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FINAL TECHNICAL REPORT

Fisheries Early Warning and Emergency Response (FEWER)

Photo source: Winsbert Harry, St. Vincent Waters (2017)

CRFM Secretariat
2018

CRFM Technical & Advisory Document – Number 2018/04

Final Technical Report: Fisheries Early Warning and Emergency Response (FEWER)

Prepared by:
ICT4Fisheries Consortium
Consultants,

under contract through the Marine sub-component of the Investment Plan for the Caribbean Regional Track of the Pilot Program for Climate Resilience, co-implemented by the Caribbean Regional Fisheries Mechanism (CRFM).

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CRFM Secretariat
Belize, 2018

CRFM TECHNICAL & ADVISORY DOCUMENT – NUMBER 2018/04

FINAL TECHNICAL REPORT: FISHERIES EARLY WARNING AND EMERGENCY RESPONSE (FEWER)

Publication of deliverables under Investment Plan for the Caribbean Regional Track of the Pilot Program for Climate Resilience (PPCR) [TC No.: ATN/SX-14969-RG]

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ABBREVIATONS AND ACRONYMS

ACP	Africa, Caribbean and Pacific States
API	Application programming interface
CAP	Common Alerting Protocol
CARICOM	Caribbean Community
CCA	Climate Change Adaptation
CCCFP	Caribbean Community Common Fisheries Policy
CDEMA	Caribbean Disaster Emergency Management Agency
CDM	Comprehensive Disaster Management
CIMH	Caribbean Institute for Meteorology & Hydrology
CNFO	Caribbean Network of Fisherfolk Organisations
CRFM	Caribbean Regional Fisheries Mechanism
CTA	Technical Centre for Agricultural and Rural Cooperation
DM	Disaster Management
DRM	Disaster Risk Management
ER	Emergency Response
EW	Early Warning
EWER	Early Warning and Emergency Response
EWERS	Early Warning and Emergency Response System
EWS	Early Warning System
FEWER	Fisheries Early Warning and Emergency Response
ICT	Information and Communications Technology
IDRC	International Development Research Centre
IPCR	Investment Plan for the Caribbean Regional
ISDR	International Strategy for Disaster Reduction
LEK	Local Ecological Knowledge
MET	Meteorological
MORI	Mona Office for Research and Innovation
NFO	National Fisherfolk Organisation
NEMO	National Emergency Management Organisation
NTRC	National Telecommunications Regulatory Commission
PMU	Project Management Unit
PPCR	Pilot Programme for Climate Resilience
SMS	Short Messaging Service
UNISDR	United Nations Office for Disaster Risk Reduction
UWI	The University of the West Indies
VHF	Very High Frequency

1. BACKGROUND

A contract for consulting services to develop, test and deploy an information and communications (ICT)-based Early Warning and Emergency Response System (EWERS) for fishers, including the respective system e-services, and to conduct the requisite training in the use and administration of the system; was signed on 31 January 2017. Signatories were Professor Archibald McDonald, Principal and Pro Vice Chancellor of the Mona Campus of The University of the West Indies (UWI), on behalf of the implementing agency, Mona Office of Research and Innovation (MORI); and Professor Brian Copeland, Pro Vice Chancellor of the St. Augustine Campus of UWI as authorized representative of the Lead Member of the consultants, the ICT4Fisheries Consortium. The start date of the 16-month assignment was 01 February 2017 and its end date, 31 May 2018.

The contract for consultancy services was issued under the Investment Plan for the Caribbean Regional (IPCR) Track of the Pilot Program for Climate Resilience (PPCR), with MORI as implementing agency and the Caribbean Regional Fisheries Mechanism (CRFM) as co-implementing agency. The general objective of the Plan is to "improve regional processes of climate relevant data acquisition, storage, analysis, access, transfer and dissemination; and to pilot and scale up innovative climate resilient initiatives".

The contract, for which this document is the final report, specifies that the EWERS for fishers is to be developed for four regional PPCR countries: Dominica, Grenada, Saint Lucia and St. Vincent and the Grenadines. It further specifies that the EWERS is to be integrated within existing national disaster risk management and emergency response frameworks and is to focus primarily on communications. The expectations, as specified in the contract, are that this EWERS would *reduce fishers' vulnerability to the impacts of climate change while at the same time provide for their sharing of local ecological knowledge to inform climate-smart fisheries planning and management decision-making as well as risk management in the fisheries sector*.

2. OVERVIEW OF FEWER

Fisheries Early Warning and **Emergency Response** (FEWER) is a set of tools that link small-scale fishers with each other and with agencies that play critical roles in disaster risk management (DRM). These links are effected through a system of information and communications facilities. The tools comprise a mobile application ("app") and web-based administrators' dashboard.

No single tool can meet all needs. FEWER is one of several tools that can reduce fishers' risks from natural hazards associated with weather (short-term) and climate (long-term) through improved information and communications on issues of particular concern to fishers, and to do so within the national DRM framework.

FEWER provides specific capabilities that small-scale fishers access through the mobile phone, and key agencies manage through a web-based administrators' dashboard. FEWER's eight modules are: Local Ecological Knowledge (LEK), Messaging, Weather, Alerts, Emergency Contacts, Emergency Procedures, Damage Reporting and Missing Persons. The key corresponding phases in the disaster management (DM) cycle (mitigation, preparedness, response and recovery) are shown in Figure 1.

DM Phase	FEWER Module		Fishers …
Mitigation		**LEK**	• **record** anything in the marine environment that should be noted to reduce fishers' risks
		**Messaging**	• keep **in touch** with other fishers to be aware if, where and when anyone goes missing
Preparedness		**Weather**	• **receive** and **share** information from local and international sources with indicators when things look risky
		**Alerts**	• **receive** from and **send** alerts to Fisheries, Met and Disaster Offices, and other fishers
Response		**Emergency Contacts**	• **access** up to date Emergency Contacts directly
		**Emergency Procedures**	• **receive** trusted guidance on procedures to follow in emergency situations
Recovery		**Damage Reporting**	• **share** reports based on property damage with the Authorities
		**Missing Persons**	• **broadcast** information to help in the recovery of missing fishers.

Figure 1 FEWER modules and key phases in the DRM cycle

Intrinsic in FEWER modules are provisions for the four elements of people-centred early warning systems: (i) risk knowledge, (ii) monitoring and warning service, (iii) dissemination and communication, and (iv) response capability, recognized by the United Nations International Strategy for Disaster Reduction (ISDR).

All FEWER modules except Messaging require either configuration and updating by local agencies; or interaction between these agencies and FEWER fishers who use the mobile app. Such administrative tasks are assigned to different types of FEWER administrators ("admins") with access privileges set accordingly on a web-based dashboard.

2.1 FEWER software components

FEWER web and mobile components, including the cloud-based software services, are shown in Figure 2. The cloud services interface directly with the mobile application and the web-based administrator dashboards, as well as with a number of internal and external databases. They are built on the mFisheries framework which provides software services common to a range of applications that support various aspects of fishers' livelihoods. The extensibility of the platform facilitates the development of additional interacting modules and the regional administration of multi-country FEWER instances.

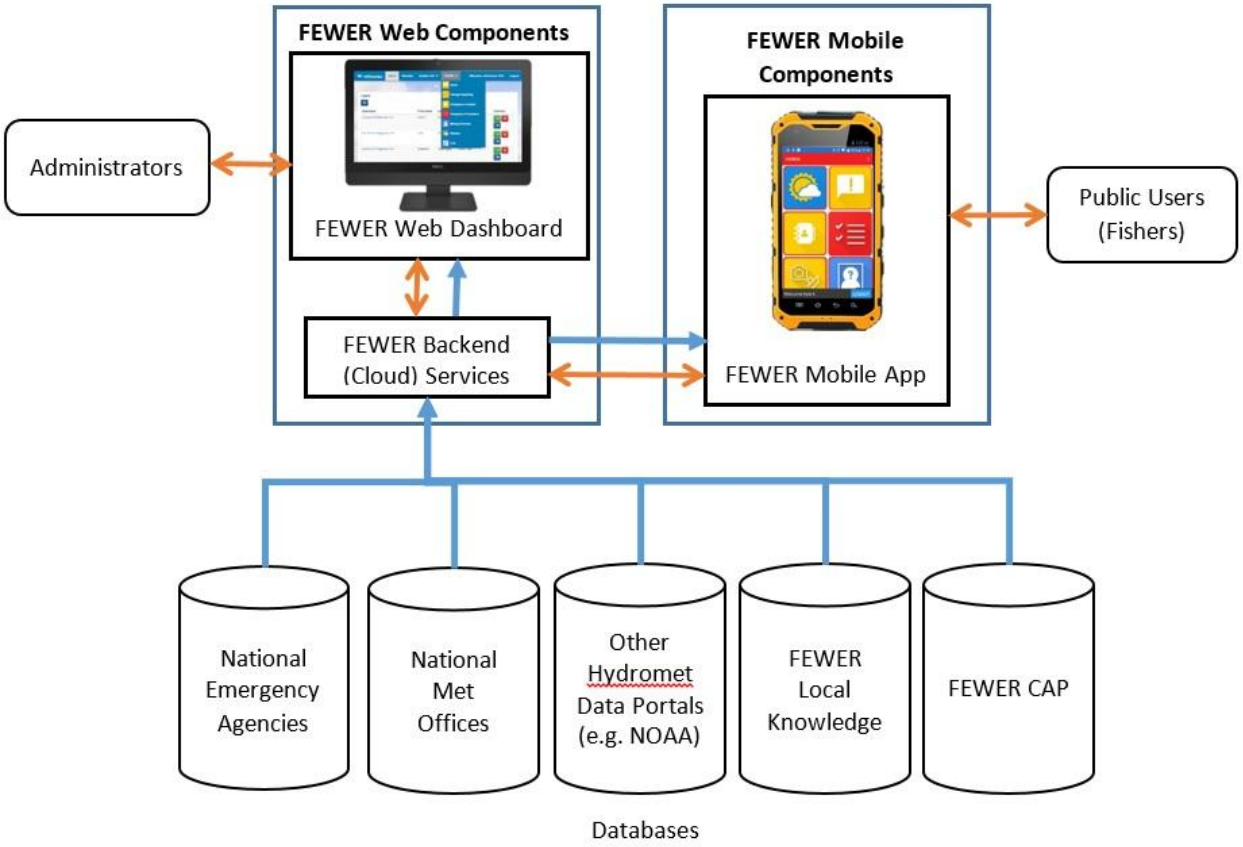

Figure 2 FEWER Software Components

2.2 FEWER DRM framework: national and regional

FEWER has been designed and implemented to operate within national and regional frameworks for DRM. These frameworks include policies, legislation, plans for preparedness and management, early warning systems, public awareness and capacity building as well as established organizational arrangements and procedures for all segments of society.

