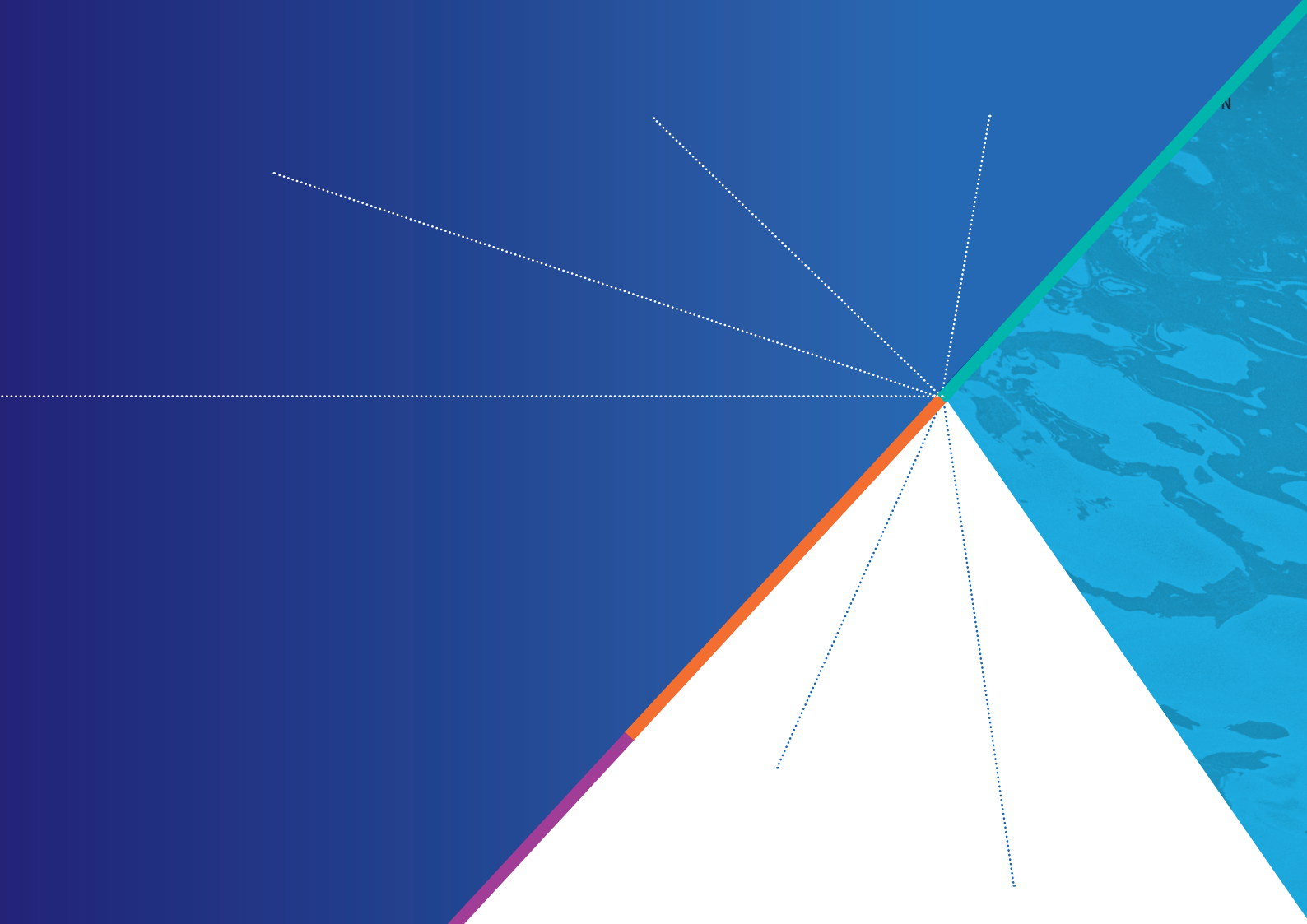

Review of South-West Indian Ocean Region

UNISDR Working Papers on Public Investment Planning and Financing Strategy for Disaster Risk Reduction

February 2015

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for Disaster Risk Reduction

Review of South-West Indian Ocean Region

February 2015

UNISDR Working Papers on
Public Investment Planning and Financing Strategy for Disaster Risk Reduction

This series is designed to make available to a wider readership selected studies on public investment planning and financing strategy for disaster risk reduction prepared for use in co-operation with Member States. Authorship is usually collective, but principal authors are named.

UNISDR Working Papers should not be reported as representing the official views of the UNISDR or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on disaster risk reduction.

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List of Acronyms

AAL	Annual Average Loss
CATSIM	CATastrophe SIMulation
CCA	Climate Change Adaptation
CAPRA	Comprehensive Approach for Probabilistic Risk Assessment
CBA	Cost Benefit Analysis
DRM	Disaster Risk Management
DRR	Disaster risk Reduction
EIA	Environmental Impact Assessment
EU	European Union
GAR	Global Assessment Report on Disaster Risk Reduction
GDP	Gross Domestic Product
GEF	Global Environment Fund
GFCF	Gross Fixed Capital Formation
HFA	Hyogo Framework for Action
IOC	Indian Ocean Commission
IIASA	International Institute for Applied System Analysis
IMF	International Monetary Fund
PML	Probable Maximum Loss
RSBR	Risk Sensitive Budget Review
SIDS	Small Island Developing States
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
WB	World Bank

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Executive Summary

In 2013, following a grant agreement signed between UNISDR and the Indian Ocean Commission, a joint UNISDR/IOC programme was started entitled "Strengthening Capacities for Unified Climate Change Adaptation and Disaster Risk Reduction Through the Facilitation of Risk Transfer and Financing Mechanisms". It was implemented within the "ISLANDS Programme for Financial Protection against Climatic and Natural Disasters". It also forms a part of UNISDR's global project for around 30 countries: "Building Capacities for Increased Public Investment in Integrated Climate Change Adaptation and Disaster Risk Reduction: 2012-2015" financed by the European Union.

Four island countries in the Indian Ocean as well as the Government of Zanzibar participated in this joint UNISDR/IOC programme composed of three components: the establishment of reliable disaster loss database (Component 1), risk evaluation and probabilistic risk assessment profiles (Component 2) and incorporation of risk management into public investment planning (Component 3). Economic analysis and policy reviews were developed as a package. This report aims to summarize all activities implemented in the programme with a focus on public investment planning (Component 3) while a technical report on Components 1 and 2 is also available[1].

As a first step (Component1), a total of 3,235 data cards on disaster events and losses between 1980 and 2013 were registered in the national disaster loss database. Economic loss totalled USD 17.2 billion (2012 constant price), out of which, 96% was due to intensive and extensive cyclones. In the subsequent probabilistic risk analysis (Component2), Average Annual Loss (AAL) for tropical cyclonic wind and earthquake combined across the region was estimated at USD 161.43 million, with a Probable Maximum Loss (PML) of USD 1,466 million for a 50-year return period.

This loss and risk information pointed to the need to reduce tropical cyclone risk. However, in itself it did not suggest policy guidance. Grounded in the loss and risk analysis, a thorough policy review and economic analysis were implemented (Component 3).

CATSIM analysis developed by IIASA identified that the fiscal resource gap year (*i.e.* the return period at which the government will face difficulty in raising sufficient funds for reconstruction) for tropical cyclone and earthquake hazards in each country. The gaps for the IOC islands were between 24 (Madagascar) and 329 (Seychelles) years. Drawing from the risk layer based approach, because of their high volume of extensive risk and their low fiscal gap years, it was judged to be more beneficial and effective for Madagascar and Union des Comores to focus on risk reduction efforts while Mauritius and Seychelles should also start to explore risk-financing mechanisms.

The following probabilistic cost benefit analysis (CBA) presents how CBA can support concrete and specific evidence-based decision making. A specific scenario and project was examined (i.e. housing retrofitting or water drainage) for each island using probabilistic (forward or backward looking) methods and a Net Present Value (NPV) for each was determined. Three of the five studied efforts were determined to be cost-effective. Key variables and updated damage and cost information were lacking to produce a more useful CBA especially in the cases that the NPV was negative.

Based on these findings, current Disaster Risk Management (DRM) policy in the Indian Ocean region and especially public finance (including DRR investment and risk financing mechanisms) were examined. In spite of much progress in HFA implementation and disaster management systems, no definite and systematic DRR investment policy exists in the IOC countries. Several sectorial ministries in all five islands make risk sensitive investment implicitly. Cost benefit analysis, when required for large-scale projects, does not take disaster risk into consideration. Critical infrastructure is not sufficiently protected against disaster risk. Contingency financing mechanisms are also under-developed.

To explore the financial aspects of DRM policy, each country also estimated the current investment in disaster risk management by applying a DRM Marker method in an examination of national budgets, proposed for the OECD by the World Bank in partnership with UNISDR.

Results determined that between 2 and 16% of studied budgets is invested in DRM, implicitly or explicitly in any given year, corresponding to approximately USD 457 million. Overall, more than twice as much marked effort is categorized as "significant" (as opposed to "principle"), demonstrating that they are embedded in development projects --mainstreamed into development. The general trend points to greater investment in preventive /

[1] For component 1 and 2, please see UNISDR /IOC (2014). Component 1 and 2: Comoros, Madagascar, Mauritius, Seychelles and Zanzíbar. Building capacities for increased public investment in integrated climate change adaptation and disaster risk reduction: 2012-2015. European Commission - Directorate General for Development and Cooperation. Geneva, Switzerland.

mitigation DRR action for Mauritius, Seychelles and Zanzibar; and investment in response for Madagascar and Union des Comores.

A comparison of annual investment in DRM to AAL and observed loss determined that among the five islands, Madagascar suffers the greatest gap, pointing to the need for greater DRR investment. Most countries identified that for the budget review to be more meaningful, it needs to more carefully capture and track investment related to specific hazards.

During several meetings with representatives of the Ministries of Finance in the IOC region, it was established that a scattered approach to DRM is inefficient and there is need for stronger collaboration between the DRM agency, Ministry of Finance and other key sectoral ministries. Continuous capacity building on risk terminology and concepts, loss and risk information management and economic analysis was recommended by Ministries of Finance in the region.

The loss and risk information should be examined from the perspective of both DRM policy maker and financial planners. Given the importance of public investment in DRR, continuous refinement of loss and risk information should be promoted through regular dialogue with data users. In the process of economic analysis, Ministries of Finance understood and appreciated the importance of loss and risk information. On some cases, they identified several mistakes and inconsistencies in the records in disaster loss databases and the data were corrected. Such exchanges of information will improve overall quality of knowledge management to support DRM decision making.

Government needs to develop investment and financing strategies to address both extensive (small scale but high frequency) and intensive (low frequency but high impact). Climate change will increase risks in terms of frequency, geography and intensity. Understanding risk structures and the expected economic impact in the country is the critical first step to determine the optimum policy mix for each risk layer. In developing investment and financing strategies to address disaster risk, DRR investment and risk financing should not be considered separately. Depending on risk layers, the most appropriate policy mix changes and DRR investment and risk financing are not mutually exclusive. For example, DRR investment often decreases insurance premiums.

This packaged approach with a focus on financial planners in government will be standardized and replicated in Asia, Africa, Latin America and other regions in the coming years and the knowledge is planned to be archived and presented globally in a working paper series of UNISDR on “Public Investment and Financing Strategy for DRR”. The report summarizing activities in IOC region will thereby contribute to increasing the global knowledge base.

1. Introduction

In 2012, the UNISDR started a project called "Building capacities for increased public investment in integrated climate change adaptation and disaster risk reduction: 2012-2015" under the financial sponsorship of EC-Development and Cooperation (EC-DEVCO). The initiative supports approximately 30 countries in Asia, Pacific, Africa, Latin America and the Caribbean to systematically account for disaster loss and to develop probabilistic estimations of future risk. It provides a baseline for an economic approach toward better public investment planning.

In the Western Indian Ocean region, this initiative has been separately planned and implemented between 2013-2015 in cooperation with the ISLANDS programme of the Indian Ocean Commission (IOC), in accordance with the programme design developed by UNISDR and implemented through the "ISLANDS Financial Protection Programme against Climatic and Natural Disaster Risks".

The initiative has three components:

- Component 1: disaster loss
- Component 2: probabilistic disaster risk assessment
- Component 3: public investment planning

Component 3 of this initiative considers disaster risks in economic analysis to support and facilitate risk-proof public investment decision-making. It especially aims to contribute to the progress of HFA priority areas monitored through core indicator 4.6 "procedures are in place to assess the disaster risk impacts of major development projects, especially infrastructure" and 3.3 "Research methods and tools for multi-risk assessments and cost benefit analysis are developed and strengthened".

UNISDR has been in charge of designing methodologies for Component 3 and in the process, considered how natural science can be linked to social science to contribute to better decision making in public investment planning. In the Indian Ocean Commission (IOC) region, this project has been planned and implemented from 2013 to 2015 in cooperation with ISLANDS, in accordance with the project design developed by UNISDR.

This report summarizes all activities implemented in the IOC Region[2]. Chapter 2 presents the regional structure and differences in basic country structure, as background. Chapters 3 and 4 outline loss and risk as the starting point of analysis. Chapter 5 briefly explains the DRR institutions and policies across the region. Chapter 6 outlines the current state of risk-sensitive public investment planning and risk financing policy and summarizes the national level results of three types of economic analysis implemented in the effort.

In Component 3, UNISDR introduced tools a) to monitor DRM budgets to analyse the current state of public investment (called the "risk sensitive budget review"), b) to measure the impact of disasters on public finance and on the economy at the macro scale (CATSIM analysis), and c) to measure the impact of DRR investment on society (probabilistic cost-benefit analysis). In Chapter 7, recommendations for policy makers are presented drawing from the analyses implemented.

For greater theoretical and technical background and detailed case studies on each tool, readers are directed to consult the country report series (one per island). In the introductory chapters of each national report, the background, especially why we need risk-sensitive public investment, is explained. Then, basic concepts of loss and risk are defined to provide a common understanding of key terminology. Lastly, the overall streamlined process from loss data analysis through probabilistic risk assessment into economic analysis is explained.

[2] A series of workshop/meetings are listed in Annex.

2. Regional Structures

This chapter sets the foundation for the exploration of risk- sensitive public investment in five islands situated in the Indian Ocean (hereafter called IOC Region), namely:

- Madagascar
- Mauritius
- Seychelles
- Union des Comores
- Zanzibar (of the United Republic of Tanzania).

While the general structure of the region is provided below, the institutional and legal structures in place for disaster risk management are described in Chapter 5.

A. Population

These five islands in the Indian Ocean are home to 25.8 million people sitting on 594,331 km2 of land. The population density of the islands ranges from 35 (in Madagascar) to 618 (in Mauritius) (Table 1).

