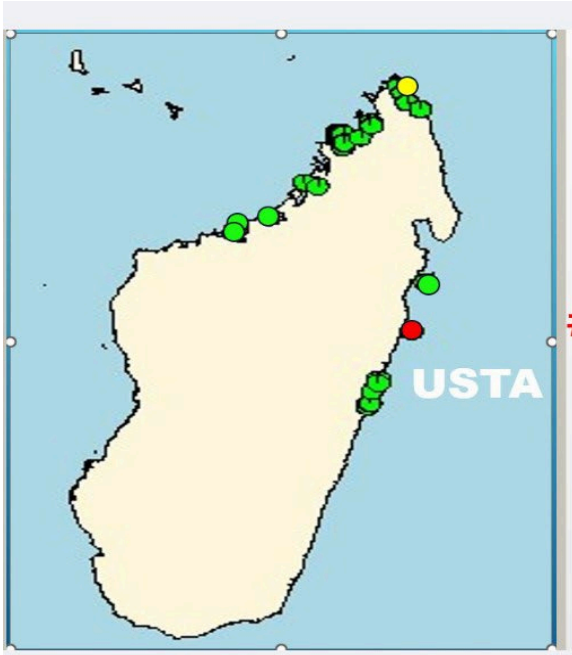
- Sample size = f°(Number of fishing units)

Fishing unit = pair (Vessel, Gear)

- Proportionality between sample size % Number of investigators per site
- 30% in Number / Target Species / Boat or Vessel
- If you have trouble identifying the species, always refer to the plates.

(Identification Guide), or take photos of the target and send them to the Responsible for advice.

III. PROGRESS AND MAJOR ADVANCES



Carte n°1: Sites Location (2015-2022)



Carte n°2: Sites Location in 2026

refresher course on species identification as well as reminders on sampling techniques.

- Better coordination between services: Where there is no DESP supervisor, the monitoring of data collector activities is ensured by qualified and trained Ministry agents in the locality.

3.1 Improvement of data collection tools

- Introduction of digital media: in addition to the species identification sheets, an identification guide has been integrated into the tablet in order to facilitate and streamline the fieldwork of the investigators on the one hand, and above all to reduce errors in the distinction of similar species.
- Standardization of data collection forms: In Madagascar, it's not just the Ministry that collects tuna fishing data; NGOs such as WWF, BV, and WCS also do so. And they often operate in different areas. This has led us to find a way to establish a standardized system from data collection to processing, in order to obtain unique data for Madagascar. To this end, two workshops have already been held to implement this standardized approach. We are currently in the final stages and hope to be able to implement it by 2027.

3.2 Technological modernization: Introduction of data collection via tablet (applications **such** as OPENARTFISH)

- The OPEN ARTFISH tool is used in production; unfortunately, it is not suitable for collecting biological data (no measurements, sex, *etc.), nor for shore fishing.* … Hence, the need for a **module** linking the two.
- To accelerate or streamline communication between investigators and managers in order to obtain data on time.
- Immediate remote verification of data before final validation.
- Easy means of species identification, by sending photos of doubtful species directly to the responsible parties.

3.3 Community involvement: Without location tools like GPS, fishermen are encouraged to specify their fishing areas (location or nearby village) at each landing.

3.4 Improved coverage: Increase in the number of officially monitored landing sites in the SOUTHEAST part of Madagascar (2 collection sites at FORT DAUPHIN)

IV - PERSISTENT CHALLENGES AND LIMITATIONS OF THE SYSTEM

4.1 Technical Challenges

Lack of equipment (tablets, GPS).

Limited telephone network coverage in coastal areas.

Absence of data from the national framework survey (last version of the ECN was done in 2012-2013)

4.2 Institutional Challenges

Insufficient human resources.

Weak inter-institutional coordination.

4.3 Socio-economic challenges

- Reluctance of some fishermen to declare their catches.
- High level of informality in the sector.
- Feedback to fishing communities: this feedback should not be neglected as it can have a serious impact on data collection activities, leading to reluctance on the part of the majority of small-scale fishermen.

4.4 Financial Challenges

- Dependence on external funding. For example, even for a simple purchase of internet connection credits, funding is still pending, despite the existence of the sector support fund.
- Lack of budget for maintenance or renewal of tools.

4.5 Logistical and Financial Challenges:

The implementation of a comprehensive statistical system is primarily hampered by the very geography of Madagascar. With over 5,000 kilometers of coastline, Madagascar exhibits an extremely dispersed network of landing sites for small-scale fisheries. Unlike industrial fishing, which concentrates its activities in a few developed ports such as Antsiranana or Toamasina, traditional fishers operate from hundreds of isolated villages, often temporary, depending on fishing migrations. The lack of road access to many coastal regions, particularly during the rainy season, makes physical access to these sites extremely difficult, if not impossible, for fisheries inspectors and supervisors.

This geographical constraint is exacerbated by a chronic lack of financial and human resources. The national budget allocated to fisheries statistics remains limited, making the administration dependent on external funding linked to development projects or environmental NGOs. This situation creates significant job insecurity for field staff: community surveyors and data collectors often suffer from delays in receiving their allowances, a lack of basic equipment (scales, identification guides, raincoats), and inadequate means of transportation. When a project ends,

The monitoring is frequently interrupted, creating breaks in time series that seriously impair the robustness of long-term statistical analyses, and this is the case with the USTA just after the end of the SWIOFISH2 project.

V. Perspectives and Recommendations for Strengthening the System

To overcome the barriers of geographic isolation and reduce transmission delays, Madagascar must accelerate the digital transition of its monitoring system. The large-scale deployment of mobile data collection applications (e-fisheries systems) represents the most viable solution. These tools allow field agents or community leaders to directly enter catch data (weight, size, species, gear used) from their smartphones, with automatic synchronization as soon as a cellular network or internet connection is available. This eliminates the risk of losing paper forms and reduces...The time for double administrative entry is zero.

Beyond data collection, technological perspectives must incorporate the automation of data processing.

To better address these challenges, the following points are recommended:

- Sustainability of funding: Creation of an autonomous national funding mechanism for statistical monitoring (fishing taxes, blue funds).
- Complete digitalization of data collection
- Capacity building for agents in data collection and, above all, data processing, using appropriate tools or software such as R, QGIS...
- System interoperability: Unification of NGO and State databases for a holistic vision.
- Data valorization: Increased integration of small-scale fisheries statistics into national management plans and regional negotiations (IOTC).
- Strengthening resilience: Using data to assess the impact of climate change on tuna migration near the Malagasy coast.

CONCLUSION

A high-performing national data collection system is essential for the sustainability of small-scale tuna fishing in Madagascar. Despite significant progress, major challenges remain and require integrated solutions tailored to local realities.