FEWER recognizes the Regional Comprehensive Disaster Management (CDM) Strategy and Programming Framework 2014-2024 Draft (CDEMA 2014[1]), established by the Caribbean Disaster Emergency Management Agency (CDEMA), as the prevailing regional framework for disaster management. It further recognizes the Model Disaster Preparedness and Risk Management Plan for the Fisheries and Aquaculture Sector of CRFM Member States (CRFM 2018), not yet published, as the sector-specific guide to the development of national fisheries disaster risk management plans. The feeder instruments to these plans are depicted in CRFM (2018[2]) as shown in Figure 3. FEWER may only reasonably be expected to meet its design objectives to the extent that DRM plans and programmes are operationalized at both the regional and national levels.

[1] CDEMA. Regional Comprehensive Disaster Management (CDM) Strategy and Programming Framework 2014-2024 (DRAFT). Barbados. 2014. Available at http://www.cdema.org/CDMStrategy2014-2024.pdf. Last viewed 24 May 2018

[2] CRFM, (unpubl). Model Disaster Preparedness and Risk Management Plan for the Fisheries and Aquaculture Sector of CRFM Member States. Technical & Advisory Document, No. 2018/ [number]. 79p. Belize.

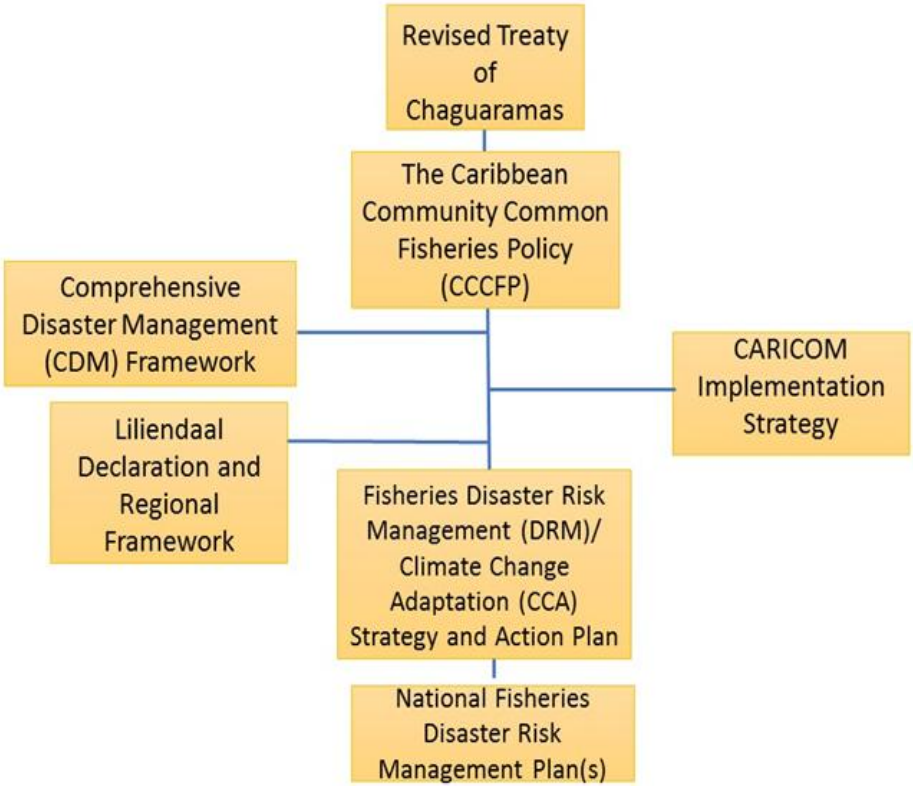

Figure 3 Organizational chart depicting CARICOM content for the formation of the National Fisheries and Aquaculture Disaster Risk Management Plan (CRFM 2018[2])

2.3 FEWER administration

National fisheries, disaster management and meteorological agencies play lead and ancillary roles in support of small-scale fishers within the DRM framework. The administration of fisher early warning and emergency response communication falls to the fisheries authorities as the FEWER **country administrators (CA)**; and the disaster management agencies, Met services and fisherfolk organizations as FEWER **agency administrators (AA)**. The overarching coordination of FEWER is the responsibility of the CRFM as the regional authority for fisheries. The CRFM is joined by regional authorities for hydrometeorology and disaster management, and the Caribbean Network of Fisherfolk Organizations, as FEWER **regional reviewers (RR)**. These regional agencies view all information accessible to country and agency administrators, and can draw on this information to create reports, but do not otherwise play a role in the day to day support of FEWER operations at the national level. As a software application, the technical aspects of FEWER are managed at the national level by **technical administrators (TA)** and regionally by the **global administrator (GA)**. The ecosystem of FEWER administrators is shown in Figure 4.

Each class of administrator is defined by the set of FEWER tasks that may be executed. The respective scope of privileges, vis-à-vis those of fishers, is shown in Figure 5.

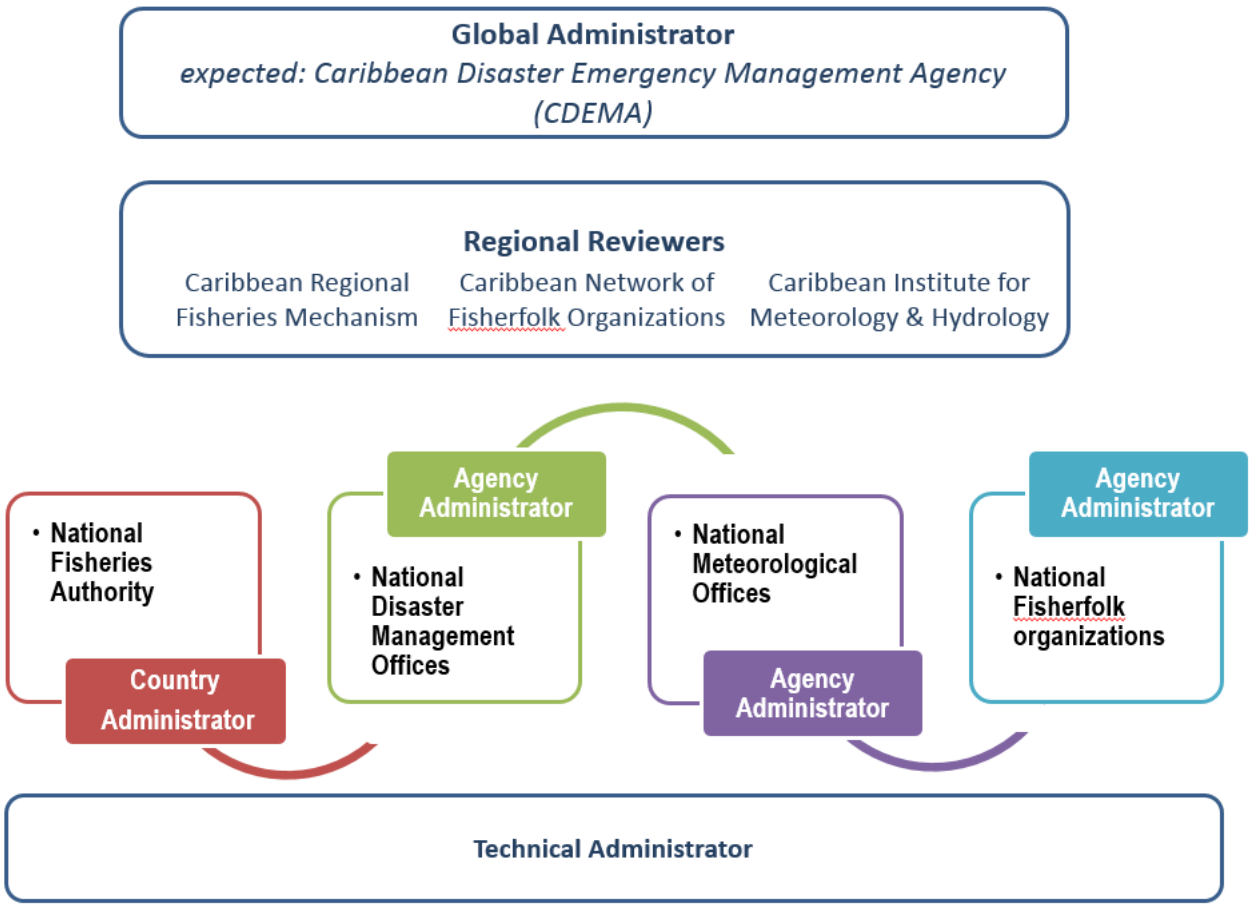

Figure 4 Ecosystem of FEWER Administration

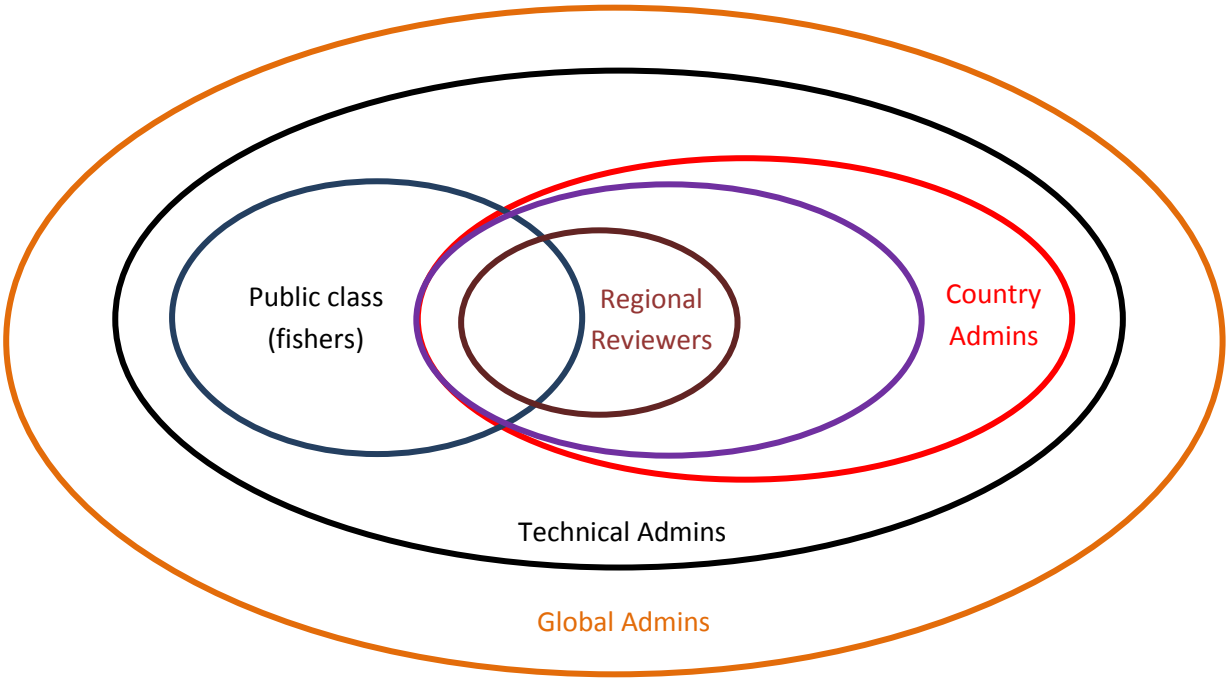

Figure 5 Relative scope of tasks for FEWER Users

There is keen interest by all parties for FEWER to be hosted by CDEMA. Technical, human resources and operational requirements have been specified, and recommendations advanced for the coverage of hosting service costs for 2 years to be borne by the PPCR.