Table 1: Population in the IOC Region

	Population	Area (km^2)	Pop. Density
Madagascar	22.3 million (2012)	587,040	35
Mauritius	1.26 million (2014)	2,040	618
Seychelles	88,300 (2012)	455	198
Union des Comores	734,900 (2013)	2,236	278
Zanzibar	1,303,569 (2012)	2,560	530
IOC REGION	**25.6 million**	**594,331**	**43**

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e) and World Bank for Union des Comores.

B. Government and Political Structures

The Indian Ocean Commission (IOC) is an intergovernmental organization that was created in 1982 in Port Louis (Mauritius) and later institutionalized by the Victoria Agreement (Seychelles) in 1984. It brings together five countries from the Indian Ocean region: Comoros, Madagascar, Mauritius, Seychelles and Reunion (France).

As a tool for regional cooperation, across all sectors - political and diplomatic, economic and ecological, cultural and health - the IOC enables its members to respond to the common challenges of sustainable development. Indeed, the IOC as an external vehicle for collective and concerted action, leads cooperation projects that cover a wide range of fields including: maritime security, health monitoring, the management and control of fisheries, disaster risk reduction, the promotion of political stability and improved air, maritime and digital connectivity. As the only African regional organization made up entirely of islands, the IOC defends the common interests of its island states on the regional and international scene.

In doing so, the IOC has become the preferred interlocutor of development partners, which it mobilises around cross border issues of common interest.

Mission of the IOC

The IOC has a mission to actively contribute to the construction of a regional platform for sustainable development by strengthening the ties of solidarity among its Member States on the basis of a smart growth strategy and concerted actions.

More specifically, the IOC's mission has two complementary components:

the development and implementation of regional cooperation projects designed to protect the populations of Indianoceanic region, improve their lives and preserve the natural resources upon which they are heavily reliant; the defence of common interests of its Member States on the regional and international scene and emphasis of their specific characteristics with development partners and in multilateral fora.

This is in the context of its mission that the island of Zanzibar of the United Republic of Tanzania, has been added to the beneficiary territories of the ISLANDS programme.

IOC operates wherever its action brings a strong added value to those of its members and / or initiatives of broader regional organizations (COMESA, SADC, Tripartite) of continental institutions (African Union) and / or multilateral (UN, WTO, etc.). While ensuring the principles of coordination, complementarity and subsidiarity, IOC assumes a supporting role in areas where its members require specific heightened support. Its aim is to increase the impact of its interventions, focusing on the implementation of initiatives that produce more tangible results and more visible benefit to the people.

At the national level within the region, there are some major differences in forms of government, etc. Highlights are described in Table 2.

Table 2: National government structure of the IOC Region (as of December 2014)

	Year of Independence	Form of Government	Legislature
Madagascar	1960	Unitary semi-presidential republic	Parliament (Senate and National Assembly)
Mauritius	1968 (Republic since 1992)	Parliamentary republic	National Assembly
Seychelles	1976	Presidential republic	National Assembly
Union des Comores	1975	Federal presidential republic	Assembly of the Union
Zanzibar	1963	Union Government, Semi-autonomous state within the United Republic of Tanzania	House of Representatives

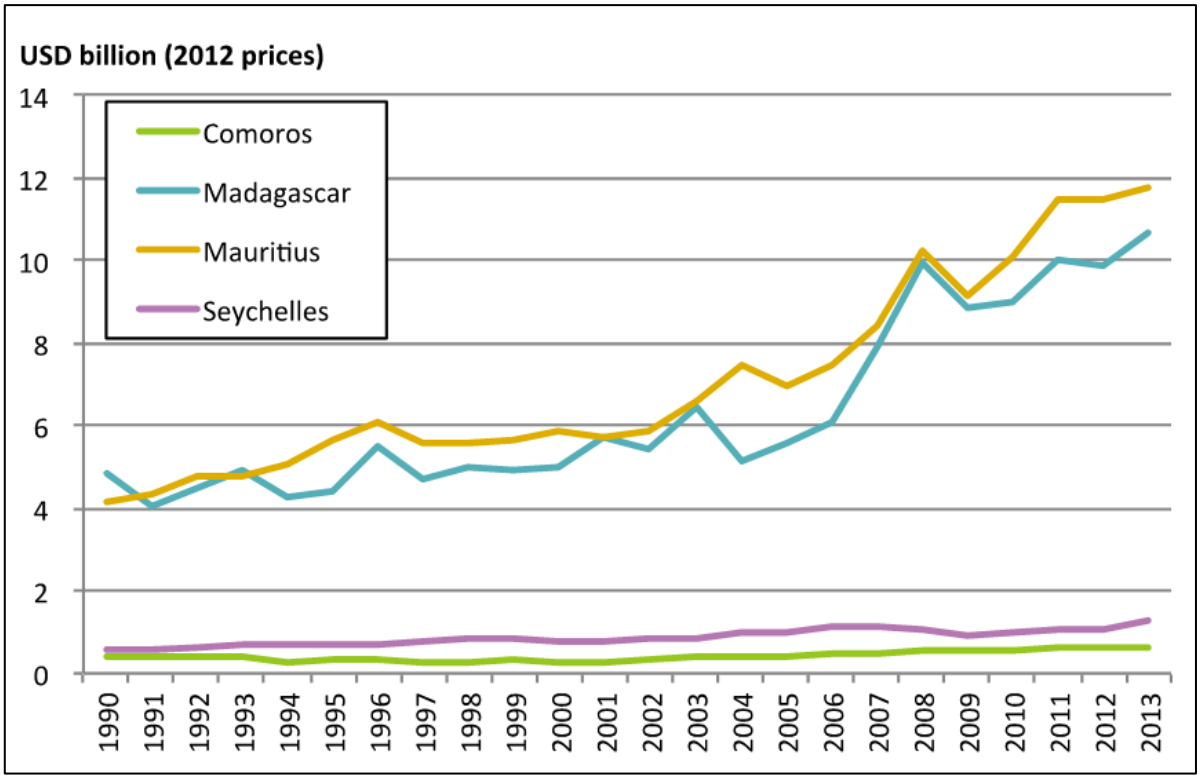
UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

C. Economic Structures[3]

While economic structures (i.e. as manifest in the GDP) in the region have been on the rise for Mauritius and Madagascar more or less since 2002, they have only risen since 2012 for Seychelles and have stagnated for Union des Comores (Figure 1). The trends for per capita GDP, however, demonstrate that while per capita growth is growing for Seychelles and Mauritius, the same cannot be said for Madagascar (Figure 2).

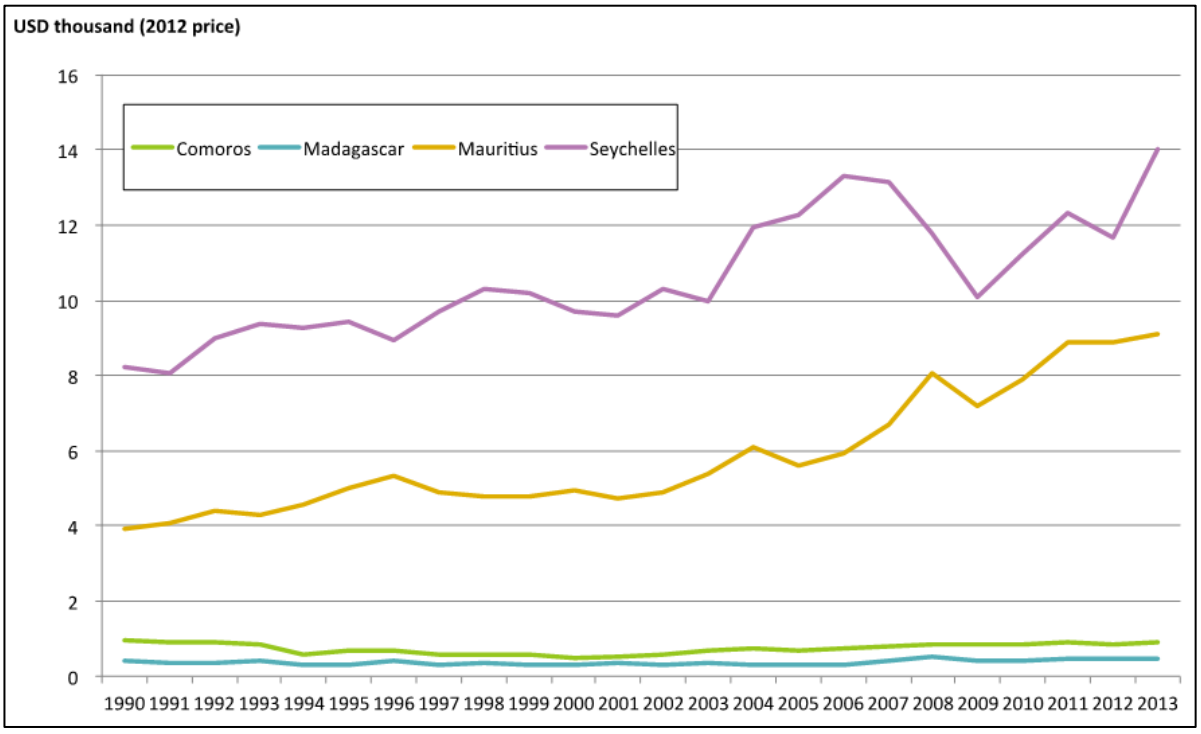
[3] Zanzibar was not analyzed together in this section due to lack of comparable data

Figure 1: GDP (in USD billion at 2012 prices)



Source: World Bank Development Indicators

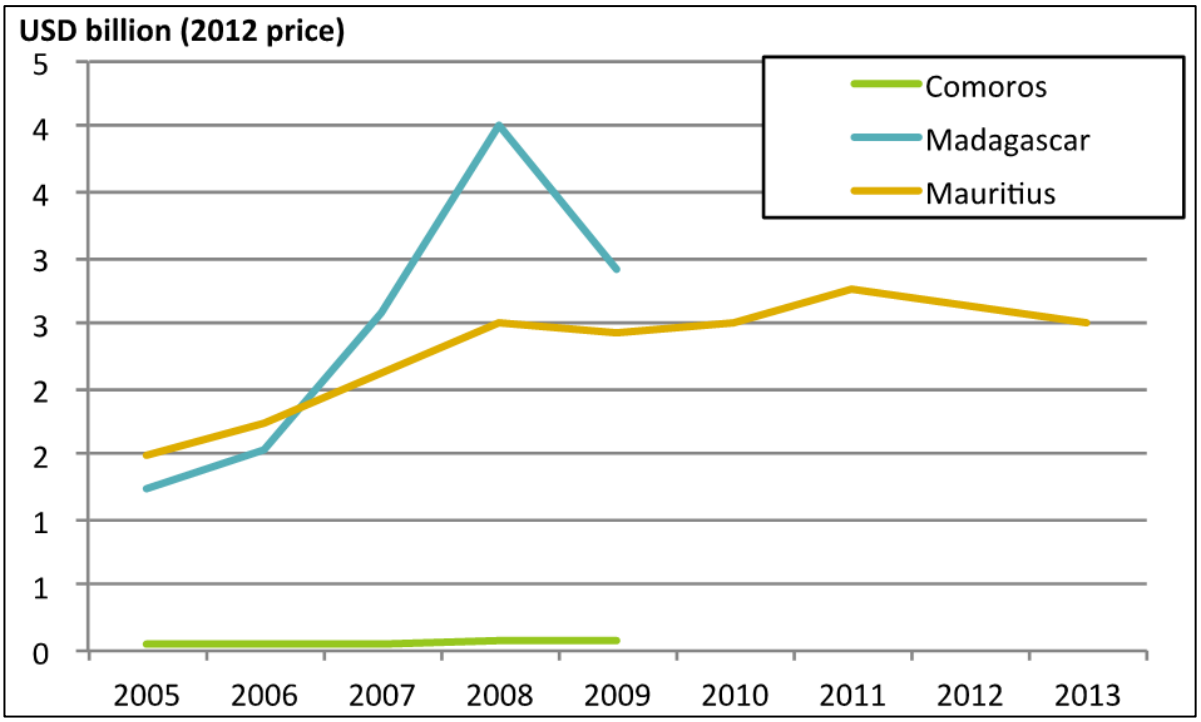
Figure 2: GDP per capita (in USD thousand at 2012 prices)



Source: World Bank Development Indicators

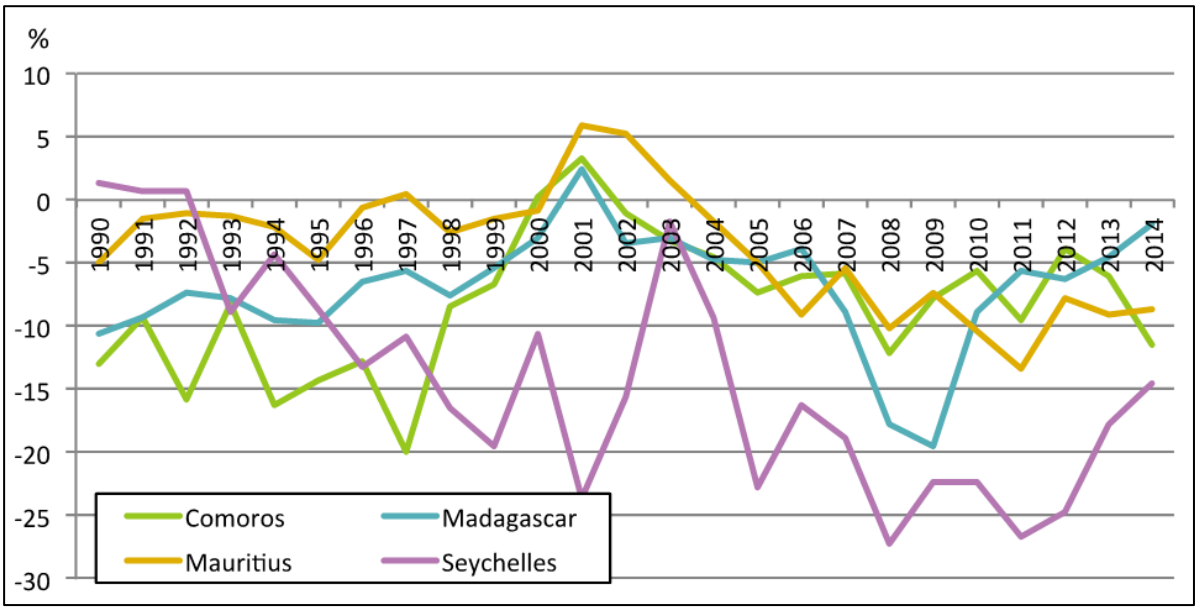
Figure 3 demonstrates growth in capital formation for Mauritius and scattered status for Madagascar until data were no longer available. For Union des Comores, available data show very little real growth (data for Seychelles not available). Figure 4 shows the current account balance as proportion of GDP in which all countries demonstrate volatile trends with Seychelles the most negative and Madagascar the most optimistic since 2009.

