DFID – GFDRR Challenge Fund

PHASE II FINAL REPORT TEMPLATE: INCLUDING MONITORING SELF-ASSESSMENT
Please address the following in narrative form, as applicable, to your project.

I. Name of project, target country(ies), USD amount and time frame of Phase II grant

Project name: Open Source Weather Stations
Country: Sri Lanka
Budget: $ 150,000
Time frame: January 2017 to January 2018

II. Description of tool, approach, toolkit

a. Was it demand-led? If yes, how?

The demand for mobile weather stations goes back to 2013, when IWMI was working in Anuradhapura to calculate storage capacity of reservoirs. At that time, the Irrigation Engineer (and reservoir manager) of the Nachchaduwa tank, Mr. Prasanna, shared that one of the biggest challenges with managing reservoirs during the rainy season was that there was no information available on the volume of runoff entering the reservoir from upstream of the reservoir. In response, IWMI proposed developing and installing prototype mobile weather stations to test if it was technically possible to have devices that measure weather information at micro scale and provide information needed by the reservoir manager. Mr. Prasanna encouraged IWMI to do so, and identified locations where such devices should be installed. These initial field experiments with the prototypes demonstrated that it was possible to develop such a device, but more work needed to be done to refine the device, and to create an atmosphere of use (including technical training and policy support).

When Mr. Lasindu took over as reservoir manager from Mr. Prasanna, he reiterated the request to continue developing the devices. GFDRR funding enabled IWMI to meet the demand by developing and deploying the weathers stations:

- The GFDRR Phase I funding enabled IWMI to move beyond the prototype and create a second generation of weather stations. Six stations were assembled, activated and installed; one community of practice session was organized; and several in field training trainings were held with the reservoir manager and his staff.
- GFDRR Phase II funding enabled IWMI to do the following:
    - Upgrade the installed weather stations; organize 4 field trainings for staff that manage Nachchaduwa reservoir.
    - Due to the work in with the Nachchaduwa staff, the Irrigation Department Headquarters (Colombo) requested IWMI to organize training for irrigation field staff from Wariyapola, Puttalam, Vavuniya, Ratmalana,

Anuradhapura, Nachchaduwa, Hiriyala, and Polonnaruwa districts, which IWMI did;

b. Did you work with local beneficiaries in Phase II to develop your tool? If yes, how many local beneficiaries and how were they involved?

Phase II specifically targeted two beneficiaries, the Irrigation Department and COSTI. Both worked with IWMI in the following ways:

Irrigation Department:

- Field staff that manage the Nachchaduwa reservoir consists of Mr. Lasindu, and his team of 6-8 staff (7-9 people in total). These beneficiaries designed the metalworks for mounting the devices; provided locations for installing the devices; installed the concrete bases for mounting improved rain gauges; reported to us when there were issues with the devices; reported their experiences with using their devices; tested the devices and conducted troubleshooting independently a few times; attended all 4 field trainings; attended 1-in class meeting; and promoted their experience with their bosses at headquarters in Colombo.

- The staff at Irrigation Department headquarters in Colombo (~10 staff) worked with us to spread this technology to other field offices in Sri Lanka. The staff at HQ organized a meeting of the community of practice in March 2017; they shared information about weather stations generally; they provided their people (brought in their staff from the field offices from across the country and bore their costs of travel and accommodation).

- The staff from field offices in Wariyapola, Puttalam, Vavuniya, Ratmalana, Anuradhapura, Hiriyala, and Polonnaruwa (18 people) attended a 2-day training, which also consisted of talking about using electronic instruments in water management in general.

COSTI:

- Three COSTI staff have been active in the project through the following activities:
    - participated in trainings;
    - shared their plans for upscaling and using the devices;
    - tried to coordinate government agencies to build a centralized database of information collected from different weather stations (they call it a National Weather Observatory);
    - collected data from MET department and compared it with data from a prototype IWMI station installed at the MET department to verify information and better calibrate the stations;
    - Helped to maintain and test alternative versions of the prototype station installed at the MET department.
    - coordinated bids for the government for these types of devices.

- Established an online innovation discussion board for discussing new technological ideas for solving data problems.

In addition, we have had a recent breakthrough with the Met Department, through our relationship with COSTI. The Met Department requested COSTI to install a weather station in their office, so that they can use the device as an educational tool, and to compare the data collected by the device to rainfall data collected through WMO-certified devices. The Met department is now hosting one of IWMI's stations at their HQ to support the verification and validation by comparing station data with met data to better understand accuracy of their devices.

c. What is 'new'? In other words, what did Challenge Fund monies support in Phase II?