2.4 FEWER channels

FEWER makes provisions for interaction between multiple agents including fishers and boat owners, fisheries authorities, fisherfolk organisations, coast guard (marine police units), national meteorological services, disaster management agencies, third party early warning and emergency response ICT systems, CRFM, CDEMA and the Caribbean Institute for Meteorology and Hydrology (CIMH). These agents variously contribute and consume FEWER information, and administer its processes.

FEWER's interaction between agents and agencies is effected through a variety of external data, information and communications systems. Channels for FEWER data and information contributors include:

- **FEWER Internal (Web browser** and **smart phone):** FEWER web and mobile applications may be used to create and post alerts.
- **CAP Feed:** FEWER aggregates feeds from multiple Common Alerting Protocol (CAP) servers, including the existing national multi-hazard early warning systems in project countries. FEWER subscribes to, aggregates and forwards alerts originating from other relevant CAP-enabled EW systems (EWS).
- **Application Programming Interfaces:** FEWER collects weather related information from select third party sources which provide well-documented and hardy Application Programming Interfaces (APIs). Currently, this includes OpenWeather.
- **Machine-readable Web Content:** Websites of select national authorities such as the meteorological agencies are scraped for climate-related and early warning information where necessary.

Channels for FEWER data and information consumers include:

- **FEWER Internal (Web browser** and **smart phone):** The FEWER solution provides its web and mobile application components with CAP alerts originating from multiple sources. Web-based FEWER dashboards are utilized by administrators to relay and convey alerts to fishers through the FEWER mobile app as well as through traditional means. The administrator dashboards are also utilized by disaster and first responder agencies to consume early warning and emergency response information. The FEWER mobile application is used by "public" FEWER users, most particularly small-scale fishers, to consume alerts. This app utilizes push-based notification to ensure that alerts are received in real time. Delivery confirmation notifications are also featured.
- **Basic phones:** While not all small-scale fishers in the target countries have or use smart phones, all have and use basic cellular phones. As all basic phones support Short Message Service (SMS), FEWER alert dissemination channels include SMS to enable the widest coverage of information delivery to target users. To avoid unexpected charges, FEWER administrators authorize the transmission of such alerts through local telecommunication providers or through their SMS gateway, where it exists, as a part of the configuration process.
- **CAP Feed:** Alerts generated by FEWER users are formatted using CAP. FEWER does not duplicate, rather it extends, the national CAP event templates to include coastal flash flood, storm surge, whitecaps, ground swell, low visibility and strange current alerts. A CAP-formatted FEWER alert feed is available for subscription by agencies including the MET office, the Marine Police Unit, fisheries authorities, fisherfolk organizations, the CRFM, disaster management agencies and third party EW & ER ICT systems. The administrator for each subscriber is expected to responsibly manage the forwarding of FEWER-generated information.

- **Marine band VHF radios**: Where equipped with CAP-enabled Very High Frequency (VHF) base stations, the Marine Police Units may opt to forward alerts on the appropriate marine band for receipt by VHF radio users at sea.
- **E-notice boards:** FEWER also provides the option for displaying information on dedicated electronic notice boards, in fisheries facilities outfitted with them, if the data format requirements are well specified and the boards are connected to the Internet.
- **Geo-spatial databases:** FEWER local knowledge may be pulled into and displayed on GeoNode databases. This enables archiving and retrieval of select FEWER data on external georeferenced data systems.
- **Social media:** FEWER alerts may be accessible from social media channels through the FEWER CAP feed.

2.5 FEWER ecosystem and architecture

FEWER data flow mechanisms relay externally-generated information, performing translation services as necessary, between data contributors and data consumers. Though FEWER-originated information may only be created from the application's web and mobile components, FEWER conveys information to non-FEWER software and hardware end points in a richly multi-modal environment as shown in Figure 6. The figure depicts the primary data and information contributors and consumers in red and green respectively. It represents the local administrators (agency and country) in black and the regional reviewers and global administrator in purple.

Channels for data and information input are shown on the top centre of Figure 6 while channels for data and information retrieval are shown on the bottom centre of the figure. The centre of the figure shows the "internet cloud" in which the FEWER and mFisheries web services are deployed. External services are shown on the edge of the cloud: the real time messaging service is essential for FEWER operation while the SMS gateway and CAP interface to VHF marine band radios are optional.

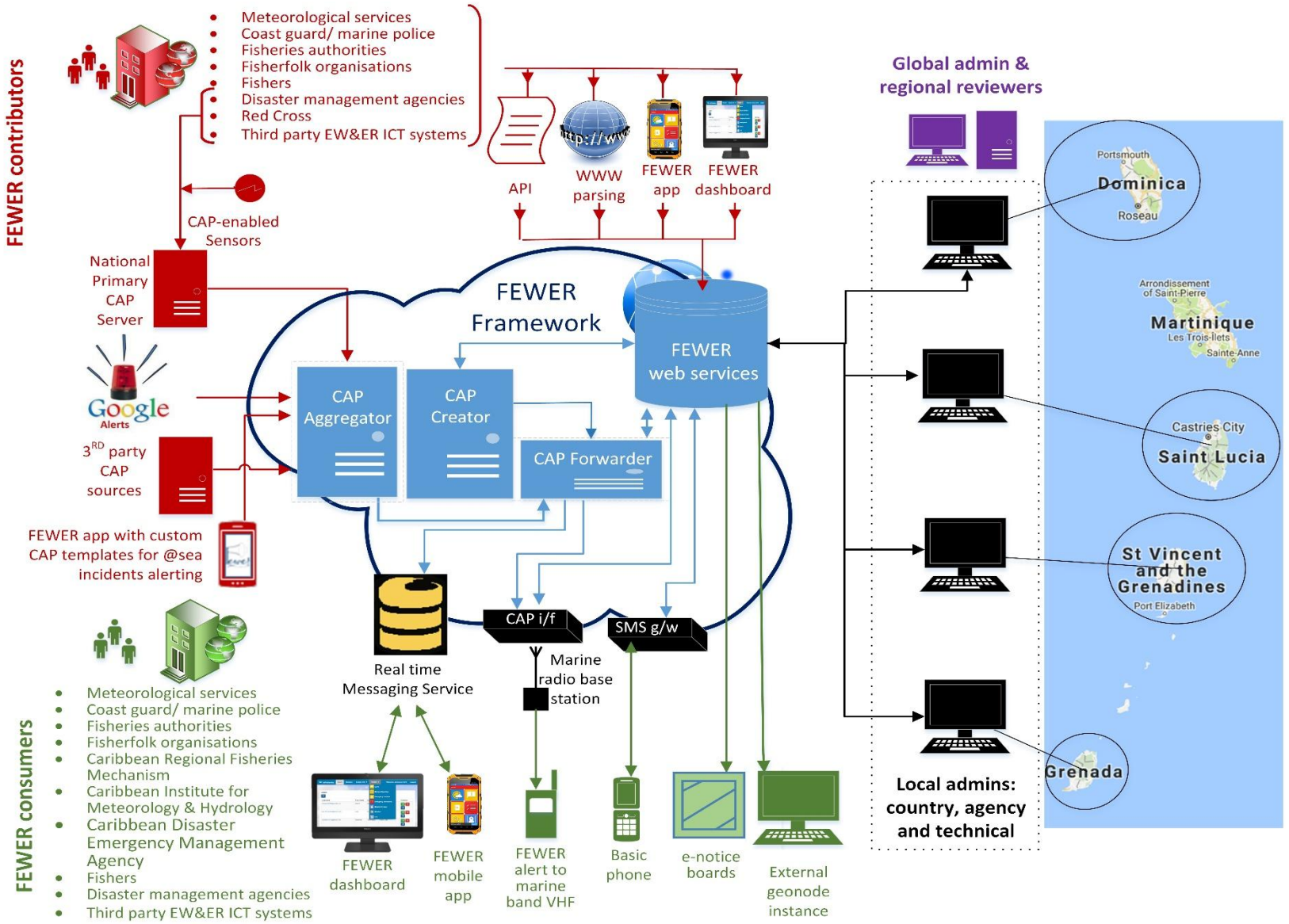

Figure 6 FEWER Ecosystem and Architecture

3. CONTRACT ACTIVITIES

The development of FEWER followed the terms of reference of the contract for consultancy services. The contract specifies that the activities "*include, but are not limited to the following:*

1. *Organizing and convening consultations with the range of national stakeholders[3] (in collaboration with the respective Fisheries Divisions) as well as with relevant regional stakeholders, necessary for development and implementation of the EWERS in four PPCR countries. These meetings are intended to identify specific country requirements which will inform EWERS design, achieve agreement on the roles and responsibilities of various national agencies and stakeholder groups in the design, testing, deployment, implementation and long-term sustainability of the EWERS, including the supporting system for management and sharing of data and information;*
2. *Accessing available key data and information (available in real-time and forecasts) on weather and oceanographic conditions from the respective national and regional agencies, designing and developing the platform for the continued management and sharing of such data and information with fishers as well as the capture and sharing of local ecological knowledge from fishers, identifying relevant weather and oceanographic data gaps and addressing these gaps to the extent possible;*
3. *Developing country-specific proposals for the EWERS, which include options for sustainable financing, for review and approval prior to development;*
4. *Developing the first draft of the Memorandum of Understanding among national agencies, stakeholder groups and the CRFM Secretariat for development, implementation and administration of the EWERS and access to the e-services;*
5. *Providing specifications of any required additional software and equipment and assisting with sourcing the requisite quotations to facilitate procurement by the IPCR PMU;*
6. *Developing, testing, installing and deploying an EWERS and the associated e-services for fishers in four PPCR countries;*
7. *Organizing and convening training workshops in four PPCR countries, in collaboration with the respective Fisheries Divisions;*
8. *Developing and finalizing user and administrator manuals and production of an infographic on the EWERS; and*
9. *Preparation of draft and final versions of a final technical report, to include the specific technical deliverables listed in paragraph 5- Reporting Requirements and Time Schedule for Deliverables.*

Training is a specific component of the assignment. The consultancy is also expected to deliver training for stakeholders in the use of the EWERS and training of designated in-country technical administrators in the management of and reporting on use of the EWERS."