Figure 3: Gross capital formation (in USD billion 2012 prices)



Source: World Bank Development Indicators

Figure 4: Current account balance as % of GDP

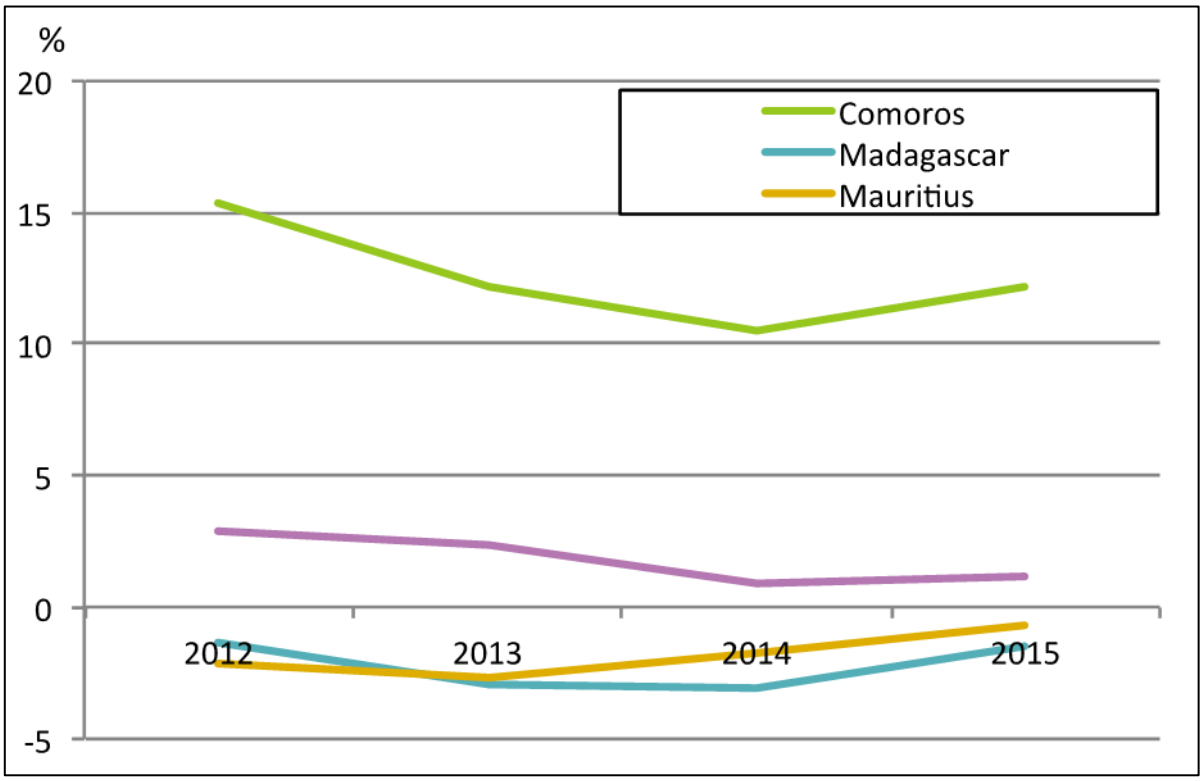


Source: International Monetary Fund, World Economic Outlook Database, April 2014

D. Public Finance

Public finance in the region is described by exploring trends in government balance as proportion of GDP. All four countries for which data exist show slight improvements over the past year (Figure 5).

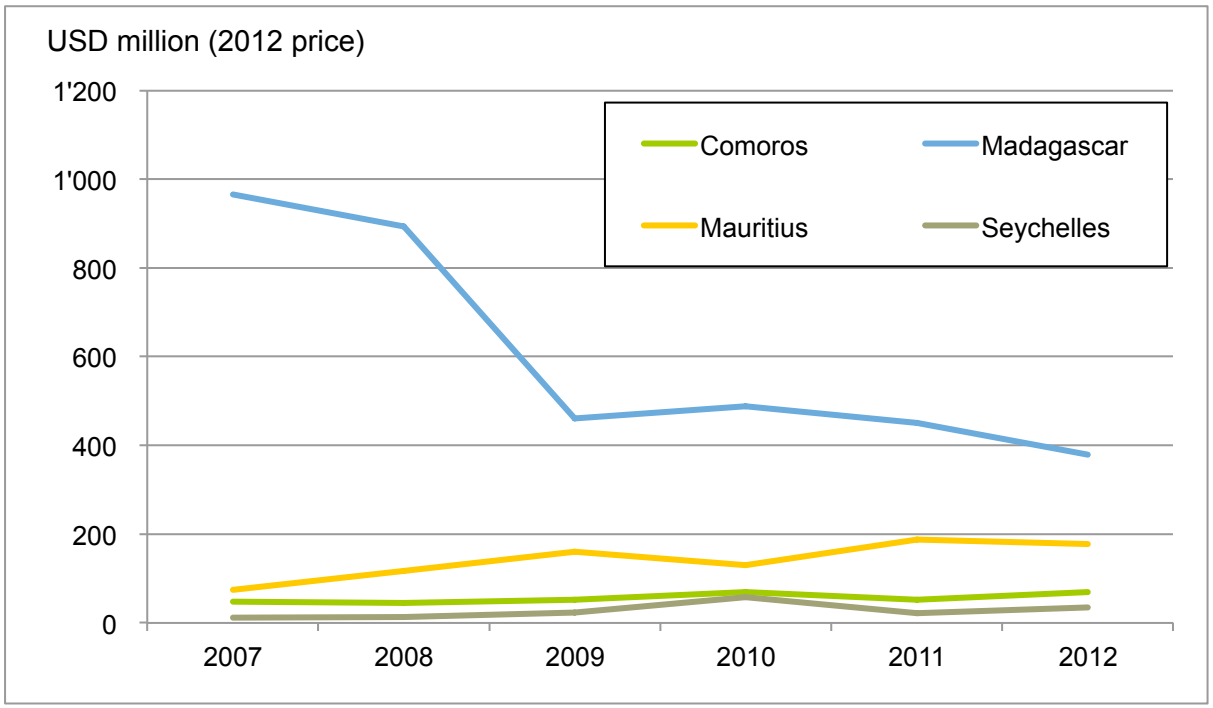
Figure 5: Government balance, % of GDP



Sources: International Monetary Fund, World Economic Outlook Database, April 2014

Donor aid is an important source for DRR in this region. Except for Madagascar, whose donor aid has fallen sharply since the civil strife, trends in donor aid has hovered under USD 200milion for the other three countries, with Seychelles and Union des Comores receiving the lowest (Figure 6). Donor fund uncertainty produces a gap between budget and expenditure (see Box 1 in Zanzibar explanation).

Figure 6: Trends of donor aid (in USD 2012 prices)



Source: African Development Bank, Organisation for Economic Co-operation and Development, United Nations Development Programme (2014)

Box 1: Donor fund uncertainty produces a gap between budget and expenditure: Case of Zanzibar

There are reported significant differences between the budget that results from the budget preparation process and the actual expenses during the financial year. This is partly caused by the fact that during the planning process, not all details may be known and imperfect estimates are provided. During implementation, changes between the budget lines are made after gaining approval from the Principal Secretary of the concerned Ministry.

The more serious problem is external financing from various development partners, which provides 37% of the total national budget of 2014/15 and is mostly directed towards the capital expenditure as indicated in the table below. The high dependency of the government budget and in particular the capital budget on funding from external sources, makes implementation of the programs and projects risky. Anticipated external funding may be delayed or even withdrawn depending on conditions that are often beyond the control of the Government of Zanzibar. Another aspect is that by far the largest part of external funding is through loans from international development banks (World Bank, AfDB, Korean EXIM Bank, BADEA and OPEC fund) that will result in increased pressure on the Zanzibar budgets when repayments are due. Most of these larger loans are for infrastructure projects such as the new airport facilities and road construction. These are not directly related to increased preparedness for natural hazards although they might have some additional provisions to withstand extreme natural events for instance large drainage systems to accommodate the expected higher rainfall intensities.

The Bank of Tanzania in its annual reports mentions that the Government total expenditures were well below the proposed annual budgets of the past five years. While the recurrent budget is usually only a few percentage points different, the capital expenditures are 40 – 60% below the planned figures. The reason given is unavailabbility of donor funding which impacts in particular on the development expenditures.

Table: Zanzibar budget 2014-15 and share of external funding

Description	Tsh billion	%
Recurrent budget	376	53%
Capital budget (internal)	66	9%
Capital budget (external, grants and loans)	265	37%
Total Government budget	708	100%

Source: Zanzibar budget 2014/15

Source: UNISDR (2015e)

3. Disaster Loss

A. Overview

Component 1 of this initiative was to build a disaster loss database that registers not only large-scale but also small-to-medium scale disasters. The small-to-medium scale disasters are rarely registered in the international disaster databases, because their effects are considered to be less relevant from a macroeconomic perspective. However, such disasters usually impact the livelihoods of poor people, perpetuating their level of poverty and human insecurity, and eroding government budgets. They exacerbate local level sustainability and pose serious problems for the development of a country as a whole. The analysis of disasters at all scales allows the identification of aggregated effects over time, regional areas and hazards targeted as high priority, and impacts on housing and livelihoods of local communities.

Loss information contributes to comprehensive risk assessment by providing an estimate of the risk of high frequency but small-scale risk. It also gives information on non-modelled hazards. Furthermore, it can be utilized as an input to economic analysis, for example cost benefit and economic impact analysis. The key concepts introduced in the loss data analysis are:

Intensive disasters: high-severity, mid to low frequency disasters, mainly but not exclusively associated with high profile fast-onset hazards. UNISDR classifies disasters as intensive when at least 30 people are killed, and/or a minimum of 600 houses are destroyed.

Extensive disasters: low severity, high frequency disasters, mainly but not exclusively associated with highly localized and often slower-onset hazards. All disasters with less than 30 people killed, and/or less than 600 houses destroyed, are classified as “extensive”. There is no minimum number of deaths or damaged houses to be considered extensive[4].

During the project, data on extensive and intensive disasters that occurred from 1980 to 2014 were collected. The data were registered by district, which allows more detailed examination of loss distribution in the country. The current loss database basically registers direct physical loss data only. Indirect and socio-economic loss data are not registered in principle. Even if registered, it needs to be analysed with caution due to ambiguity of definitions. The disaster data not directly associated with natural hazards (*e.g.* traffic accident, marine accident, epidemic, shark attack) were registered in the database but excluded for analysis in this report[5].

The disaster loss database takes into account the different disaster types and registers a series of indicators to classify impact such as:

- Damaged houses

- Destroyed houses

- Basic human loss (mortality, injured, affected).

The loss data were assigned monetary value by applying the methodology developed by UNISDR, which allows comparison across countries[6].

This effort benefited substantially from the hosting and technical guidance and contextualization of the following entities in the five islands (Table 3).

[4] The most well-known international disaster loss database called EM-DAT registers disasters for a minimum of 10 deaths (see http://www.emdat.be/criteria-and-definition).
[5] Fire is included in the analysis, though.
[6] For methodology of assigning monetary value to loss, see http://www.preventionweb.net/english/hyogo/gar/2013/en/gar-pdf/Annex_2.pdf

Table 3: Hosting agencies of national disaster loss database

	Hosting Agency	Other Cooperating Agencies
Madagascar	Emergency Management and Prevention Unit (CPGU - Cellule de Prévention et Gestion des Urgences)	Ministry of Environment
Mauritius	NDRRMC - Disaster Risk Reduction and Management Centre	Meteorological Services
Seychelles	Division of Risk and Disaster Management	Ministry of Environment and Energy
Union des Comores	Civil Protection	Ministry of Environment
Zanzibar	Department of Disaster Management	Second Vice President's Office

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

The data is open source, available at the following site:

http://www.desinventar.net/DesInventar

B. Disaster Loss in the IOC Region

Disaster Incidence

Table 4 portrays the compilation of data for the period 1980 to 2014 on hazard events for the five entities in the Indian Ocean studied in this project. While 3,235 data cards were registered for GAR Universe (standardized data excluding man-made disasters and epidemics), the vast majority of registered hazards were categorized as "extensive" for all countries; overall this represents 97% of registered events in the region.

Table 4: Hazard events in the IOC (1980-2011)

	Data Cards Total Number	**Extensive Events** Number (%)	**Intensive Events** Number
Madagascar	1,378	1,298 (94%)	80
Mauritius	1,105	1,104 (99%)	1
Seychelles	636	636 (100%)	0
Union des Comores	105	104 (99%)	1
Zanzibar	10	10 (100%)	o
REGION	**3,235**	**3,152 (97%)**	**82**

Source: Author, based on National Disaster Loss Database.

Disaster Loss

Loss of lives due to the 3,235 registered events totals 1,635 (see Table 5). Over 85% of these deaths occurred in Madagascar (N=1,399). About half of the lives lost due to natural hazards were lost during intensive events.

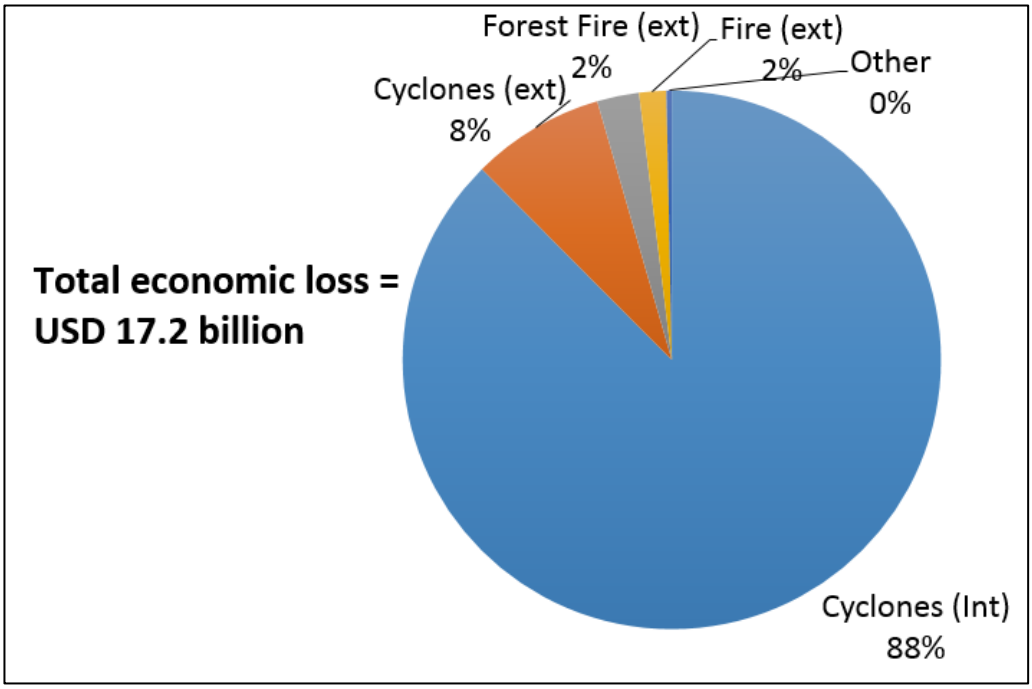
Table 5: Mortality due to disasters in the IOC

	Deaths Incurred (% in IO region)	Deaths due to Intensive Events (% of total events)
Madagascar	1,399 (89%)	785 (56%)
Mauritius	127 (8%)	1 (1%)
Seychelles	7 (0.4%)	No intensive events
Union des	34 (2%)	No data
Zanzibar	1 (0.06%)	0
TOTAL 5 Islands	**1,635**	786

Source: Author based on National Disaster Loss Database.

In terms of physical loss, the full set of events registered in the Indian Ocean totalled USD 17.2 billion at 2013 prices (see Figure 7**Error! Reference source not found.**). The most costly events in the region are intensive cyclones (contributing 88% of the loss) and extensive cyclones (an additional 8%). Fires (forest and others) are the second most costly types of hazards in the region.

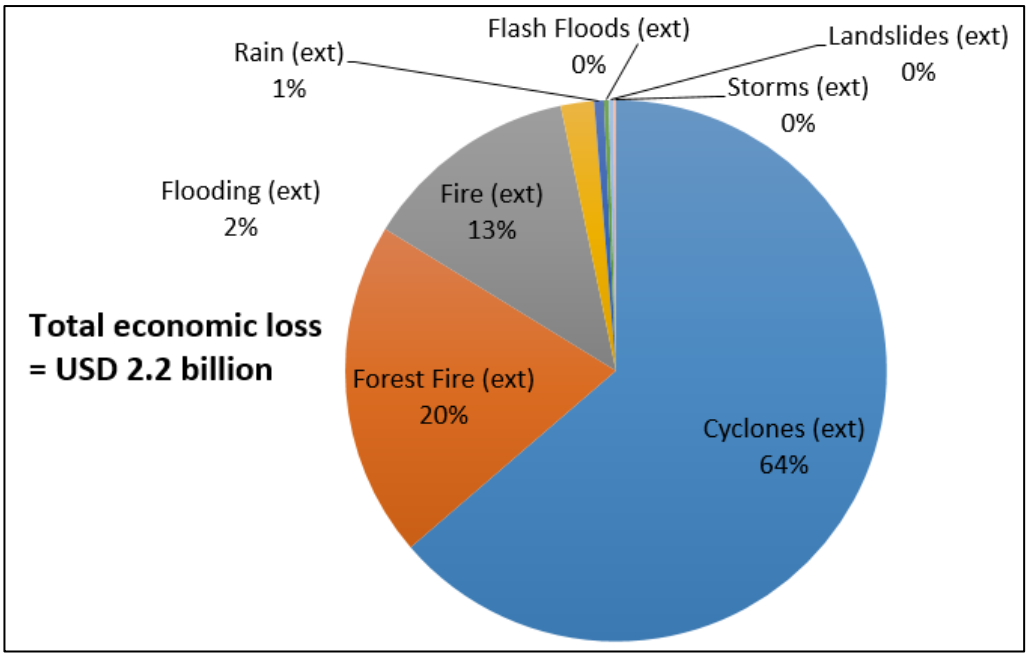
Figure 7: Total Economic Loss (infrastructure and agriculture)



Source: Author based on National Disaster Loss Database.

A closer look at extensive events alone (Figure 8), further emphasizes the destructive role that fires play in the region as well as heavy rains, despite the much lower overall loss (USD 2.2 billion).

Figure 8: Economic Loss due to extensive events (infrastructure and agriculture)



Source: Author based on National Disaster Loss Database.

Economic loss by country is as follows (Table 6). Madagascar DRR policy should mainly focus on cyclones because 93% of economic loss is due to cyclones. The target of Mauritius DRR policy should be also cyclones, which contribute to 82% of total economic loss. In Seychelles, floods and landslides are considered major natural hazards. Flooding, especially in the coastal zones where 80% of settlement and business infrastructures are accumulated, would have significant direct and indirect loss. Union des Comores has been suffered mainly from cyclones and floods. In Zanzibar, though past loss dais not still sufficiently recorded, the UNISDR/IOC (2015e) reports the disaster events are mainly related to rainfall causing droughts and floods.

Table 6: Economic loss by country

	TOTAL	Intensive (cyclone)	Extensive (cyclone)	Flood	Fire	Others
Madagascar	8,838,785,661	85%	8%	-	5%	2%
Mauritius	59,062,996	37%	45%	5%	3%	10%
Seychelles	15,593,630	-	-	50%	-	50%
Union des Comores	9,800,000	58%		35%		7%
Zanzibar	1,286,745	-	-	88%	-	12%

Note: Others in Seychelles include tsunami, landslide, rain and storm (15%, 13%, 10%, 10% each). Union des Comoros is an approximate figure.
Source: Author based on National Disaster Loss Database.

4. Disaster Risk

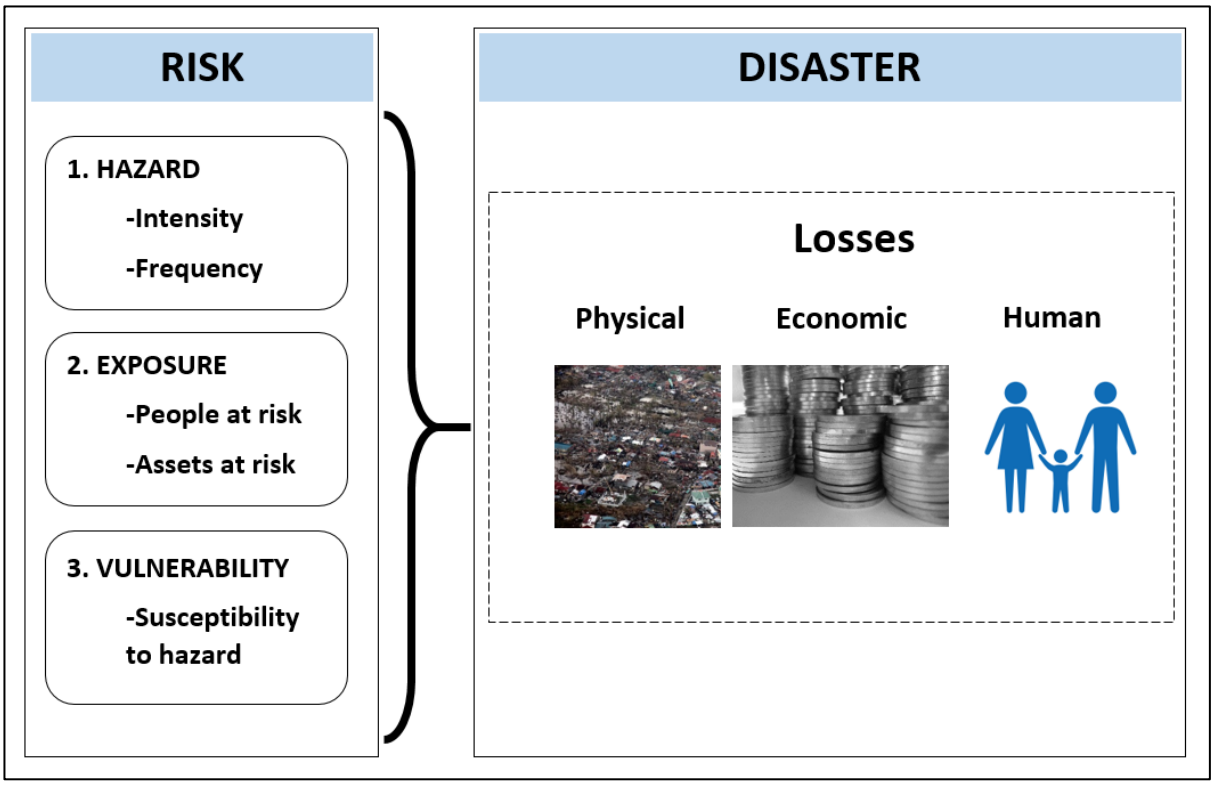
A. Overview

Component 2 of this initiative aimed to build a database for probabilistic risk assessment. UNISDR facilitated the identification and consolidation of a national focal point for disaster risk information and enhanced the understanding of risk concepts and risk assessing methodologies through capacity building workshops

Probabilistic risk assessment differs from a “deterministic” risk assessment in that it attributes a probability to hazardous events. Probability indicates the likelihood of the event to occur during a given year; it is estimated using frequency and is expressed in terms of “return period” or “loss exceedance rate”. Risk is expressed as a combination of the probability of the event occurring and the expected loss when such an event occurs.

In probabilistic risk assessment, risk is composed of three factors: hazard, exposure and vulnerability (Figure 9). Hazard data are basically calculated from a set of stochastic scenarios and in this initiative the data were extracted from global datasets[7]. **Exposure** data measures the degree at which people and assets will be at risk when a hazard hits, and often consists of inventories of buildings, population and infrastructure. In this initiative, we used a combination of global exposure databases and data compiled by national experts (processed to construct a proxy). **Vulnerability** indicates the susceptibility of exposed population or assets to suffer damages and loss. This is important because hazard affects exposed element in different ways. For example, a certain wind speed affects a wooden house more heavily than a concrete building. In other words, vulnerability data show the relationship between hazard intensity and the expected values of damage. In this initiative, vulnerability data were also taken from global data sets.

Figure 9: Key concepts of probabilistic risk assessment

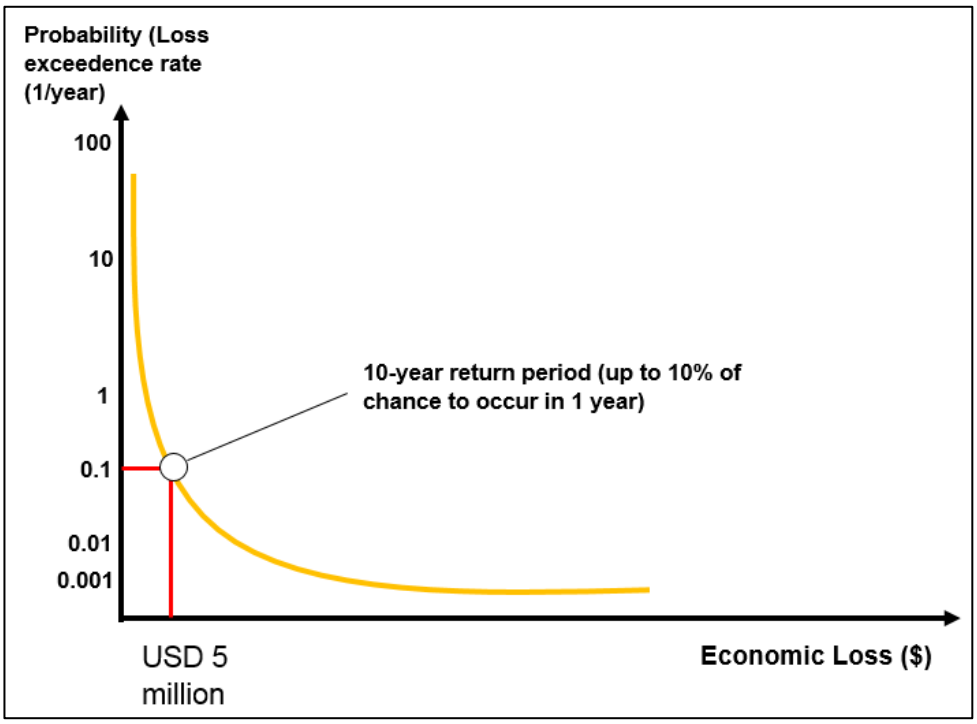


Source: Author

[7] Hazard, exposure and vulnerability data used for the risk assessment in Mauritius is outlined in INGENIAR (2014) and UNISDR/IOC (2014).

Based on probabilistic risk assessment, a loss exceedance curve for each hazard is produced (Figure 10). The curve shows the relationship between each value of the losses and the likelihood (probability) of having such loss during one year.

Figure 10: Loss exceedance curve



Source: Author

This curve enables the calculation of important national risk metrics called Annual Average Loss (AAL) and Probable Maximum Loss (PML). The AAL is basically the combination of all the potential losses that can occur every year due to a particular hazard, weighted according to their likelihood of occurrence. Simply said, the AAL is the loss that can be expected every year, regardless of whether it actually occurs or not. It gives insights into investment planning because the value shows how much risk should be reduced or transferred annually to prepare for all layers of risk. The PML is the loss associated to a specific, usually long return period. PML is a loss that is not frequent, therefore usually high, but still plausible. PML is a useful reference value to draft a worst-case scenario and prepare for intensive events.

Probabilistic risk assessment can be utilized for diverse policy areas, from emergency management planning to land use planning and financial and investment planning. However, caution should be given to the limitation caused by scarce data that feed into probabilistic risk assessment, and simplified modelling of complex phenomena.

In the IOC region, UNISDR supported probabilistic risk assessment for tropical cyclone (wind) and earthquake hazards. Tropical cyclone was selected because it was clear from the disaster loss data outlined in Chapter 2, that the region (especially Madagascar and Mauritius) has been hit by cyclone very often causing much loss. Earthquake was selected due to data availability given the short time frame of the initiative, even though it is not a major hazard for the region.

UNISDR and the national team collaborated to produce hybrid loss exceedance curves that combine probabilistic risk curves based on data collected in Component 2 with empirical risk curves based on historic loss data registered in Component 1. Probabilistic risk assessment tends to underestimate the extensive risk and historic loss data is used to remedy this problem.

As described above, the probabilistic risk assessment implemented in this initiative is very often based on global data and does not have high resolution. Therefore it cannot be utilized for detailed cost benefit analysis, local planning and insurance premium calculation. The result is currently also limited to the assessment of physical assets due to data availability. However, the result can be very useful to raise awareness of disaster risk and initiate dialogues on incorporating DRM into the country's public investment planning.

The challenge is that the current historic loss databases have time series that are too short to produce high quality risk assessments. Achieving more detailed risk assessments requires continuity on capacity building processes, improvement of data/information and commitment of institutions, technical personnel and decision makers.

In the Indian Ocean, the hosting entities for this component of the project are portrayed in Table 7.

Table 7: Hosting agencies for probabilistic risk assessment.