All activities were undertaken in accordance with the contract's scope of services, tasks (components) and expected deliverables. They were all delivered according to agreed time lines.

[3] Stakeholders may include but are not limited to fisher organizations, national agencies with responsibility for disaster risk management and emergency response, meteorology, search and rescue, national security, maritime services, and health and telecommunications service providers.

4. CONTRACT SUBMISSIONS

Contract outputs were scheduled for submission according to eight tranches of deliverables as follows:

1. **First deliverable**: Inception Report; a report including the work plan for the consultancy;
2. **Second deliverable**: Reports of each stakeholder consultation in the four PPCR countries (one report for each) with specific proposals for the EWERS in each country;
3. **Third deliverable**: Memoranda of Understanding among stakeholder groups for each of 4 PPCR countries, outlining the respective roles and responsibilities for the design, testing, implementation and long-term sustainability of the EWERS;
4. **Fourth deliverable**: Prototype Early Warning and Emergency Response System (EWERS) for testing – includes mobile software and software for e-services;
5. **Fifth deliverable**: Draft user and administrator manuals for EWERS;
6. **Sixth deliverable**: Report of training workshops in four PPCR countries including training materials, participants' evaluation of the training workshops and an impact assessment tool for monitoring uptake and usage of the training;
7. **Seventh deliverable**: Final EWERS, including e-services, installed and tested;
8. **Eighth deliverable**: Final user and administrator manuals for EWERS.

All deliverables were completed in accordance with contract specifications and within agreed deadlines.

4.1 Submission requirements

The contract specifies that the prototype and production EWERS software are to be submitted electronically using an appropriate mode of transfer; and that every report, including manuals, is to be submitted in three (3) hardcopies and one (1) electronic copy. However the implementing agencies subsequently confirmed hard copy submission requirements as follows:

1. Three copies to Programme Manager, Research and Resource Assessment Programme, CRFM Secretariat, Halifax Street, Kingstown, St Vincent and the Grenadines;

2. One copy to PPCR- Project Management Unit, Ground Floor, Electronics Building, c/o Physics Department Office, The University of the West Indies, Mona Campus, Kingston 7, Jamaica.

4.2 Submissions per specified deliverables

Hard copies of reports, in the prescribed quantities, were duly dispatched via registered mail on acceptance of draft versions by the CRFM. Electronic versions of reports were uploaded to a Google Drive with links and access credentials shared with the CRFM and MORI.

Links to submissions as per the deliverables specified in the contract are provided in Table 1.

Table 1 Links to Electronic Versions of FEWER Submissions Specified in Contract Deliverables

Ref	Links to Deliverables	Specification in Contract
D1	Inception Report	A report including the work plan for the consultancy
D2	1. FEWER country report: Grenada 2. FEWER country report: Dominica 3. FEWER country report: Saint Lucia 4. FEWER country report: St. Vincent & the Grenadines 5. FEWER country proposal: Grenada 6. FEWER country proposal: Dominica	Reports of each stakeholder consultation in the four PPCR countries (one report for each) with specific proposals for the EWERS in each country

Ref	Links to Deliverables	Specification in Contract
	7. FEWER country proposal: Saint Lucia 8. FEWER country proposal: St. Vincent & the Grenadines	
D3	MoU: Grenada MoU: Dominica MoU: Saint Lucia MoU: St. Vincent & the Grenadines	Memoranda of Understanding among stakeholder groups for each of 4 PPCR countries, outlining the respective roles and responsibilities for the design, testing, implementation and long-term sustainability of the EWERS
D4	Prototype FEWER	Prototype Early Warning and Emergency Response System (EWERS) for testing – includes mobile software and software for e-services
D5	1. Draft Administrator Manual 2. Draft User Manual	Draft user and administrator manuals for EWERS
D6	1. Report of training workshops and participants' evaluations (folder) 2. Evaluation instruments and training impact assessment tool (folder) 3. Training materials (folder)	Report of training workshops in four PPCR countries including training materials, participants' evaluation of the training workshops and an impact assessment tool for monitoring uptake and usage of the training
D7	1. Final FEWER Installed & Tested on CIRP's Infrastructure 2. Final FEWER for installation & testing on the Global Admin's Infrastructure	Final EWERS, including e-services, installed and tested
D8	1. FEWER Global Administrator Manual 2. FEWER Local Admin Manual 3. FEWER User Manual	Final user and administrator manuals for EWERS

4.3 Additional submissions per activities

The activities specified in the contract made reference to the development of particular documents that were not listed in the deliverables. These have been provided, as shown in Table 2. They are identified as D7-A and D8-A to denote that they are related to deliverables D7 and D8.

Table 2 Links to Electronic Versions of FEWER Documents Referenced in Contract Activities but not in Deliverables

Ref	Links to Additional Activity Deliverables	Reference in Contract
D7-A	Software & Equipment for FEWER Deployment	3 Scope of Services, Tasks (Components) and Expected Deliverables 3.1 The Consultancy's activities include, but are not limited to the following: (e) *"… specifications of any required additional software and equipment and assisting with sourcing the requisite quotations to facilitate procurement by the IPCR PMU"*
D8-A	FEWER infographics: pptx pdf	3 Scope of Services, Tasks (Components) and Expected Deliverables 3.1 The Consultancy's activities include, but are not limited to the following: (h) *"…Developing and finalizing user and administrator manuals and production of an infographic on the EWERS"*

4.4 D1 Inception report

The inception report preceded project implementation. The report kicks off with an introductory section that comprises background and an overview of the assignment. It then describes the approach and methodology to be applied to project implementation. It also describes project organization in terms of the implementation, deliverables and due dates. The work plan and schedule are outlined and comments provided on adjustments and clarifications coming out of the inception meeting and related communications between the project team and the project management unit (PMU). The inception report closes with a summary of risks.

Among other things, the inception report presents the planned implementation strategy, as shown in Figure 7. Implementation followed this strategy. Desk and local research, as well as considerable logistical planning, preceded stakeholder consultations in all four project countries. FEWER proposals and MOUs were crafted on the basis of research and engagement within the terms of reference for the consultancy. Functional as well as non-functional software requirements specifications were distilled and used as the basis for the development of a FEWER prototype. Face to face training workshops followed and the project concluded with the delivery of the final "production" version of FEWER installed, tested and fully documented.

In-situ training and support were provided by the ICT4Fisheries Consortium from the start of engagement exercises with stakeholders, through to the end of the project. This support was provided through multiple channels, most particularly an extended schedule of remote co-design meetings, chat groups, face to face workshops, and training resources. Multiple delivery channels and modes were employed to increase time on task and provide rich opportunity for engagement.

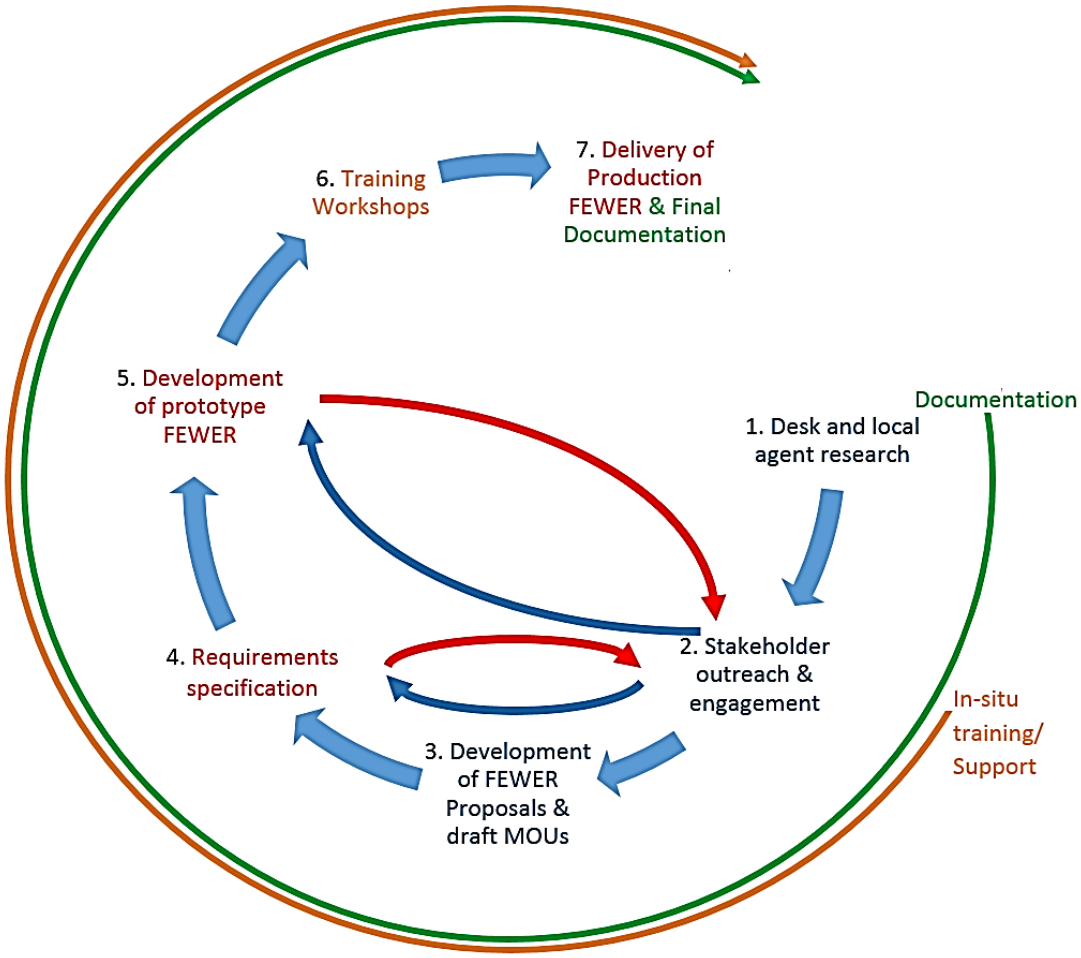

Figure 7 Implementation Strategy

4.5 D2 FEWER country reports and proposals

4.5.1 D2-1 FEWER country reports

As noted in the inception report, FEWER design and implementation depended critically on the outcome of early-stage in-country consultations and other data gathering. The availability of information and data as well as the adequate participation and logistical arrangements for consultations were of concern. Another key concern was the burden of the consultation process on stakeholders, particularly fisherfolk, who face regular demands on their time by national and regional projects. Notwithstanding, considerable insights were gained from the country visits as documented in the country reports. They provide an introduction and then elaborate on the approach, risk knowledge, monitoring and warning service, dissemination and communication, response capacity, collaboration and conclusions. The reports also include appendices: the announcement flyer, meeting notices, checklist for early warning systems and list of contacts. The detailed scope of contents is provided in Appendix A.1.