	Hosting entities for Disaster Risk (Component 2)
Madagascar	**Emergency Management and Prevention Unit (CPGU - Cellule de Prévention et Gestion des Urgences)** Centre for Research and Development/University of Madagascar (Centre de recherche et dévéloppement / Université de Madagascar)
Mauritius	**National Disaster Risk Reduction and Management Centre** Mauritius Meteorological Services
Seychelles	**Département de gestion de risque et catastrophe** Planning Department (Departement de planification) Ministry of Land Use and Housing (Ministere de l'Utilisation des terres et logement) Ministry of Environment Communication, Information and Technology Department
Union des Comores	**Ministry of the Interior** Meteorological Service (Direction Générale de Météorologie, ANACEM) Ministry of Finance and Budget (Ministère des Finances et du budget) Union of Chamber of Trade, Industry and Agriculture of Comoros (Union des Chambres de Commerce, d'Industrie et d'Agriculture des Comores (UCCIA)) Jurist Business Law (Jurisconsulte Droit des Affaires)
Zanzibar	Office of Chief Government Statistics (OCGS) **Disaster Management Department (DMD)**

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

B. Probabilistic Risk Assessment in the IOC Region

In the IOC region, UNISDR supported building of probabilistic risk assessment for tropical cyclonic wind (Madagascar, Mauritius, Seychelles and Union des Comores) and earthquake (Madagascar, Seychelles, Union des Comoroes and Zanzibar). Tropical cyclone was selected because it was clear from the disaster loss data that the region (especially Madagascar and Mauritius) has been hit by cyclone very often causing much loss. Earthquake was selected due to data availability given the short time frame of the initiative, even though it is not a major hazard for the region.

Table 8 presents the regional summary of results: the AAL in absolute terms and relative to other values for both hazards in the five islands. Total Absolute AAL for both hazards in the studied islands sums to USD 161.43 million and constitutes an average of 3.65‰ of Exposed Assets, 3.7% Goss Fixed Capital Formation (GFCF) and 0.9% of GDP. Tropical cyclone in Madagascar and Mauritius contributes to 99.6% of total AAL. AAL in Seychelles is estimated to be zero for both hazards due to the location.

Table 8: Absolute and Relative AAL in the IOC

TROPICAL CYCLONIC WIND	Absolute AAL Wind (USD million)	Relative AAL Wind (‰ for Exposed Assets and % for GDCF and GDP)		
Madagascar	USD 73.39	2.90‰	4.26%	1.21%
Mauritius	USD 86.91	8.27‰	4.40%	1.00%
Seychelles	USD 0.00	0.00‰	0.00%	0.00%
Union des Comores	USD 0.16	0.20‰	1.90‰	0.40‰
EARTHQUAKE	**Absolute AAL Earthquake (USD million)**	**Relative AAL Earthquake (‰ for Exposed Assets and % for GDCF and GDP)**		
Madagascar	USD 0.56	0.02‰	0.33‰	0.09‰
Seychelles	USD 0.00	0.00‰	0.00%	0.00%
Union des Comores	USD 0.21	0.03‰	2.44‰	0.47‰
Zanzibar	USD 0.20	0.15‰	1.39‰	0.22‰

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

Table 9 and Table 10 portray the results of the PML for cyclonic winds and earthquakes, respectively. Regional PML is estimated at USD 1465 million for wind and USD 2.29 million for earthquake in a 50-year return period, increasing with longer return periods. Earthquake PML is relatively much smaller than the tropical cyclonic wind PML. PML in Mauritius and Madagascar for tropical cyclonic winds are very high.

Table 9: PML for tropical cyclonic winds

CYCLONE PML	Madagascar	Mauritius	Union des Comores
RETURN PERIOD 50 (USD million) (% of Exposed Assets) (% of Gross Fixed Capital Formation) (% of GDP)	USD 367.10 (1.4%) (21.4%) (6.0%)	USD 1,094.00 (10.4%) (55.6%) (12.6%)	USD 2.61 (0.3%) (3.0%) (0.6%)
RETURN PERIOD 100 (USD million) (% of Exposed Assets) (% of Gross Fixed Capital Formation) (% of GDP)	USD 438.38 (1.7%) (25.5%) (7.2%)	USD 1,726.00 (16.4%) (87.7%) (19.9%)	USD 3.13 (0.4%) (3.6%) (0.7%)
RETURN PERIOD 250 (USD million) (% of Exposed Assets) (% of Gross Fixed Capital Formation) (% of GDP)	USD 545.03 (2.1%) (31.7%) (9.0%)	USD 2,288.00 (21.8%) (116.3%) (26.4%)	USD 3.87 (0.5%) (4.5%) (0.9%)
RETURN PERIOD 500 (USD million) (% of Exposed Assets) (% of Gross Fixed Capital Formation)	USD 583.36 (2.3%) (33.9%)	USD 2,773.00 (26.4%) (141.0%)	USD 4.52 (0.6%) (5.3%)

(% of GDP)	(9.6%)	(32.0%)	(1.0%)
RETURN PERIOD 1000 (USD million)	USD 650.34	USD 2,929.00	USD 5.05
(% of Exposed Assets)	(2.5%)	(27.9%)	(0.6%)
(% of Gross Fixed Capital Formation)	(37.8%)	(148.9%)	(5.9%)
(% of GDP)	(10.7%)	(33.8%)	(1.1%)

Source: UNISDR/IOC (2015a, 2015b, 2015d)

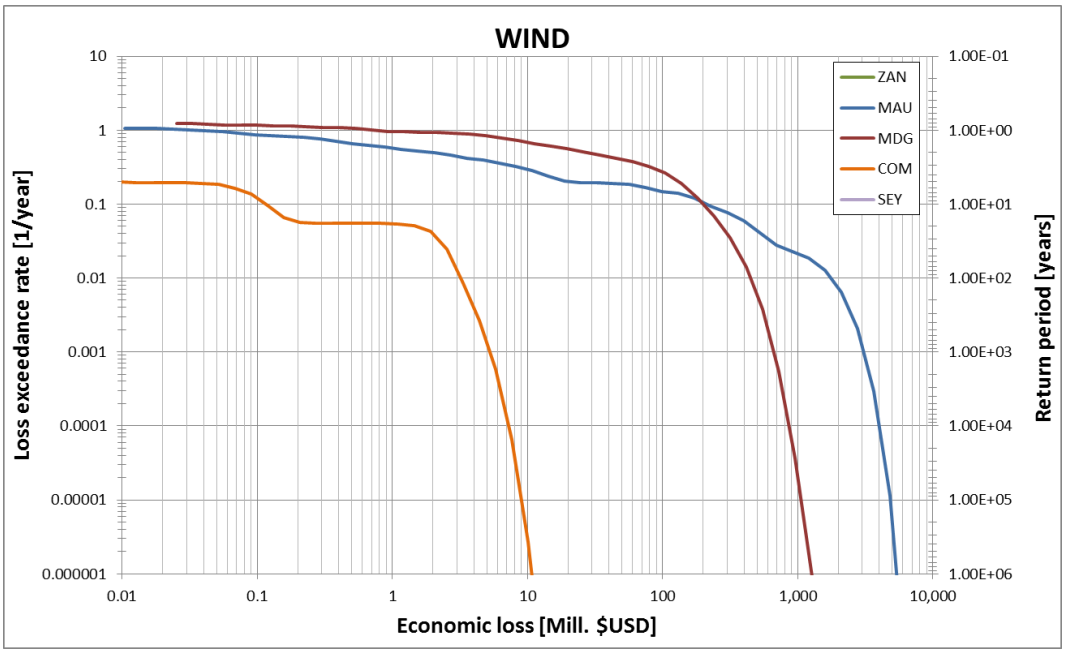
Table 10: PML for earthquake

EARTHQUAKE PML	Madagascar	Union des Comores	Zanzibar
RETURN PERIOD 50 (USD million)	USD 1.40	USD 0.49	USD 0.40
(% of Exposed Assets)	(0.01%)	(0.06%)	(0.03%)
(% of Gross Fixed Capital Formation)	(0.08%)	(0.57%)	(0.28%)
(% of GDP)	(0.02%)	(0.11%)	(0.04%)
RETURN PERIOD 100 (USD million)	USD 3.74	USD 1.25	USD 1.00
(% of Exposed Assets)	(0.01%)	(0.15%)	(0.08%)
(% of Gross Fixed Capital Formation)	(0.22%)	(1.45%)	(0.69%)
(% of GDP)	(0.06%)	(0.28%)	(0.11%)
RETURN PERIOD 250 (USD million)	USD 14.68	USD 5.70	USD 4.00
(% of Exposed Assets)	(0.06%)	(0.71%)	(0.30%)
(% of Gross Fixed Capital Formation)	(0.85%)	(6.63%)	(2.78%)
(% of GDP)	(0.24%)	(1.27%)	(0.45%)
RETURN PERIOD 500 (USD million)	USD 37.20	USD 17.09	USD 12.50
(% of Exposed Assets)	(0.15%)	(2.12%)	(0.95%)
(% of Gross Fixed Capital Formation)	(2.16%)	(19.87%)	(8.68%)
(% of GDP)	(0.61%)	(3.80%)	(1.40%)
RETURN PERIOD 1000 (USD million)	USD 83.06	USD 42.07	USD 34.00
(% of Exposed Assets)	(0.33%)	(5.21%)	(2.58%)
(% of Gross Fixed Capital Formation)	(4.83%)	(48.92%)	(23.61%)
(% of GDP)	(1.37%)	(9.35%)	(3.81%)

Source: UNISDR/IOC (2015a, 2015d, 2015e)

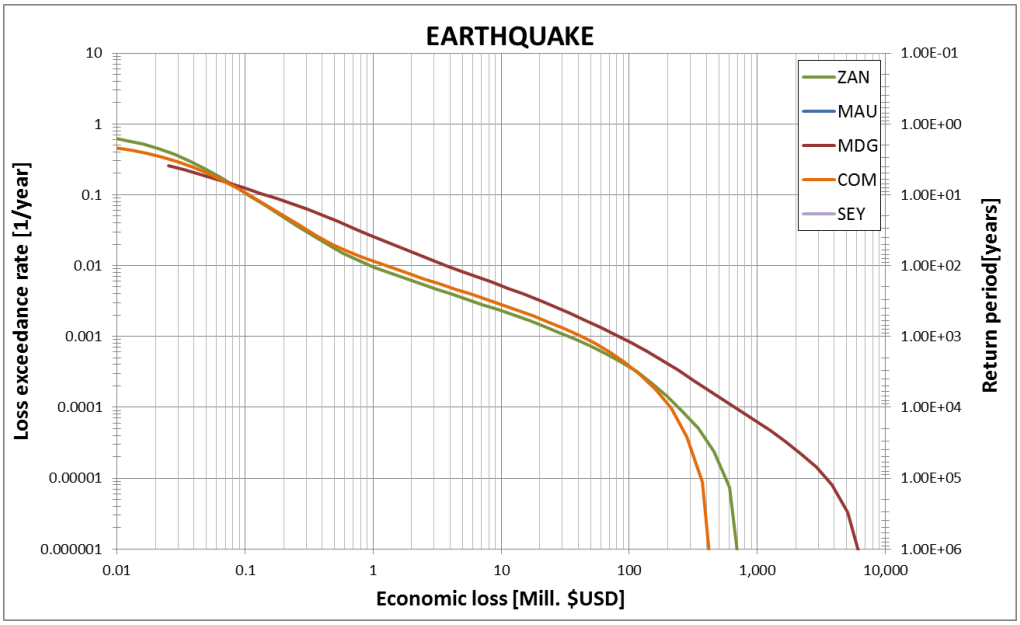
When we see the curve, different characteristics across countries surfaces: Regarding tropical cyclonic wind risk, higher risk in Madagascar regarding law and mid risk layers while in intensive risk layer, Mauritius risk is higher (Figure 11). Union des Comores needs to prepare for intensive risk for earthquake but have more needs to invest in DRR to reduce extensive tropical cyclonic wind risk instead of earthquake (Figure 12). Careful look at loss exceedance curve informs policy makers of the priority out of several hazards that the country faces.

Figure 11: Loss exceedance curve of SWIO region for tropical cyclonic winds



Note: Risk of Seychelles is estimated to zero. Assessment of Zanzibar was not implemented due to low risk.
Source: UNISDR

Figure 12: Loss exceedance curve of SWIO region for earthquake



Note: Risk of Seychelles is estimated to zero. Assessment of Mauritius was not implemented due to low risk.
Source: UNISDR

5. Regional DRM/DRR/CCA Framework

This chapter describes the regional structures and dynamics in place that can serve as a foundation for risk-sensitive public investment and financing strategy across the Indian Ocean region.

A. Institutional Structures

In the IOC Region, there is no regional entity, or department/unit to date that is officially mandated to focus on disaster risk reduction or disaster management. Examples of such a regional entity elsewhere include the Caribbean Disaster Emergency Management Agency (CDEMA), headquartered in Barbados, or the Disaster Risk Reduction Unit inside SADC. Such an entity has been proposed for the IOC region, with many different options to consider (See Grünewald and Sallustro, 2014[8]). It merits being reconsidered with a greater focus on DRR than on response.

At the national level, all studied countries have created an entity mandated to manage risk with very different names (see Table 11). While some of the countries (Madagascar and Mauritius) still have two entities, one with a primary focus on DRR, before the event, and another filling above all the role of emergency management after an event, Seychelles and Zanzibar have only one entity. All of the entities are now anchored at the highest levels of government, such as Prime Minister's Office or the Vice Presidency. This is a good sign that they can provide compelling arguments in favour of risk reduction for key decision makers.

Table 11: Disaster risk Management agencies

	Name of National Disaster Authority	Anchorage and Date of creation	Mandate (DM, DRR or both)	Number of full-time personnel
REGIONAL	None			
Madagascar	National Council of DRM (CNGRC);	Min. Dom. Affairs; 2006	Mainly DM	55
	National Office of DRM (BNGRC); Emergency Prevention and Management Agency (CPGU)	PM 2006	Both	24
Mauritius	National DRR and Management Centre (NDRRMC)	PM, 2013	Both	1-8
	National Emergency Operations Command (NEOC) within NDRRMC	PM, 2013	DM	
Seychelles	Division for Risk and Disaster Management (DRDM)	Vice Pres., 1999	Both	6
Union des Comores	Directorate General of Civil Protection (DGSC)	2012 (COSEP since 2007)	DM	n.a.
Zanzibar	Disaster Management Department (DMD)	2nd V.P., 2006	Both	22

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

B. Legal structures

There are numerous continental and regional entities in Africa that provide a wider perspective of strategic thought and protection for DRM/DRR/CCA. The Africa Union established the "Disaster Risk Reduction for Sustainable Development in Africa" as a regional strategy for Sub Saharan Africa. It aims to increase political commitment to DRR; improve identification and assessment of disaster risks; enhance knowledge management for DRR; increase public awareness of disaster risk reduction; improve governance of DRR institutions; and integrate DRR in emergency response management. This strategy has also informed the sub-regional efforts made by African RECs to strengthen their capacities in the area of DRR. One REC, the Southern Africa Development Commission Secretariat (SADC, to which some IOC islands also belong) elaborated, in 2011, their

[8] François Grünewald F. and Sallustro, J-L., 2014. Élaboration de procedures exceptionnelles en cas de crise dans les pays membres de la COI. URG; Référence projet: COI AO-PGRNC-2012-02.