4.5.2 D2-2 FEWER country proposals

As little variation was noted between the countries, application requirements differed only in local information, such as telephone area codes, from country to country. The proposals, crafted on the basis of research and stakeholder engagement within the terms of reference for the consultancy, provide an

introduction and then elaborate on the cross-cutting governance and institutional arrangements, proposed FEWER, risk management and sustainable financing, monitoring, evaluation, learning and adaptation and draw conclusions. The UNISDR checklist for early warning systems and sample FEWER training requirements are included as appendices. The detailed scope of contents is provided in Appendix A.1.

4.6 D3 MoUs

This Fisheries Early Warning and Emergency Response Memorandum of Understanding (the "FEWER MOU") sets out collaboration among national agencies and stakeholder groups, and with regional supporting organisations, for development, implementation and administration of FEWER in each project country. The parties to the FEWER MOU differ from country to country but are generally:

- Fisheries Division
- Coast Guard Service
- Meteorological Services
- National Fisherfolk Organisation (NFO)
- National Telecommunications Regulatory Commission (NTRC)
- National Emergency Management Organisation (NEMO)
- Red Cross Society

The MOUs are supported by regional organisations, in particular:

- Caribbean Regional Fisheries Mechanism (CRFM) Secretariat
- Caribbean Disaster Emergency Management Agency (CDEMA)
- Caribbean Institute for Meteorology and Hydrology (CIMH)

The 2-year MOUs are not legal documents and do not establish binding rights or obligations. They may be renewed, amended or terminated by agreement of the parties at any time. They were drafted in the early stages of project implementation in accordance with the contract schedule. These drafts were developed on the basis of research and stakeholder engagement within the terms of reference for the consultancy. They were revised subsequent to face to face training, taking account of feedback from participating FEWER administrator agents. They include specification of national parties and regional supporting organisations, background, aim and scope, responsibilities, operation and focal points. The MOUs identify optional annexes: work plan schedule with budget and list of focal points and alternates.

4.7 D4 Prototype FEWER

The FEWER application prototype comprises the following components:

1. Mobile application
2. Web application
3. Web and API services platform
4. Weather extractors

The explanation, description and links to these software resources, as well as instructions for their installation and use, are captured in the submission document titled "D-4 Prototype EWER for Fishers (FEWER)". The submission document elaborates on the background, FEWER software components, mobile application, web application, web and API services, and weather extractors. The detailed scope of contents is provided in Appendix A.2.

4.8 D5 Draft manuals

Deliverable D5 comprises two draft manuals: one for administrators and the other for public users (primarily fishers). As for all submissions, these documents were issued for review by the implementing agencies and key FEWER stakeholders in the project countries. Feedback informed revisions prior to final submission.

4.8.1 Draft administrator manual

The draft administrator manual was prepared in Microsoft Word and, once finalized, converted to pdf before revealing through the FEWER administrator dashboard. Early versions were utilized as key resources for co-design meetings with over a dozen country and agency administrators conducted between October 2017 and the end of January 2018.

These meetings informed revisions which were implemented in the final administrator manual. The draft administrator manual comprises sections on background, FEWER administrators, the FEWER administrators' dashboard, administrators' tasks and details on how readers can make FEWER better. The detailed scope of contents is provided in Appendix A.3.

4.8.2 Draft user manual

The draft user manual was prepared in Microsoft Word and, once finalized, converted to pdf before revealing through the FEWER mobile application. Early versions were utilized as key resources for co-design meetings with fishers. These meetings informed revisions which were implemented in the final administrator manual. The hand motif, used to point to controls on the mobile user interface was drawn from a recommendation by a FEWER fisher.

The draft user manual is posed as a comprehensive set of questions and corresponding answers for ease of use. These include: What is FEWER? Why was FEWER produced and by whom? Why would I use FEWER? What do I need to use FEWER? How do I get FEWER? How do I set up FEWER after installation? Why do I need to sign in? Why do I need to give FEWER permissions? How do I set up FEWER some time after installation? How can I access FEWER if I don't have an Android phone? How do I use FEWER? Can I use FEWER if I am not in a FEWER country? It provides a wrap up of FEWER "So that's the FEWER Prototype!" and then follows with broader questions: Anything else I need to know about the FEWER Prototype? Anything else I should know about Android apps? Can I make FEWER better? The detailed scope of contents is provided in Appendix A.3.

4.9 D6 Training

Training support was provided through multiple channels, most particularly remote co-design meetings and chat groups, face to face workshops, and training resources. Multiple delivery channels were employed to increase time on task and provide rich opportunity for engagement. The submission comprises the training materials; the report of training workshops including workshop evaluation; and the impact assessment tool and evaluation instruments.

4.9.1 Training materials

The FEWER training materials refer to the very many documents used for the *delivery* of face to face workshops in Saint Lucia, Grenada and St. Vincent and the Grenadines. The training materials comprise the training brief and face to face training agendas as well as the powerpoint presentations and other resources delivered at the face to face workshops. The latter for the training of administrators (technical, TA: country, CA; agency, AA, coast guard, CG) in each country include:

1. Welcome and Introduction to FEWER – powerpoint presentation
2. FEWER walk-through – powerpoint presentation
3. Hands-on activity with web dashboard – powerpoint presentation
4. Hands on FEWER Activities (All) – powerpoint presentation
5. Evaluation (TA, CA and AA) – document
6. Hands on FEWER Activities (CG and TA) – powerpoint presentation
7. Hands on FEWER Activities (TA) – powerpoint presentation
8. Evaluation - document.

The powerpoint presentations and other resources delivered at the face to face workshops for fishers include:

1. Welcome and Introduction to FEWER – powerpoint presentation
2. Hands-on activity with mobile phone – powerpoint presentation
3. FEWER walk-through – powerpoint presentation
4. Hands on FEWER Activities – powerpoint presentation
5. Practice using FEWER – powerpoint presentation
6. Practical Tips on Mobile Phones - document
7. Evaluation – document.

4.9.2 Report of training workshops and participants' evaluation

The training report opens with an introduction and follows with sections covering training methodology, the face-to-face training workshops as well as particulars of reaction and learning assessment. It closes with an introduction to impact assessment. Appendices include FEWER prototype meeting details and face to face training participant lists. The detailed scope of contents is provided in Appendix A.4.

4.9.3 Evaluation instruments and Impact assessment tool

The training impact assessment tool uses the Kirkpatrick Model (1955)[4] to frame the impact of the Fisheries Early Warning and Emergency Response (FEWER) training workshops across four dimensions of training impact measurement: reaction, learning, behaviour and results.

The reaction dimension (Kirkpatrick, 2018) of assessment, that is to say "the degree to which participants found the training favourable, engaging and relevant to their jobs", gauges the initial reaction of participants to training. In the case of FEWER, reaction is reviewed for the training experience, mobile phone tips, trainers, venue and refreshments.

The assessment of learning, "the degree to which participants acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the training" measures information retention. Introductory FEWER training provides an orientation to the mobile application and the web-based dashboard; and learners are asked to identify, describe and match basic features, concepts and functions using a variety of techniques. Without additional follow-up and regular testing, measurement of actual learning retention remains superficial.

Behaviour, in the Kirkpatrick Model, is the assessment dimension used to assess the degree to which participants apply what they learned during training when they are back on the job. In the case of FEWER, this is tied to a qualitative assessment to be delivered every three months over a period of a year. Quarterly reports are to be examined for behaviour changes and trends. The impact assessment tool

[4] https://www.kirkpatrickpartners.com/Our-Philosophy

provides guidelines and templates for the measurement of both instrumental and informational competence of the user through behavioural observation. Statements of performance are derived.

Familiarity performance statements assess the degree to which the user is familiar with a feature or task that can be performed using FEWER while the fluency performance statements assess the extent to which the user can confidently execute tasks using FEWER for job-related activities. Of interest are answers to questions such as: To what extent does the user readily engage with FEWER? How often does this interaction take place? To what extent is the user able to use FEWER to locate relevant information in response to common work-related tasks or queries? Average scores are calculated over all applicable statements. The association of average scores and rankings are provided in the impact assessment tool.

Results facilitate a higher-level review of training through a comparison of actual results and baseline results or a set of established metrics. For FEWER, an increase in networked agents facilitating information flow to help reduce risks related to weather (short-term) and climate (long-term) in the fisheries sector is the expected result. The impact assessment tool captures this through two questions: are users connected to a service that they did not have before? Are users able to receive or communicate with other users in a useful way?

Within the project timeline assessment was deliberately constrained to measure learners' **reactions** and immediate **learning** of workshop content. The impact assessment tool is to be used beyond the timeline of the project, to assess learner's change in **behaviour** will and long term **results**. The tool provides a number of assessment instruments specific to FEWER. These include: fisher's reaction survey, administrator's reaction survey, fisher's learning questionnaire, administrator's learning questionnaire, fisher's matching activity, administrator's matching activity, ranking of familiarity & fluency, familiarity performance rating for qualitative statements of performance, fluency performance rating for qualitative statements of performance, quantitative statements of performance and template statements on analysis of results. Guidance is provided for the application and interpretation of each instrument.

The impact assessment tool starts with an introduction and follows with sections on the FEWER reaction survey, learning assessment, behavioural assessment and results assessment. It ends with brief closing remarks.

4.10 D7 Final FEWER installed and tested (and required hardware & software specifications)

The *reference* submission for D7 "Final Early Warning and Emergency Response System, including e-services, Installed and Tested on CIRP's Infrastructure" is provided in two documents:

1. one for the application installed on the infrastructure used for development, that is to say the infrastructure of the Caribbean ICT Research Programme.
   This configuration was in effect at the end of the project life time as at that time hosting services for regional administration were not yet in place.

2. the other applicable to installation on external infrastructure and managed by the global FEWER administrator, expected to be the Caribbean Disaster Emergency Management Agency, CDEMA.
   This configuration is proposed, and largely agreed, to be the means through which FEWER would be managed by the regional administrator past the lifetime of the current consultancy project.

The explanation, description and proposed links to the final FEWER software resources, instructions for their installation, test procedures, and recommended regional administration service infrastructure, are

captured in the submission document titled "Final Early Warning and Emergency Response System, including e-services, for installation and testing on the Global Administrator's Infrastructure". The explanation, description and links to the final FEWER software resources, instructions for their installation, test procedures and results, and recommendations for regional administration service infrastructure, are captured in the submission document titled "Final Early Warning and Emergency Response System, including e-services, Installed and Tested on CIRP's Infrastructure". The former includes the template for testing, without results, while the latter includes test results. The general narrative in each case is appropriate to the document's context, and the links to resources and their recommendations are also context appropriate.

Both documents provide an Introduction and then follow with explanations of FEWER software components, administrator credentials, CAP templates, installation and testing. They provide additional resources then close with an appendix that provides an overview of FEWER. The detailed scope of contents is provided in Appendix A.5.

The specifications for software and equipment for FEWER deployment are provided as a separate document as well as an appendix to the FEWER global administrator manual. The specifications document opens with a background discussion and then presents the scope, assumptions and particulars of hosting requirements. Appendices include service dimensioning and comparative costing, weather API dimensioning and comparative costing, real time communications dimensioning and comparative costing, hosting dimensioning and comparative costing and dimensioning and comparative costing of optional SMS service. As per the contract, the IPCR PMU will procure the specified hardware and software. The request was submitted by the ICT4Fisheries Consortium prior to the end of contract.

4.11 D8 Final user manuals (and FEWER infographics)

The detailed scope of contents for these manuals is provided in Appendix A.6.

4.11.1 FEWER Global administrator manual

For the final submission, a FEWER global administrator manual has been prepared. This manual is a superset of the FEWER local administrator manual, and includes background, FEWER administrators, the FEWER administrators' dashboard, administrative tasks by module, country-specific FEWER configuration, system Installation and configuration, providing data to FEWER external consumers through GeoNode, testing, system deployment and troubleshooting. Appendices include the FEWER extractor manual and the specifications for software and equipment for FEWER deployment.

Appendix 11.2 of the FEWER global administrator manual provides the specifications for software and equipment for FEWER deployment. Though not explicitly listed as a FEWER contract deliverable, production of these specifications was included in the list of activities. They specify the requirements for hosting and management of FEWER by the global administrator, independent of the development team, ICT4Fisheries Consortium.

4.11.2 FEWER Local administrator manual

The FEWER local administrator manual is a subset of the global administrator manual. It comprises all sections and respective subsections other than system installation and configuration, testing, system deployment, troubleshooting and the specifications for software and equipment for FEWER deployment Appendix. The general narrative is context-specific to the global and local administrator manuals.

4.11.3 FEWER user manual

Minor revisions were made to the draft FEWER user manual in accordance with application adjustments. It covers: What is FEWER? Why would I use FEWER? What do I need to use FEWER? How do I set up FEWER after installation? Why do I need to sign in? Why do I need to give FEWER permissions? How do I set up FEWER some time after installation? How can I access FEWER if I don't have an Android phone? How do I use FEWER? Are there Any Additional Operations? Can I use FEWER if I am not in a FEWER country? So that's FEWER! Anything else I need to know about the FEWER? and Anything else I should know about Android apps?

4.11.4 FEWER infographics

Though not explicitly listed as a FEWER contract deliverable, production of a FEWER infographic was included in the list of activities. Two infographics have been produced. They may be multi-purposed as a single double-sided or as two single-sided handouts. They may also be printed as posters or incorporated into FEWER promotional materials and presentations. They have been provided in PowerPoint and pdf formats and are shown in Figure 8 and Figure 9.

Figure 8 FEWER Infographic 1: What is FEWER?

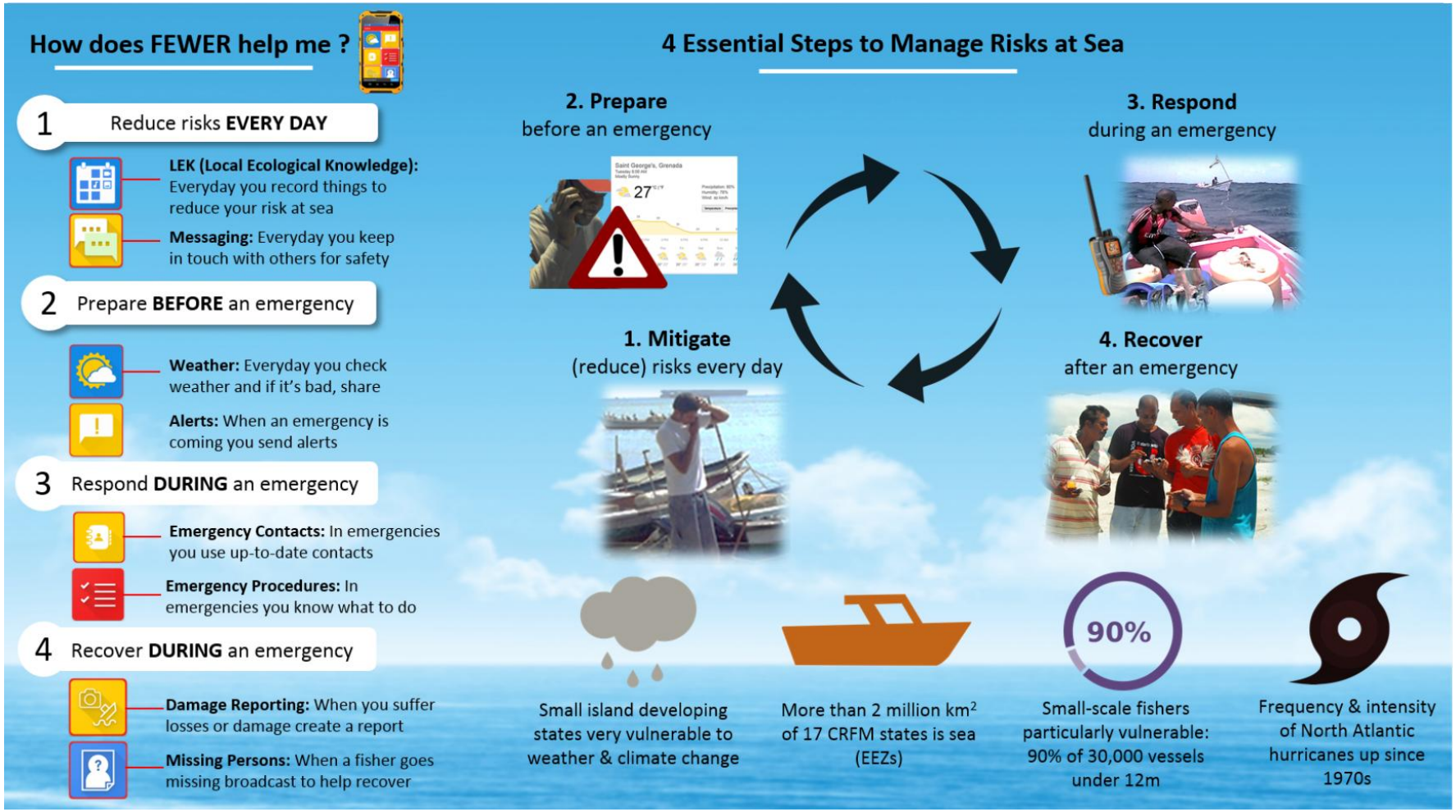

Figure 9 FEWER Infographic 2: How Does FEWER Help Me?

5. RECOMMENDATIONS

The expectations of FEWER contract drafters are that the tool would "reduce fishers' vulnerability to the impacts of climate changes while at the same time provide for their sharing of local ecological knowledge to inform climate-smart fisheries planning and management decision-making as well as risk management in the fisheries sector." FEWER is one of several tools that reduce fishers' risks. No single tool can meet all needs. Additionally, reduction of fishers' vulnerability to weather and climate impacts, does not only require tools but also requires relevant knowledge and skills that are exchanged and built through a variety of foundational channels; and applied as a matter of course.

5.1 Foundational channels

The most accessible means of weather- and climate-smart knowledge transfer is through public communications channels: free to air radio and television. These channels hold the power of reach and reinforcement. They are the obvious first choice for building universal awareness about potential impacts of weather and climate systems, what to look out for, and what to do before, during and after a disaster strikes.

Recommendation 1: Promote resilience-building understanding and strategies through sustained TV and radio campaigns.

Contextualization of resilience-building understanding and strategies within small-scale fishers' experience, essential to building necessary skills, is possible through existing training programmes. This applies both to transferable skills such as observation and assessment; and to specific skills such as are required to operate particular tools including marine band VHF radios and mobile applications.

Recommendation 2: Incorporate resilience-building understanding, strategies, skills and tools into regular fisher training programmes.

The choice to apply knowledge and skills is strongly influenced by social norms. Such norms are in turn strongly influenced by community members who are admired and respected. The influence of these stewards is critical to the establishment of new norms built around the use of resilience strategies on a daily basis.

Recommendation 3: Provide keen support for stewards to drive resilience-centred social norms.

The strength of social networks is not only critical for the establishment of resilience as a norm but is also the basis of a very important aspect of resilience: regular communications. All channels over which such communications is in effect add to fishers' resilience. These include but are not limited to word of mouth, SMS, smart phone and VHF radio communications as well as facebook, whatsapp and twitter.