"Disaster Risk Reduction Strategy and Plan of Action, 2010 – 2015". This strategy is a tool for the implementation of the SADC DRR Policy framework among the 15 member states.

The Mauritius Strategy (MS) for the 'Further Implementation of the Barbados Programme of Action (BPoA) for the Sustainable Development of Small Island Developing States (SIDS)' was adopted by 129 countries and territories in the conference held in Mauritius, January 2005. It addresses the unique development problems of SIDS and sets out the basic principles and specific actions required to support sustainable development. In Section II of the MS, all five IOC islands agreed to "strengthen their respective national frameworks for more effective disaster management and … regional mechanisms as facilities to improve national disaster mitigation, preparedness and early-warning capacity, increase public awareness about disaster reduction, stimulate interdisciplinary and intersectoral partnerships, and the mainstreaming of risk management into the national planning process"; as well as to "augment the capacity of SIDS to predict and respond to emergency situations, including those affecting human settlements, stemming from natural and environmental disasters".

The ISLANDS programme seeks to bridge these gaps through innovative pillars in: regional cooperation and integration, SIDS-SIDS knowledge exchanges, and a methodology to deal with the large asymmetries between the developmental stages of the beneficiary countries. One of the ISLANDS flagship programs is the "Capacities for Risk Financing Mechanisms" in light of natural and climatic disasters, the effort guiding this study.

Countries that have a DRM, DRR or CCA strategy are delineated in Table 12 below. New momentum for DRR has been emerging, for example, by Disaster Risk Management Act in Seychelles and Disaster Risk Reduction Management Bill (in draft) in Mauritius.

Table 12: Instruments related to DRM/DRR or DM

	Strategies, Policies and Plans	Legislation (Bills, Acts, etc.)
Madagascar	National Strategy on Disaster Risk Management (2003)	The Act no 2003-010 related with National Strategy on Disaster Risk Namangement
Mauritius	Disaster Risk Reduction and Management Strategic Framework and Plan; Climate Change Adaptation Policy (20 years) Climate Change Adaptation Strategy and Action Plan (1998)	Disaster Risk Reduction and Management Bill, *in draft*; Climate Change Bill, *in draft*
Seychelles	National Risk and Disaster Management Policy (2008, updated in 2014) Climate Change Strategy (2009)	Disaster Risk Management Act, 2014
Union des Comores[9]	National Strategy for the Reduction of Risk and Disasters (SNRRC, draft)	-
Zanzibar	Disaster Management Policy (2011) Emergency Preparedness and Response Plan (2011) Zanzibar Climate Change Strategy (2014)	Disaster Management Act, No.2 (2003, under review)

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

[9] A recent study guided by IOC (AFD, 2014: *Renforcement des politiques publiques et appui aux structures nationales…dans les pays membres de la COI*) states that the Law on environmental protection, 1995, could be the basis upon which to develop a legislative position on DRM in Union des Comores.

C. Status of Hyogo Framework for Action

Based on the HFA Monitor data, the overall status of the HFA priorities among the five islands varies from 1.86 in Union des Comores to 3.68 in Mauritius, all indicators averaged (Table 13). Priority 1, "Ensuring that DRR is a national and local priority with a strong institutional basis" demonstrates the most progress, with an average of 3.25 across the region (it is among the two highest for three countries: Madagascar, Mauritius and Seychelles). Priority 4 "Reducing the underlying factors of risk" is the area needing the most support, especially for Madagascar and Union des Comores. Risk sensitive public Investment planning is the most related with Priority Action 4 (e.g. HFA Core Indicator 4.6) and needs more efforts according to the country's self-assessment reports.

Table 13: Hyogo Framework for Action progress reported by IOC countries

(Best rating is '5')	Priority Action 1: Ensure that DRR is a national and local priority with a strong institutional basis	Priority Action 2: Identify, assess and monitor disaster risks and enhance early warning	Priority Action 3: Use knowledge, innovation and education to build a culture of safety and resilience	Priority Action 4: Reduce the underlying risk factors	Priority Action 5: Strengthen disaster preparedness for effective response at all levels	Average of all Scores
REGIONAL AVG	**3.35**	**3.30**	**2.95**	**2.90**	**3.20**	**3.12**
Madagascar	3.75	3.50	3.75	2.67	3.50	**3.36**
Mauritius	4.00	3.50	3.50	3.67	3.75	**3.68**
Seychelles	4.00	4.00	2.00	3.33	3.75	**3.41**
Union des Comores	1.75	2.50	2.25	1.50	1.50	**1.86**
Zanzibar	3.25	3.00	3.25	3.33	3.50	**3.27**

Note: The figures for Zanzibar use those for the United Republic of Tanzania, as Zanzibar does not report to the HFA Monitor independently. The Tanzanian figures may not be a true reflection of capacity in Zanzibar.
Source: Author, Compiled from UNISDR's HFA Monitor, self-reported progress on most recent submission (year varies)

6. DRR/DRM/CCA in Public Investment Planning

A. Current Status of Risk-Sensitive Public Investment

Risk-sensitive public investment is not an integral part of fiscal policy and practice in the region. Disaster risks are not addressed explicitly in most of the Indian Ocean countries. However, there have been many efforts to recognize risk (see Box 2 as good practice Box for Mauritius EIA guidelines and Seychelles and Zanzibar legal/policy progress toward strengthened risk sensitive investment). Key government stakeholders in each country that would eventually be implicated in risk-sensitive public investment are described in Table 14.

Table 14: Key government stakeholders identified in each country

	Key Government Stakeholders for DRR Investment Identified in each country
Madagascar	Prime Minister's Office (CPGU), Ministry of Agriculture, Ministry of Finance and Budget the Ministry of Domestic Affairs (BNGRC), Ministry of Public Works, Ministry of Transport, Ministry of Health, Ministry of the Interior, Ministry of Education
Mauritius	Prime Minister's Office, NDRRMC, Ministry of Health, Police and Coast Guard, Fire Services, Meteorological Services, Local Government, Ministry of Public Infrastructure (Roads & Drainage) and Ministry of Public Utilities (Water and Electricity)
Seychelles	Ministry of Finance, Ministry of Environment and Energy, Ministry of Health, Ministry of Land Use and Habitat (Planning), Land Transport Division, Ministry of Youth, Sports and Community Development, Chamber of Commerce and Industry, Meteorology and Climate Change Division, Division of Risk and Disaster Management, Public Utilities Corporation (PUC), Police and Fire Services
Union des Comores	Directorate General of Budget, General Planning Commission (CGP), Ministry of the Interior, Ministry of Foreign Affairs, Directorate General of Civil Protection (DGSC), Technical Directorate of Meteorology (DTM and ANACM), Volcanological Observatory of Karthala, Regional Directorates of Civil Defense (Grand Comore - Anjouan and Moheli), National Directorate of Health (DNS)
Zanzibar	Disaster Management Department, Ministry of Finance and Planning Commission, Line ministries (health, natural resources, infrastructure, etc.) Disaster response agencies: police, coast guard, fire services, local government

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

Box 2: Good practices toward risk sensitive investment

Mauritius: One of the priorities of Mauritius has been to mainstream climate change risk management, mitigation and adaptation in the development process through the EIA mechanism. For specified projects under the Environment Planning Act 2002, either a preliminary environment report (PER) or Environmental Impact Assessment (EIA) needs to be carried out and contain relevant details on the environmental factors of the project, and the measures to avoid or minimize adverse effects on the environment. As such, all projects which have environmental risks require an EIA licence granted by the Department of the Environment. Depending on the sector, the guidelines for EIA report drafting specify that the consultant should assess the 'vulnerability of the site to natural hazard or climate change impacts like storm surges, inundation or flooding'. As such few environmental sectoral guidelines prepared by this Ministry in December 2013 on the content for EIA report have included climate change issues; such as a vulnerability assessment with respect to climate change issues, storm surges (as applicable, flooding, inundation, landslides and other climatic conditions**)**, should be provided along with the proposed adaptation and mitigation measures.

Seychelles: The Disaster and Risk Management Act, 2014 (just put to the National Assembly) addresses core DRM issues, inclusive of DRR investments, budgeting and financing. The Act has provisions for national Risk Disaster Management Fund though the levels of funding and investments are not clearly articulated. It is to note that the composite of the funds include amounts appropriated by the National Assembly and those transferred from other divisions to the Fund, as/when required and agreed upon. There is great opportunity to mainstream risk sensitive public investment in the government budget and public investments with the introduction of programme-based budgeting, which is being piloted in Seychelles.

Zanzibar: The Disaster Management Policy (2011) and the draft Disaster Management Act of 2012 propose the establishment of a Zanzibar Disaster Management Fund (ZDMF) to ensure the accessibility of enough resources for disaster preparedness, mitigation, response and recovery. The sources of the ZDMF shall consist of:

- any monies voted to it by the House of Representatives for that purpose
- any monies made by way of donations or grants made within and outside Zanzibar
- subscriptions by the public
- any monies as a result of fines imposed as penalties under this Act

It is not yet clear if the ZDMF will actually be approved by the Zanzibar House of Representatives and if so, when it will be put in place.

Source: UNISDR/IOC (2015a, 2015c, 2015e)

B. Contingency Finance Mechanisms

Beyond the legal and explicit liability, also lies the implicit liability where governments are expected to intervene promptly after a disaster event to provide relief and recovery to those affected (damaged and destroyed housing, loss of property). There are various financial mechanisms that support natural hazard management. The use of these mechanisms to address recovery and reconstruction costs in the region is summarized in

Table ***15*** Out of the four ex-ante mechanisms, there are live examples in the region for each one. Contingency Funds are established in four islands. However reality check clarifies the limitation. For example, the contingency funds in Madagascar is deplete and needs additional funding to support the scheme. All islands have some experience with insurance, though the use level differs different across countries (see Box 3, explaining Mauritius insurance as good practice).

Five of the seven ex-post mechanisms are currently employed in the region. While Madagascar and Zanzibar commonly accept international assistance, they also cast 'diverting funds from another budget' as a mechanism employed, even if Mauritius and Seychelles deems this possible. A credit from the Central Bank and borrowing by issuing domestic bonds is used in Zanzibar, and is deemed possible by the other islands. Madagascar can also borrow from multi-lateral institutions, which is possible in the other islands. The report of each country highlights that countries are struggling with accessing sufficient money to finance disaster management and combining several tools with diversion from other budget items as main financing sources.

Table 15: Financial mechanisms to address recovery and reconstruction costs in the region

	Madagascar	Mauritius	Seychelles	Union des Comores	Zanzibar
Ex-ANTE (4)					
Contingency budget line	-	YES	No	YES	YES
Contingency funds	YES	NO	SOME	SOME	YES
Insurance	SOME	SOME	SOME	NO	SOME
Others	-	Corporate and population contributions	CSR Tax, Disaster relief fund from private sector	NO	-
EX-POST (7)					
Diverting funds from other budget items	YES	POSSIBLE	POSSIBLE	NO	YES
Imposing or raising taxes	NOT YET USED	NO	NO	NO	POSSIBLE
Taking a credit from the Central Bank (either prints money or depletes foreign currency reserves)	POSSIBLE	NO	NO	POSSIBLE	YES
Borrowing by issuing domestic bonds	POSSIBLE	POSSIBLE	POSSIBLE	NO	YES
Accessing international assistance	YES	NO NEED	IF NEEDED	NO	YES, USED
Borrowing from multilateral institutions	NOT YET USED	POSSIBLE	POSSIBLE	NO	POSSIBLE
Issuing bonds on the international market	NOT YET USED	POSSIBLE	NO	NO	NO

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

Box 3: Insurance in Mauritius

State Owned Enterprise: Though Central Government does not insure its assets, state owned enterprises insure their assets (e.g. Central Electricity Board (CEB) for electricity infrastructure, Central Water Authority, Mauritius Wastewater Authority, Mauritius Port Authority, the Airport of Mauritius Co.Ltd).

Insurance-related Funds: In certain economic sectors, insurance funds or special grants and loans have been set up to cater specifically for damage caused by natural hazards. Under the Small Farmers Welfare Fund, an insurance scheme (Agricultural Calamity Solidarity Scheme) for registered small planters and breeders is made available, which provides financial support to those who experience difficulties in the aftermath of calamities such as cyclones, excessive rainfall, drought and flood.

The Sugar Insurance Fund Board (SIFB): Sugar industry has a long established insurance system for sugar cane planters. SIFB is a form of 'contingency finance mechanism' as it provides covers to all insured planters (compulsory for planters and millers) for losses in sugar production arising from weather-related hazards such as cyclones, drought and excessive rainfall. The Fund was set up by Government in consultation with the sugar producers and operates under the aegis of the Ministry of Finance and Economic Development. However it is funded entirely by the sugar industry. Compensation is only paid to insured planters in an event year, defined as 'crop loss beyond 20% due to unfavourable climatic conditions'. The Fund also operates a fire insurance. For instance, compensation amounting to Rs 7.6 million (USD 0.25 million) for Crop Year 2012 and Rs 6.01 million (USD 0.19 million) for Crop Year 2013 was paid to insured planters for loss consequent upon destruction of cane plantations by inter-crop fire. Moreover, Rs 0.3 million (USD 10,622) in Crop Year 2012 and Rs 1.4 million (USD 45,710) in 2013 was paid to eligible insured planters as transport allowance for the milling of burnt canes (during the harvest season) outside their respective factory areas. The SIFB however remains a fund and as such does not provide for re-insurance, which can pose a limit to the compensation to be paid in an exceptionally catastrophic year.

Source: UNISDR/IOC (2015a)

C. Economic analysis to support risk sensitive public investment planning

Three types of economic analysis were conducted under this project. A summary follows for the 1.) Risk-Sensitive Budget Review, 2.) Macro/CATSIM assessment and 3.) Micro/Cost Benefit Analysis. Each of the technical elements and case studies is also described in greater detail in the country-specific reports.

C.1. Summary of the Risk-Sensitive Budget Review (RSBR)

The Risk-Sensitive Budget Review (RSBR), applying a "DRM Marker" aims to identify the degree to which Government has budgeted or/and invested in Disaster Risk Reduction and Management implicitly or explicitly. To that effect, the budgets of key Ministries and Departments have been scrutinized to mark both those projects whose "significant" (but not main) objective is DRR and those projects specifically addressing DRR that would not have been undertaken without the "principal" DRM objective.

A Risk Sensitive Budget Review (RSBR) is a simple systematic quantitative analysis of a budget (or series of budgets) that enables parties to estimate and take credit for investment in risk management and risk reduction (see thorough description of budget review methodology in Annex A of each National Report). If the RSBR is conducted by a national government, the findings typically track public investment. An RSBR conducted on a series of annual budgets allows for the identification and tracking of temporal trends (i.e., increasing investment in risk reduction). An RSBR that also categorizes components of risk management can point to trends in focus (i.e. increasing investment in prevention and risk reduction, as opposed to repeatedly and/or only responding to disasters). In both cases, the RSBR can convincingly monitor accountability (protecting the public) and make public investment more efficient (investing in prevention is known to be a savings for response).

To that effect, the budgets of key Ministries and Departments were analysed to mark those efforts appearing in the budgets whose "significant" (but not main) objective is DRR and those specifically addressing DRR, which would not have been undertaken without the "principal" DRM objective. In addition to categorizing the budget/expenditure for different projects, functions and administration activities as Significant or Principal, they were tagged, or classified into four distinct categories of disaster risk management, namely, Risk Prevention/mitigation, Preparedness, Response/Relief and Reconstruction.

Although the country analyses each employed the OECD-WB-UNISDR proposed DRM Marker method, readers are cautioned to be prudent when comparing results across countries. This is because they were obliged to use different years and numbers of years, different types of budgets (some included capital others only recurrent budget for consumption; some drew on expenditure reports while others stuck to actual budgets), levels (some were able to pull in devolved budgets and even donor funding) and sectors/ministries (while small countries may have included every budget, larger countries chose seven to 13 different budgets as their focus for the exercise) and hazards. Table 16 demonstrates the variety of different scopes that were selected for a national budget review from the five IOC countries included in the present effort.

Table 16: Different scopes in budget review

	Years (Number: Span)	Capital / Current (Budgets/ Expenditures)	Coverage (Number of sectors, ministries, etc.)	Hazard Focus
Madagascar	5 years: 2010-2014	Current (Budgets)	9	Cyclone, floods, epidemics and locust
Mauritius	2 years: 2013, 2014	Both (Both)	9	Cyclone, heavy rains, flood, landslide, drought, fire, epidemics
Seychelles	3 years: 2012-2014	Both (Both)	17	Geological (e.g. earthquake, tsunami), meteorological (e.g. Cyclone), hydrological (e.g. flood, landslide), epidemics and others
Union des Comores	4 years: 2011 to	Both (Budgets)	7	n.a.

	2014			
Zanzibar	1 year: 2014/15	Both (Budgets)	11	Fires, drought, epidemics (human and animal), climate change

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

The five IOC islands implemented their first ever risk-sensitive budget review in 2014, under the supervision of this project. The results, although preliminary, are an exciting first glance at possible levels of investment (and gaps) in risk reduction over the recent years. Across the region, DRM-marked investments ranged from 2 to 7% of the studied national budgets (Table 17). According to this analysis, the greatest proportion of investment in DRR to date occurs in Mauritius.

While two countries marked a greater proportion as "Significant", the others marked more as "Principle". Significant markings are considered potential signs of mainstreaming, as those investments are not pinned to specific DRR projects (or designed as such). In this respect, mainstreaming of DRR concepts would appear to be more thoroughly underway in and Seychelles and Zanzibar.

Table 17: DRM marked investments

Proportion of studied budgets "marked" for DRM	Principal ("2") (USD million)	Significant ("1") (USD million)	Total "Marked" (USD million)	Total "Marked" / total budget (%) (% of total studied)
Madagascar (Sum: 2010-2014)	120.7	10.4	131	1.87% (of USD 7.03 billion)
Mauritius (Sum: 2013 and 2014)	333	256	588	7% (of USD 8.4 billion)
Seychelles (Average of 2012 - 2014)	3.3	13.2	16.5	3.75% (of USD 440 million)
Union des Comores (Average of 2011-2014)	3.81	0.39	4.2	7%
Zanzibar (2014/2015, 1 year)	2.56	10.60	13.2	3% (of USD 440 million)

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

In terms of tagging components of Risk Management (See Table 18), the overall trend points to a greater investment in preventive / mitigation action for Mauritius, Seychelles and Zanzibar. In Madagascar and Union des Comores, the greatest current investment is in response. A closer look at how this has evolved in the IOC region through the years would shed more light on whether or not it is a real trend, driven by rising awareness levels.

Table 18: Tagging by component of risk management (% of total DRM investment)

	Prevention/ Mitigation	Preparedness	Response	Recovery/ Reconstruction
Madagascar	13.7%	34.9%	47.7%	3.7%
Mauritius	74.3%	22.4%	0.1%	3.2%
Seychelles	62.6%	27.4%	9.4%	0.6%

Union des Comores	33.0%	2.0%	65.0%	0.0%
Zanzibar	80.0%	5.0%	15.0%	0.0%

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

As promising additional analysis, Zanzibar divided marked budget between DRM and CCA objectives. The analysis shows that 43% of the identified budgets are DRM related and these are in particular for activities implemented through the Ministry of Health. The balance of 57% has been classified as CCA-related, mainly in the agricultural and environment sectors such as for agricultural research and irrigation development.

The gap analysis (Table 19) was conducted in this effort more to demonstrate utility and to become familiar with the process than to produce concrete results. To be credible, a gap analysis needs to compare both observed historic loss and estimated Average Annual Loss (AAL) to estimated current investment in DRR focused on the same set of hazards. It is not useful, for example, to compare the AAL for earthquakes to a budget review focused only on flooding and storms. Nonetheless, the regional results of the gap analysis described below--to be explored with caution, can inform a healthy debate. Table 19 uncovers a gap in DRR investment for example, in Madagascar. The results should not be interpreted, however, to signify that "enough is already being done" in the other islands.

Table 19: Gap Analysis

	A. Annual Loss (Multi-hazard, total: 1980-2013) (USD Million)	B. AAL (Quake and/or Wind) (USD Million)	C. Current Annual Investment in DRR/DRM (USD Million)	Gap (If C<A or C<B→ gap)
Madagascar	260 (8,839)	75 (both)	**26.2** (2010-2014 average)	Both
Mauritius	4.5 (59)	87 (wind only)	**294** (2013-2014 average)	Neither
Seychelles	1.2 (15.6)	0 (both)	**15.6** (2012-14 average)	Neither
Union des Comores	0.29 (9.8)	0.37 (both)	**4.2** (2011-14 average)	Neither
Zanzibar	0.04 (1.3)	0.2 (quake only)	**13.2** (2014/15)	Neither

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

The Ministries of Finance involved in the above analyses are convinced that the exercise can serve as a useful tool to both become more effective in spending (in the face of evolving risk profiles) and to demonstrate accountability to their respective publics and/or donors. Furthermore, it was proposed that such an exercise, not requiring a huge investment in time/effort and could be readily contracted to an agent each year, under the careful supervision of the NDMA and Min. Finance. Another solution would be to develop a roving team at the regional level that could lend capacity each year at a given time to the national stakeholders for a renewed analysis.

C.2. Macro-economic analysis: CATSIM

Generally regarded as the 'insurer of last resort,' national governments assume primary responsibility in providing response, recovery and reconstruction resources in times of disasters (Mechler, 2004). Governments play an important role in the post-disaster period, conducting timely and accurate damage assessment, devising rehabilitation plans, and financing and executing rehabilitation projects. Reconstruction is often very costly. Appropriate assessment of existing risk and contingency liability and reducing risk as much as feasible before

events occur is therefore of paramount importance for government's strategic decision-making, planning and resource allocation.

To respond to such needs in 2006, International Institute for Applied Systems Analysis (IIASA) invented the CATSIM (Catastrophe Simulation), an interactive simulation tool to build capacity of policy makers to estimate and reduce public sector financial vulnerability. Annex B of the national reports describes a recent application of CATSIM in each island; the National Reports of each country also hold much greater detail and figures specific to each country-level analysis.

Building on the results for loss and risk, the main findings specific to CATSIM analysis are as follows:

- Fiscal resources available for reconstruction and recovery (excluding international aid) under an optimistic assumption are portrayed in Table 20. In each country, fiscal resources available for reconstruction and recovery include, for example, those drawn from budget diversion, domestic credit, IMF and international borrowing. Uncertainty regarding fiscal resources availability is high and these numbers should be interpreted with caution as locally specific economic and policy considerations could significantly limit the use of these resources. Same assumptions were applied for all islands.
- Fiscal resources gap years were estimated – the return period at which each government will face difficulty in raising sufficient funds for reconstruction. The gaps for the IOC islands were between 24 and 329 years (see Table 20). Zanzibar was identified as having no fiscal resource gap for earthquake risk.

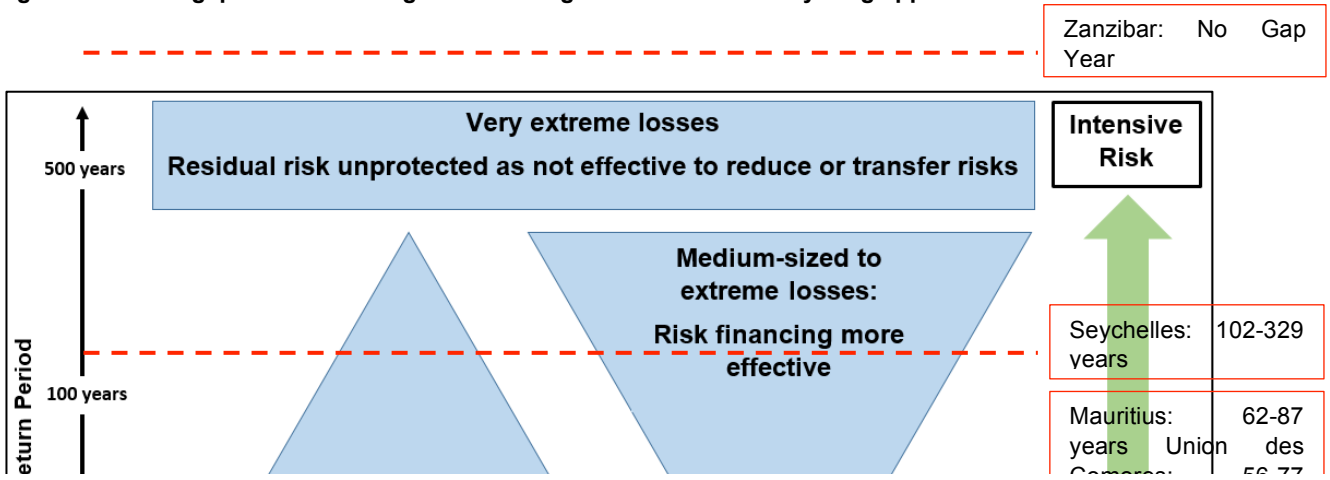
Table 20: CATSIM Analysis (for tropical cyclone and earthquake)

	AAL (own estimate)	Financial resources available (USD Million)	Fiscal Resources Gap Year
Madagascar	58	158	24
Mauritius	58	278	62 to 87
Seychelles	0.59	34	102 to 329
Union des Comores	1.07	11	56 to 77
Zanzibar (earthquake only)	0.18	85	None identified

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

Based on these findings, the IOC and the governments of the Indian Ocean are encouraged to take a 'layered risk management' approach, in which resources are allocated based on the varying levels of risk facing each country, with a priority given to reducing existing risk and preventing the creation of new risks in the extensive risk layer (Figure 13). Drawing from the current CATSIM analysis, because of their high volume of extensive risk and their low fiscal gap years, it would be more beneficial and effective for Madagascar and Union des Comores to focus on risk reduction efforts. Due to different exposure profiles and resources, Mauritius and Seychelles should also start to explore risk-financing mechanisms.

Figure 13: Fiscal gap and risk management strategies based on 'risk layering approach'



Source: Author based on UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

The present study identified data gaps and sources of uncertainty regarding fiscal risk assessment (see Box 4 for the data challenges in Seychelles). The present studies did not fully account for indirect effects of disaster damage, and further studies are needed to quantify and evaluate the indirect risks caused by disaster damage.

Box 4: Insufficient risk information limits credibility of fiscal risk assessment': Case of Seychelles

This study evaluated fiscal resources gap using both the current CAPRA estimates and statistical estimates available from Hochrainer-Stigler et al. (2014) (**Error! Reference source not found.**). In general, the estimates based on CAPRA GIS shows lower loss estimates than those from Hochrainer-Stigler et al. (2014). In particular, the aggregate risk of Seychelles appears small relative to the previous estimate, and also to the empirical observations: in 2013 there was a storm event that results in estimated USD 9.3 million in damage; in 2004 there was an earthquake that resulted in USD 30 million in damage; and in 1997 there was a flood event that resulted in USD 1.7 million in damage (EM-DAT 2014). Based on the current CAPRA estimate, this 2013 storm would have a return period of approximately 200 years, while the 2004 earthquake would have a return period of 300 years and 1997 flood 140 years. The probability that such rare events happen three times in the past 17 years is very small, suggesting that the CAPRA estimates may be significantly underestimating the existing risk of Seychelles. A large discrepancy in risk information highlights further

Source: UNISDR/IOC (2015c)

It is also important to discuss and update fiscal resilience parameter and value at critical time, for example, when administration changes or after disaster (see Box 5 for Madagascar experience in CATSIM 2012 and 2014). Contingency financing mechanism for disaster management should be checked regularly. Defining government liability more concretely is also recommended.

Box 5: Madagascar CATSIM simulation in 2012 and 2014

Based on the current study, the fiscal resources gap is estimated at 24 years while 2012 study shows 23 years. The relatively close figures estimated for fiscal gaps in 2012 and this study is explained partly by the fact that assets and disaster related information collected in 2012 was used as inputs for risk analysis in Component 2. However, the breakdown of funding sources is markedly different, especially with regards to the access to domestic credit and international lending. This difference is due to the fact that the current estimate of fiscal parameters is made based on standard assumptions applied in the global assessment (Hochrainer-Stigler et al. 2014). Therefore, further validation of fiscal parameters through national workshops and interviews with national stakeholders will be necessary.

The fiscal parameters must have been changed because of political change and especially a reserve fund has been discontinued and deplete in recent years, where the government faces a practical issue regarding how the account created in the name of a former administration can be transferred to the current one.

Also, it is important to point out that the use of economic risk assessment has not been sustained in Madagascar. Economic risk assessments are hence conducted on ad-hoc bases, *i.e.* only when donor-supported project funding becomes available for this type of effort. There is therefore a need to create a more sustainable system of iterative fiscal and economic risk assessment embedded in the existing domestic institutional framework. A further assessment of capacity and institutional needs as well as development of appropriate risk assessment tools and training materials that cater to the operational needs of government decision-making should be conducted.

Source: UNISDR/IOC (2015b)

C.3. Micro-economics: Cost Benefit Analysis

Cost benefit analysis (CBA) is an established tool in economics. This analysis can be used for both sectorial and project analysis. Many countries already adopt cost benefit analysis as a requirement prior to large-scale public investment projects. In this initiative, probabilistic CBA was applied to account for the benefits of risk reduction (Box x for probabilistic CBA workshop in Madagascar). Forward-looking CBA was applied for Madagascar and Mauritius based on the risk data developed in Component 1 and backward-looking CBA based on past loss data was applied for Seychelles, Union des Comores and Zanzibar. The benefit is estimated by measuring how much annual average loss (AAL) will be reduced after the investment, thereby determining if the result is cost efficient or inefficient.