Recommendation 4: Utilize all existing social network and media channels to keep fishers and their communities in touch with each other and with sector management and first responder agents.

5.2 Disaster management framework

FEWER operates within the national DRM framework. For greatest effect, the communication between fishers and key agencies is sustained through all phases of the disaster management cycle. For the mitigation phase, an acute awareness of the marine environment and any noticeable changes is key, as is the practice of letting others know of plans to set out before trips. For the preparedness phase, information about the weather and sea conditions, how to plan around these and what to do if they are unavoidable,

are key. For the period during a disaster, emergency contacts and knowledge of what to do in the event of an emergency is vital. Also, during and immediately following a disaster, identification of missing persons is critical. In the latter period of the response phase and the early stages of recovery, the reporting of damage is an essential input for subsequent planning exercises. FEWER provides channels and facilities for all of these functions. Yet the efficacy and the uptake of FEWER depend on the strength of the disaster management framework, and its operationalization.

Recommendation 5: Ensure that FEWER is incorporated into national disaster preparedness and risk management plans and operations for the fisheries and aquaculture sector of CRFM member states.

5.3 Weather and oceanographic data gaps

There are very few monitoring stations in the eastern and southern Caribbean marine environment so existing weather and oceanographic forecasts for this region rely heavily on modelling, simulation and expert knowledge of local weather and climate dynamics. Even so, there are a number of areas in which weather forecasts in the project countries can be made to better meet small-scale fishers' needs. These include increased geographic specificity and more intuitive presentation.

The conditions that pose risks to fishers differ across different regions of each country's waters. This is not only true for project countries but is universally the case. In Trinidad and Tobago, for example, the MET Office[5] recognizes the thresholds shown in Table 3 for the severity of hazardous seas off the windward and leeward coasts. Note that 3 m waves off the windward coast are a moderate hazard while off the leeward coast they present an extreme hazard. Significant wave height causes rolling and pitching; and the considerable energy contained in swells is cause for caution as crafts on the shore line or jetty may be damaged if not moved to safety. Forecasts expressed as sea state parameter values without geographic specificity are therefore of limited value to fishers whose safety, and that of their crafts, is tightly linked to conditions at sea.

Table 3 Severity of Select Sea State Parameters in Trinidad and Tobago Waters

Trinidad & Tobago Coast	Parameter	Severity			
		Minor	**Moderate**	**Severe**	**Extreme**
Windward	Wave height	0-2.4 m	2.5-3.0 m	3.1-5.0 m	> 5.0 m
	Swell period	0-10 sec	11-12 sec	13-15 sec	> 15 sec
Leeward	Wave height	0- 1.0 m	1.1-2.0 m	2.1-3.0 m	> 3.0 m
	Swell period	0-10 sec	11-12 sec	13-15 sec	> 15 sec

Contemporary weather forecasting and early warning in particular are increasingly impact-based, rather than meteorology-based, and in many cases expressed with geographic specificity according to coarse regions. An impact-based warning generally specifies the severity of the anticipated weather system using terms such as minor, moderate, severe and extreme. In contrast, a traditional report may express the same system using phrases such as "waves of 2 m in open waters".

Though implementation of forecasting methods is entirely outside the scope of this project, the provision of key information with greater geographic specificity and in intuitive formats is an important means of

[5] Information acquired through a series of consultations with Mr. Haley Anderson, Quality Manager, Trinidad and Tobago Meteorological Service

strengthening fishers' resilience to weather and climate-related risks. Such methods require slight adjustments to the operations of the local MET Services but no capital costs.

Recommendation 6: Explore willingness of MET Offices in FEWER countries to implement impact-based forecasting with greater geographic specificity.

5.4 Climate-smart fisheries planning & management decision-making & risk management

Climate-smart fisheries planning and management decision-making and risk management is intrinsically a collaborative enterprise. In such a regime, fishers trust and derive benefit from sector management and management in turn is trust-worthy, consistent and able to make planning and management decisions on the basis of necessary data and information. FEWER LEK, Weather, Alerts, Emergency Contacts, Emergency Procedures, Damage Reporting and Missing Persons modules present opportunities to keep fishers and management in touch on an ongoing and as-needed basis to this end. Let's consider two examples:

5.4.1 FEWER CAP

The Common Alerting Protocol (CAP) is promoted by the World Meteorological Organization, WMO, and has been introduced into all FEWER countries. For several reasons, CAP operationalization is at different stages in these countries yet its provisions present a powerful and effective means of including small-scale fishers in the national disaster management framework. CAP not only facilitates the dissemination of uniform early warning and disaster-related messages across multiple physical channels (tv, free to air radio, feature phones, smart phones and VHF radio) but more significantly calls for an impact-based methodology for reporting on the part of the Meteorological services and disaster management agencies. In turn, this requires the implementation of risk-based assessment. The risk management chain in turn includes end users, chief amongst which in the case of the marine environment, are fishers.

Recommendation 7: Present impact-based sea state measures on maps in FEWER for intuitive, easily-consumable sea-state information *(contingent on response to Recommendation 6).*

5.4.2 FEWER LEK

In addition to the very limited geographic specificity of weather notifications within each jurisdiction, warning thresholds differ considerably from country to country. Recommended thresholds for wind speed warnings, for example, were reported to be 32 – 38 mph for Saint Lucia and 20 – 30 mph for Grenada. Wave height warning thresholds were reported to be 10 - 13 feet for Saint Lucia and 8 – 13 feet for Grenada. These considerable differences arise from a mix of differences in local bathymetry and coast line shape as well as interpretations and codification. They also highlight the critical need for local knowledge as the basis for interpretation of sea state parameters, as several expert consultations confirmed during the course of FEWER implementation.

As forecasters are generally not maritime experts, marine forecasting draws on the knowledge and skills, theory and practice, of multiple disciplines. In the case of Trinidad and Tobago, the specification of the severity of sea state parameters (Table 3) was established through MET Office-facilitated consultation with the Maritime Service Division and the Institute of Marine Affairs[5].

Fishers' local knowledge represents a key, yet untapped, input to local wave and weather forecasting verification and validation; and ultimately the provision of improved data products for the marine environment. Though the implementation of such strategies is outside the scope of this project, the FEWER local ecological knowledge (LEK) module presents an ICT channel for the provision of

structured feedback to local Met Services which ultimately is a means of strengthening fishers' resilience to weather and climate-related risks.

Recommendation 8: Expand the circle of marine forecasting knowledge sources to include small-scale fishers; and utilize the FEWER LEK module as the ICT channel for feedforward and feedback.

5.5 Sustainability

The sustainability of FEWER comprises demand-side and supply-side considerations. The latter in turn comprise externalities that are entirely outside of the scope of FEWER, as well as FEWER-specific operational costs.

5.5.1 Demand-side sustainability

Demand-side sustainability of FEWER depends entirely on the value that the application brings to fishers on a daily basis. If it is not used regularly, it will not be used or useful in times of emergencies. As a tool designed around disasters which do not happen on a regular basis, the sustainability challenge is to ensure that there is good reason for fishers to use the application suite whenever they plan to go fishing or otherwise venture to sea – each day.

Recommendation 9: Enable greater geographic specificity of sea-state information that can be incorporated into FEWER weather module.

5.5.2 Supply-side sustainability

5.5.2.1 Externalities

The overarching strategy to reduce weather- and climate-related risks for fishers is to build their **resilience**. FEWER is the information and communications technology (ICT) component of this strategy. Other key aspects of the strategy ensure fishers' understanding of risks and mechanisms for mitigation and response, enable context-appropriate reinforcement of these mechanisms, build relevant skills, and provide operational support. They also crucially call for the incorporation of fisher engagement and support into the planning and regular operations of a number of agencies, primarily fisheries authorities, fisherfolk organisations, Met services and DMAs. The sustainability of FEWER depends critically on the strength of these other aspects of resilience building.

Recommendation 10: Strengthen context-appropriate reinforcement of resilience-building strategies for fishers outside of FEWER and provide ongoing operational support.

5.5.2.2 Operational costs

The operating assumptions of FEWER are that both the use and administration of the modules are incorporated into the normal daily activities of fishers and administrators respectively. Both use and administration require effort. This is the cost of resilience. Once properly integrated, there are no incremental financial burdens on local (country) agencies. Administrator access from each country requires only a standard desk-top machine, outfitted with a web browser and reliable, high speed internet connection – the same as used for other administration functions. These are assumed to already be in place and otherwise used by the respective country and agency administrators for their regular duties. A comprehensive document outlining all requirements for regional hosting by the global administrator has been prepared and comprehensively discussed between all necessary parties. The allocation of time on the part of the administrator to administer FEWER is critical to its success. This in turn requires institutional will and the regular demand for FEWER admin reports, both features of comprehensive integration into the daily operations of FEWER agencies.

Recommendation 11: Integrate and prioritize FEWER into the regular planning and operations of fisheries authorities, MET offices, disaster management agencies and fisherfolk organisations.

In jurisdictions which support dissemination of FEWER alerts via a free Short Message Service (SMS), subscription to a software service such as Twilio is additionally required. Waivers of such costs may be negotiated at the country or regional levels. This service and the related costs are optional and not considered for the baseline nominal deployment. The relay of FEWER CAP alerts to marine band VHF radio is only assumed to be supported in jurisdictions which already have the appropriate hardware and software installed within their national CAP infrastructure. No associated costs are included in the specifications of required software and equipment for FEWER deployment.

The only sustainable financing, then, is for the state agencies to institutionalise support for FEWER as the early warning and emergency response channel for small-scale fishers in their normal operating budgets. It is recommended that this is supplemented by occasional projects and corporate social responsibility. Universal service funding for improved access to telecommunications services is also highly recommended.

Recommendation 12: Institutionalize financial support for FEWER, and apply for universal service funding for WiFi hotspots at fishing depots and landing sites; and infrastructure to provide greater coverage at sea for marine band VHF radio.

The costs of sustainability will diminish as the use of FEWER features becomes routine in the fishing industry and requires no or minimal additional effort. Occasional externally-funded projects and domestic or regional corporate social responsibility inputs are windfall gains that cannot be considered the core of sustainability. On the other hand, costs such as industry training and field extension, practice drills, and information exchange for local knowledge sharing fall within the normal operating duties and costs of fisheries authorities.

Recommendation 13: Integrate and prioritize FEWER into the regular training and informational campaigns of fisheries authorities, MET offices, disaster management agencies and fisherfolk organisations.

6. CLOSING REMARKS

FEWER, like most other facets of DRM, is not revenue-generating but a public good. Its sustainability requires state agencies engaged in DRM, non-state organisations such as the Red Cross, and private sector stakeholders such as fishing enterprises and fisherfolk organisations to institutionalise in-kind and real cost support in their normal operating budgets.

The ICT4Fisheries Consortium closes this project with a few final observations:

- In comparison to many fisheries projects FEWER accomplished quite a lot in a short space of time with limited resources;
- Like many gear and technology projects it captured the attention of a small number of early adopter fishers that are key for the diffusion of innovation;
- The weakness of fisherfolk organisations and fisheries authorities in undertaking moderately complex field extension may slow the rate of diffusion;
- Fewer requires champions in the various agencies included in the national collaborative memoranda for it to be sustained and to develop, for everyday use and not only in the hurricane season;
- FEWER requires little fisheries science or management expertise so leaders and champions can come from the fisherfolk organisations, disaster agencies or other interested parties;
- The DRM literature suggests that success in sustaining multi-level, multi-hazard early warning systems remains elusive in the region due, in part, to project dependence;
- The FEWER philosophy of integration into everyday life is critical to its sustainability, this includes the requirement for the agencies involved to insist on linking new initiatives to FEWER rather than the customary practice of abandonment and isolation due to new initiatives;
- State agencies are sometimes slow to use ICT effectively and to communicate using social media, so exposure to FEWER may assist in removing some of the organisational and individual barriers;
- There is a trend towards increasing marginalisation of the fishing industry in the FEWER countries and in the CARICOM region generally that FEWER may help counter by improving the image of the industry from stagnant and stunted to embracing technology and forward-thinking.

Appendix Scope of deliverable submission documents

A.1 D2 FEWER country reports and proposals

D2-1 FEWER country reports

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1 Introduction
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- 1.2 Document Arrangement
- 1.3 Intended Audience and Reading Suggestions

2 Approach
- 2.1 Logistics
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5 Dissemination and Communication
6 Response Capacity
7 Collaboration and Conclusions
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8 Appendices
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D2-2 FEWER country proposals

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2 Cross-cutting governance and institutional arrangements
- 2.1 Fisheries, climate adaptation and disaster management
- 2.2 Information and communications for disaster risk management
- 2.3 Summary

3 Proposed Fisheries Early Warning and Emergency Response (FEWER)
- 3.1 Risk knowledge
- 3.2 Monitoring and warning service
- 3.3 Dissemination and communication
- 3.4 Response capability

4 Risk management and sustainable financing
- 4.1 Risk management

4.2 Sustainable financing
5 Monitoring, evaluation, learning and adaptation
6 Conclusions
7 Appendices
Appendix 1. Checklist for early warning systems
Appendix 2. Sample FEWER Training Requirements

A.2 D4 Prototype EWER for Fishers (FEWER)

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   1.2 Intended audience
2. FEWER Software Components
3. Mobile Application
   3.1 Requirements
   3.2 Installation
4. Web Application
   4.1 Requirements
   4.2 Installation
5. Web and API Services
   5.1 Requirements
   5.2 Installation
6. Weather Extractors
   6.1 Requirements
   6.2 Installation

A.3 D5 Draft Manuals

Draft administrator manual

1. Background
   1.1 Small-scale fishers' vulnerabilities to hazards
   1.2 National Disaster Risk Management (DRM) framework
   1.3 Multi-agent roles in disaster management for fishers
   1.3.1 Role of fishers
   1.3.2 Role of fisheries authorities
   1.3.3 Role of fisherfolk organisations
   1.3.4 Role of meteorological services
   1.3.5 Role of disaster management agencies
   1.4 FEWER
   1.4.1 Aims
   1.4.2 Strategy
   1.4.3 Objectives
   1.4.4 Modules
   1.4.5 Administration
   1.5 Intended audience for this manual

Draft user manual

12. Can I use FEWER if I am not in a FEWER country?
13. So that's the FEWER Prototype!
14. Anything else I need to know about the FEWER Prototype?
15. Anything else I should know about Android apps?
    - 15.1 What is the Android app drawer?
    - 15.2 What is an Android launcher?
    - 15.3 What is Google Play Store?
    - 15.4 What are some other Android apps that could help me?
    - 15.5 Why do I need to use passwords?
    - 15.6 How can I remember my password?
16. Can I make FEWER better?

A.4 D6 Training

The archive of D6 submissions: report of training workshops, training materials, workshop evaluation & impact assessment tool, is organized within a nested system of folders as follows:

I. Report of Training Workshops & Participants' Evaluations
   - i. FEWER Training Report (doc)
   - ii. Participants Evaluations

II. Evaluation Instrument & Impact Assessment Tool
   - i. Training Impact Assessment Tool (doc)
   - ii. Evaluation Instruments

III. Training Materials
   - i. Training Brief (doc)
   - ii. Training Agendas
   - iii. Face to Face Workshop Materials
     1. <Country> {Grenada, Saint Lucia, St. Vincent and the Grenadines}
        a. Admin
           1 _ 2 Welcome _ Introduction to FEWER
           3 FEWER walk-through
           4 Hands-on activity with web dashboard
           5 Hands on FEWER Activities - All
           6 - Evaluation - TA, CA and AA
           7 - Hands on FEWER Activities - CG _ TA
           8 - Hands on FEWER Activities - TA
           9 - Evaluation _ End
        b. Fishers
           1 _ 2 Welcome _ Introduction to FEWER
           3 Hands-on activity with mobile phone
           4 FEWER walk-through
           5 Hands on FEWER Activities
           6 Practice using FEWER
           7 Practical Tips on Mobile Phones
           8 Evaluation _ End

Report of training workshops and participants' evaluation
Acknowledgement
List of Tables
List of Figures
Abbreviations and Acronyms
Executive Summary
1. Introduction
2. Training Methodology
    2.1 Remote Co-design Meetings
    2.2 Remote Chat Group
    2.3 Face-to-face Training Workshops
    2.4 Training Resources
3. Face-to-Face Training Workshops
    3.1 Objectives
    3.2 Schedules
    3.3 Participants
    3.4 Support Beyond Workshops
    3.5 Logistics
        3.5.1 Key Resource Persons
        3.5.2 Pre-arrival Logistics
        3.5.3 In country Logistics
        3.5.4 Modifications to Logistics
4. Reaction and Learning Assessment
    4.1 Assessment of Reaction
    4.2 Assessment of Learning
        4.2.1 Assessment on FEWER's Purpose
        4.2.2 Assessment on Identifying FEWER Modules, Icons and Role-related Functions
        4.2.3 Assessment on FEWER Agencies and their Roles
        4.2.4 Assessment on using FEWER to Perform Tasks
5. Impact Assessment

Appendix
    Appendix A Prototype Meeting Details
    Appendix B Participant Lists
    Appendix B.1. Grenada Participant Lists
    Appendix B.2. Saint Lucia Participant Lists
    Appendix B.3. St. Vincent and the Grenadines Participant Lists

A.5 D7 Final FEWER Installed and Tested

The submission for D7 "Final Early Warning and Emergency Response System, including e-services, Installed and Tested on CIRP's Infrastructure" is provided in two documents:

3. one for the application installed on the infrastructure used for development, that is to say the infrastructure of the Caribbean ICT Research Programme.
   This configuration was in effect at the end of the project life time as at that time hosting services for regional administration were not yet in place.

4. the other applicable to installation on external infrastructure and managed by the global FEWER administrator, expected to be the Caribbean Disaster Emergency Management Agency, CDEMA. *This configuration is proposed, and largely agreed, to be the means through which FEWER would be managed by the regional administrator past the lifetime of the current consultancy project.*

Both documents are structured as follows:

Contents

7. Additional Resources
8. Appendix: Overview of FEWER
    - 8.1 Module-specific Configurations
        - 8.1.1 Damage Reporting Categories
        - 8.1.2 Local Ecological Knowledge Categories
        - 8.1.3 Community Alert Groups
        - 8.1.4 Weather Extractors
        - 8.1.5 Emergency Procedures
        - 8.1.6 Emergency Contacts

A.6 D8 Final User Manuals

Global administrator manual

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    - 1.1 Small-scale fishers' vulnerabilities to hazards
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        - 1.4.1 Aims
        - 1.4.2 Strategy
        - 1.4.3 Objectives
        - 1.4.4 Modules
        - 1.4.5 Administration
    - 1.5 Intended audience for this manual
    - 1.6 Purpose and arrangement of this manual
2. FEWER Administrators
    - 2.1 FEWER country administrator
    - 2.2 FEWER agency administrator
    - 2.3 FEWER administrator scope: country vs agency
    - 2.4 Other FEWER administrators
3. The FEWER Administrators' Dashboard
    - 3.1 The Browser
    - 3.2 Accessing the administrators' dashboard
    - 3.3 How do I access the FEWER administrative features?
4. Administrative Tasks by Module
    - 4.1 Alerts
        - 4.1.1 How do I access the Alerts Module?
        - 4.1.2 What is a CAP alert?
        - 4.1.3 What is the difference between a CAP and a community-based alert?
        - 4.1.4 How do I view CAP alerts?

11.2.2 Hosting Requirements
11.2.3 Appendix I Service Dimensioning and Comparative Costing

Local administrator manual

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   - 1.1 Small-scale fishers' vulnerabilities to hazards
   - 1.2 National Disaster Risk Management (DRM) framework
   - 1.3 Multi-agent roles in disaster management for fishers
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     - 1.3.3 Role of fisherfolk organisations
     - 1.3.4 Role of meteorological services
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     - 4.1.3 What is the difference between a CAP and a community-based alert?
     - 4.1.4 How do I view CAP alerts?
     - 4.1.5 How do I create a new CAP alert?
     - 4.1.6 Are the CAP field specifications unique to FEWER?
     - 4.1.7 What is a CAP template?
     - 4.1.8 What is the Type of Message field?
     - 4.1.9 What options does the Hazard field support?
     - 4.1.10 What options does the Recommended Action field support?
     - 4.1.11 What options do the Message Priority fields support?
     - 4.1.12 What is the Time to Expire field?
     - 4.1.13 What fields are included in CAP Alert Details?

FEWER User Manual

The CRFM is an inter-governmental organization whose mission is to "Promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region". The CRFM consists of three bodies – the Ministerial Council, the Caribbean Fisheries Forum and the CRFM Secretariat. CRFM members are Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago and the Turks and

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