Results from the exercise in the IOC (Table 21) determined that, in the case of Madagascar, Mauritius and Seychelles, the scenarios were judged to be cost-efficient while the cases of Union Des Comores and Zanzibar was cost-inefficient. The lack of documentation regarding past disaster damage and losses seems to lead to underestimation of probabilistic benefit in the latter cases (see Box 7 for Zanzibar case).

Box 6: Probabilistic CBA workshop in Madagascar

In 29 January 2015, in response to request from Government of Madagascar, UNISDR/IIASA implemented capacity building workshop for probabilistic cost benefit analysis. Participants were more than 30 government officials from Ministry of Finance and Budget, Emergency Prevention and Management Agency (CPGU), Ministry of Public Works, Ministry of Agriculture and many other critical ministries/agencies. Methodology for backward-looking CBA was first presented and participants implemented simulation. The main objective was that participants understand the basic method to calculate AAL by using statistical rule called Simpson rule, and understand that difference of AAL before and after DRR investment can be the benefit of CBA. The analysis is possible by using EXCEL spreadsheet. And then, forward-looking CBA was presented and participants were asked to implement simulation using CAPRA model. The main objective is that they understand that DRR policy can change the vulnerability curve and therefore AAL. UNISDR/IIASA saw the potential that future capacity building workshop for probabilistic risk assessment can integrate a component of probabilistic CBA because it clearly shows the participants how probabilistic risk assessment can be utilized to support public finance planners and DRR practitioners.

Table 21: Cost Benefit Analysis

	Scenario / Project evaluated	Type of Analysis	Benefit-Cost Ratio at 5% discount rate	Result
Madagascar	Retrofitting housing for tropical cyclonic wind	Probabilistic (forward-looking)	1.26 (wood and unreinforced masonry)	Cost efficient
Mauritius	Retrofitting iron housing for tropical cyclonic wind	Probabilistic (forward-looking)	2.80	Cost efficient
Seychelles	Flood alleviation (Point La Rue)	Probabilistic (backward-looking)	1.21	Cost efficient
Union des Comores	Retrofitting housing for tropical cyclonic wind and flood	Probabilistic (backward-looking)	0.32	Cost inefficient
Zanzibar	Urban surface water drainage	Probabilistic (backward-looking)	0.14	Cost inefficient

Source: UNISDR/IOC (2015a, 2015b, 2015c, 2015d, 2015e)

Box 7: Insufficient loss data limits accuracy and credibility of CBA: Zanzibar CBA case

Based on limited data, the surface drainage project seems inefficient use of funds, given the negative NPV and B/C ratios less than one, regardless of the discount rate or increase in exposed assets.

For estimating the AAL for Zanzibar, data only offered was one previous event, a 2005 flood. Given this event and probability of first loss, a probable maximum loss curve was created.

Information revealed inconsistencies in the damages caused by the 2005 flood. In the data received and analysed in this report, there were only 64 houses destroyed (IFRC 2005). Yet another source claim that "20,000 people" were affected in the 2005 flood event and still other source claims that 3,645 housings are affected annually by flooding (questions for expert opinions, 2011). However, with no concrete data other than the 64 housings destroyed and the water sanitation recovery costs, it is difficult to obtain a rather accurate amount of economic losses caused by the 2005 flooding in the region where the drainage system will be implemented.

Lack of any further detailed information on the economic losses as a result of the flood limits the robustness of any attempt at accurately estimating the probabilistic losses caused by flooding or any other event. Without a robust assessment of the losses caused by past hazardous events, estimations of the benefits of disaster risk reduction investment will also be inaccurate.

In addition, the present assessment did not take into account many of the indirect and intangible losses that may result due to natural disasters, such as business losses due to floods, additional medical cost associated with morbidity and any reduction in land values that may result due to frequent inundation. These are clear limitations of this current analysis and further studies are certainly needed to improve the accuracy and comprehensiveness of our analysis.

Source: UNISDR/IOC (2015e)

Based on these findings, the IOC and the governments of the Indian Ocean are encouraged to compile more complete sets of damage and cost data that will refine future cost benefit analyses. They are also encouraged to explore how to systematize the use of CBA in the hopes of making risk reduction a predominate characteristic of public investment.

7. Conclusions and Recommendations

Comparison of empirical observations of economic loss (1980-2013) related to registered disaster events and projected risk estimates (AAL and PML) demonstrate considerable uncertainty. The main findings of the regional loss and risk assessment are synthesized below:

- The Indian Ocean Region has lost at least **USD 17.2 billion** in infrastructure and agricultural investments since 1980 (at 2013 prices). It loses an average of **USD 430 million each year** to the registered natural hazards, the greatest volume lost in Madagascar.
- The projected combined Average Annual Loss (AAL) associated with two hazards (tropical cyclonic wind and earthquake), however, is estimated in **USD 161 million,** or nearly 1% of the combined GDP for the region (relative loss ranges from 0.02% of Zanzibar GDP to 1.2% Malagasy GDP each year). Beyond the sheer number of hazards included in the risk estimates, other differences between registered losses and AAL may be attributable to a combination of incomplete registered exposed assets and the uncertain future impacts of climate change, etc.
- Probable maximum losses for the 50-year return period (combining wind and earthquake) sum to **USD 1.5 billion** in the region, the greatest losses to be incurred in Mauritius (USD 1,094 million) followed by Madagascar (USD 368 million).

Regardless of the level of loss, investing in DRM is already underway in the five IOC islands. Across the region, DRM-marked investments found in national budgets over the past years ranged from 2 to 16% of total annual budgets amounts. This amounts to a combined **USD 457 million** each year in the region, ranging from USD 288 million each year in Mauritius to USD 4.2 million in Union des Comores.

The overall trend points to a greater investment in preventive / mitigation action only for Mauritius, Seychelles and Zanzibar. In Madagascar and Union des Comores, the greatest current investment is still in emergency response. Clearly, DRR, the prevention and reduction of risk, merits greater investment now.

While at face value, comparing these figures to registered loss and AAL points to a gap (or need for greater investment) only in Madagascar, the results should not be interpreted to signify that “enough is already being done” in the other islands. In fact, there are strong indications that the real value of losses and risks is not currently sufficiently captured and that the budget analysis may overcompensate for some efforts.

Through the present study, the IOC islands are now exposed to a suite of tools and a list of risk management options to prepare them for an uncertain future. With more improved data, and enhanced in-house capacity, the respective governments should be posed to choose which of those tools and options are best suited for their risk profile (hazard events, exposure and loss, etc.). A risk-layered approach suggested by CATSIM analysis and cost benefit analysis highlights how to choose more appropriate policies in DRR/DRM.

Further challenges: Data gaps, capacity training and awareness raising toward risk layered approach

During several meetings with representatives of the Ministries of Finance in the IOC region, it was established that a scattered approach to DRM is inefficient and there is need for stronger collaboration between the DRM agency, Ministry of Finance and other key sectoral ministries. Continuous capacity building on risk terminology and concepts, loss and risk information management and economic analysis was recommended by Ministries of Finance in the region. Institutional support for iterative management should be embedded in the existing DRR/CCA policy framework of respective countries. This can begin only alongside a regularly refreshed regional awareness-raising endeavour, highlighting risk-sensitive pubic investment.

The present study identified data gaps and sources of uncertainty regarding fiscal risk assessment. While the CATSIM portion of the study assessed cyclone wind and earthquake risks only (except for Zanzibar where only earthquake risk was evaluated), further analyses are certainly needed to include risks from additional hazards. Also, a large discrepancy in risk data was identified for Seychelles, which requires further validation. Given the relatively short period of data availability for these countries, high uncertainty can be expected of catastrophic risks with return periods of above 500. It is advisable, therefore, to promote further data collection, registry and tracking, validation and analyses performed in an iterative fashion to reduce this range of uncertainty. The present studies also did not fully account for indirect effects of disaster damage; further studies are needed to quantify and evaluate them.

The loss and risk information should be examined from the perspective of both DRM policy maker and financial planners. Given the importance of public investment in DRR, continuous refinement of loss and risk information should be promoted through regular dialogue with data users. In the process of economic analysis, Ministries of

Finance understood and appreciated the importance of loss and risk information. On some cases, they identified several mistakes and inconsistencies in the records in disaster loss databases and the data were corrected. Such exchanges of information will improve overall quality of knowledge management to support DRM decision making.

Technical and institutional support is necessary to establish iterative risk management system in the IOC countries. In terms of technical needs, knowledge regarding probabilistic risk assessment (CAPRA) and economic assessment tools (CATSIM) would be required along with general awareness of risk related concepts and statistics. Given the limited availability of risk experts in each country, a regional approach may be appropriate. A pool of trained resource persons at regional level whose main focus is not only to regularly update the event registry, risk analyses, RSBR, CATSIM and CBA, but are skilled as trainers to promote national-level capacity building may be an effective way to leverage local capacity and resources.

Government needs to develop investment and financing strategies to address both extensive (small scale but high frequency) and intensive (low frequency but high impact). Climate change will increase risks in terms of frequency, geography and intensity. Understanding risk structures and the expected economic impact in the country is the critical first step to determine the optimum policy mix for each risk layer. In developing investment and financing strategies to address disaster risk, DRR investment and risk financing should not be considered separately. Depending on risk layers, the most appropriate policy mix changes and DRR investment and risk financing are not mutually exclusive. For example, DRR investment often decreases insurance premiums.

This packaged approach with a focus on financial planners in government will be standardized and replicated in Asia, Africa, Latin America and other regions in the coming years and the knowledge is planned to be archived and presented globally in a working paper series of UNISDR on “Public Investment and Financing Strategy for DRR”. The report summarizing activities in IOC region will thereby contribute to increasing the global knowledge base.

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Annex D: Workshops and Meetings in IOC region

Inception meeting

Dates: 15-17 April 2013

Venue: ICCS, Seychelles

Host: Ministry of Environment

UNISDR staff in charge: Julio Serje, Kazuko Ishigaki, Manuela Di Mauro

Participants: 34

Component 1: capacity building for national disaster loss database

Comoros national workshop:

Dates: June 11-13, 2013

Venue: Hotel Retaj

Host: the Civil Protection and the Ministry of Environment.

UNISDR staff in charge: Sylvain Ponserre and Julio Serje

Participants: 25

Seychelles national workshop:

Dates: 14 - 19 Jul 2013.

Venue: Seychelles Fishing Authority, Division of Risk and Disaster Management (DRDM)

Host: the Division of Risk and Disaster Management (DRDM)

UNISDR staff in charge: Sylvain Ponserre

Participants: 22

Madagascar national workshop:

Dates: 28 Jul - 01 Aug 2013.

Venue: Hotel Colbert

Host: The "Cellule de Prévention et Gestion des Urgences"(CPGU)

UNISDR staff in charge: Sylvain Ponserre

Participants: 36

Mauritius national workshop:

Dates: 24 - 29 Aug 2013.

Venue: Indian Ocean Commission headquarters

Host: Ministry of Environment

UNISDR staff in charge: Sylvain Ponserre

Participants: 40

Zanzibar national workshop:

Dates: 11-14 June 2013

Venue: Zanzibar Ocean View Hotel

Host: NBI Office

UNISDR staff in charge: XXXXX

Participants: 37

Component2: Capacity building for Probabilistic Risk Assessment:

First regional workshop

Dates: 21-23 October 2013

Venue: Indian Ocean Commission headquarters, Mauritius

Host: Ministry of Environment

UNISDR staff in charge: Manuela Di Mauro, Mabel Cristina Marulanda Fraume (consultant)

Participants: 40

Second regional workshop

Dates: 20-22 November 2013

Venue: Indian Ocean Commission headquarters, Mauritius

Host: Ministry of Finance

UNISDR staff in charge: Mabel Cristina Marulanda Fraume (consultant)

Participants: 22

Third regional workshop

Dates: 19-21 March 2014

Venue: Indian Ocean Commission headquarters, Mauritius

Host:

UNISDR staff in charge: Mabel Cristina Marulanda Fraume (consultant)

Participants: 31

Mauritius national workshop:

Dates: 17-18 February 2014

Venue: Indian Ocean Commission Secretariat

Host:

UNISDR staff in charge: Mabel Cristina Marulanda Fraume (consultant)

Participants: 10

Seychelles national workshop:

Dates: 23-27 June 2014

Venue:

Host: The Division of Risk and Disaster Management (DRDM)

UNISDR staff in charge: Mabel Cristina Marulanda Fraume (consultant)

Participants:

Component 3: economic analysis and public investment planning

First regional workshop

Dates: 24-26 June, 2014

Venue: ICCS, Seychelles

UNISDR staff in charge: Kazuko Ishigaki, Lezlie Moriniere (consultant)

Host: Ministry of finance

Participants: 15

Second regional workshop

Dates: 20-22, October, 2014

Venue: Indian Ocean Commission headquarters, Mauritius

Host: Ministry of Finance

UNISDR staff in charge: Kazuko Ishigaki, Lezlie Moriniere (consultant)

Participants: 19

Zanzibar national workshop:

Dates: 10 December, 2014

Venue: Zanzibar Ocean View Hotel

Host: Department of Environment

UNISDR staff in charge: Kazuko Ishigaki, Lezlie Morinière (consultant)

Participants: 30

Seychelles national workshop:

Dates: 02-03 Feb 2015
Venue: Conference Center
Host: Ministry of Finance
UNISDR staff in charge: Kazuko Ishigaki, Julio Serje, Lezlie Moriniere (consultant)
Participants: 30

Comoros national workshop:

Dates: 05-06 Feb 2015

Venue: Direction générale de la Sécurité Civile

Host: Direction générale de la sécurité civile

UNISDR staff in charge: Julio Serje, Lezlie Morinière (consultant)

Participants:55

Madagascar national workshop:

Dates: 28-30 Feb 2015

Venue: STC

Host: Ministry of Finance

UNISDR staff in charge: Kazuko Ishigaki, Lezlie Morinière (consultant)

Participants: 30

Mauritius national workshop:

Dates: tbc

Venue: tbc

Host: tbc

UNISDR staff in charge: tbc

Participants: tbc

UNISDR Working Papers on
Public Investment Planning and Financing Strategy for Disaster Risk Reduction

1. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of Mauritius, February 2015

2. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of Madagascar, February 2015

3. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of Seychelles, February 2015

4. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of Union des Comores, February 2015

5. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of Zanzibar, February 2015

6. Public Investment Planning and Financing Strategy to Reduce and Mange Disaster Risk: Review of South-West Indian Ocean Region, February 2015

The series offers analysis and policy guidance to national governments and other stakeholders to strengthen public investment planning and financing strategy to reduce and manage disaster risk. These reviews are part of a larger body of UNISDR work on disaster risk reduction, including loss database building, global probabilistic risk assessment, HFA Monitor and others. This work includes both theoretical reports and reports on specific countries or regions.

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