- The big 'new' is that the headquarters of the Irrigation Department got involved in Phase II, after hearing about the work that was being done around the Nachchaduwa tank in Phase I. HQ wanted IWMI to spread the technology to other parts of Sri Lanka, and nominated its staff to attend the training. Apart from the engineer of the Nachchaduwa tank, 18 other irrigation engineers from Wariyapola, Puttalam, Vavuniya, Ratmalana, Anuradhapura, Hiriyala, and Polonnaruwa attended the two-day training that was organized by IWMI and funded by the GFDRR Phase II project.
- A media visit was organized in May 2017; a field trip was organized for journalists from leading Sri Lankan papers. Articles about the GFDRR project appeared in several major newspapers, which also helped to get the word about the devices around.
    - http://dailynews.lk/2017/05/03/features/114789/better-handling-bad-weather
    - http://g9jzk5cmc71uxhvd44wsj7zyx.wpengine.netdna-cdn.com/wp-content/uploads/2015/03/Virakesari_Tamil_May_9.jpg
    - http://ravaya.lk/?p=168081
    - http://allasiaweb.com/?p=1205
    - http://www.dailymirror.lk/article/Flooding-can-be-MINIMISED-through-technology-134066.html
- The Met Department contacted COSTI to have a weather station installed in their premises in Colombo for piloting and data calibrating purposes. COSTI requested IWMI to assist them; and IWMI and COSTI installed a weather station at the Met Department in November 2017; and then upgraded it in December 2017. This station has become a prototyping station, where new sensor options and technological upgrades are tested. IWMI and COSTI continue to visit this station at least once per month. COSTI and the Met Department are collecting data from this test weather station to compare it to other standardized rain gauges.
- With experience from Phase I, in Phase II all weather stations were fitted with improved rain gauges and electronic parts; the maintenance and repair manual

was updated; alternative designs of the devices were tested; an online discussion board was created, and the online knowledge platform was updated.

- Data from three IWMI stations has been made to report to a server at IWMI, and the data from the stations is now publically availableonline. Please go to the site: http://www.iwmi.cgiar.org/resources/mobile-weather-stations/ and click on the green button that says "Online Data Repository".

d. How does it support risk identification and decision-making?

The purpose of the device is to send an alert to the reservoir manager of the Nachchaduwa tank via SMS when rainfall exceeds 10mm/hr, to increase response time for making a management decision. The early warning on estimated rainfall in the basin helps managers prepare the tank to minimize the impact of a flood. The weather stations also store data on a micro SD card, so that data for longer term planning is also available.

One of the important changes has been that the irrigation department staff have seen evidence of cheaper viable solutions to have access to weather data, and that these solutions can be owned and operated in-house. In the event the irrigation department decides to contract out the installation and maintenance of such gadgets (as it has in the past), they are now better trained to make procurement and ordering decisions.

e. Describe the degree to which it is openly-available and how users can access it.

The process for assembling, activating, installing, programming, mounting, repairing and maintaining the devices is available on IWMI's website, and can be assessed by everyone (http://www.iwmi.cgiar.org/resources/mobile-weather-stations/). All parts used to build the devices are open-source and can be purchased locally and on online stores. All software is also available on IWMI's website. The website also hosts a discussion board to help practitioners share experiences and discuss ideas.

f. Discuss how it enables (or will enable) users to make more effective disaster management and resilience decisions.

At the request of the Nachchaduwa reservoir managers, the weather stations are programmed to send a text message to the managers' cellphones when rainfall exceeds 10mm/hr upstream of the reservoir. This provides the manager with an estimate of the volume of water that would enter the reservoir. The reservoir manager has a bathymetry model of the reservoir; knowing the volume of water would allow the reservoir manager to estimate whether these is enough capacity in the reservoir to accommodate the expected runoff. If there isn't, then the reservoir manager can release the sluice gates to release water in a controlled manner and make storage space for the anticipated runoff. In addition, the devices contain micro SD cards that store weather data; and analysis of this data can improve projections into the future for better management.

III. Description of partnerships (active in Phase II, but which could have started in Phase I), in particular those involving local partners.

Did you work in partnership(s) with a local partner(s)? If yes, please provide the name(s) of the local partner(s) and the nature/strength/sustainability of the partnership.

We have worked in partnership with the Irrigation Department at Nachchaduwa and at their HQ; and COSTI in Phase II, building on the work that we did in Phase I.

- Irrigation Department:
  - The field office at the Nachchaduwa reservoir is an implementation partner; they have been troubleshooting and repairing the weather stations on their own, in addition to seeking IWMI's expertise on such issues.
  - Most importantly, they have been communicating with HQ in Colombo about the project and its developments.
  - HQ has upscaled the technology to other field offices; the headquarters asked IWMI to conduct a technical training for staff from other field offices as well. HQ instructed field offices to select members of their staff, and bore the costs of their travel, accommodation, and time to send them to a 2-day training organized by IWMI in November 2017. The staff selected for this training were technical, and all had a background in using electronic equipment. Irrigation Engineers from Wariyapola, Puttalam, Vavuniya, Ratmalana, Anuradhapura, Nachchaduwa, Hiriyala, and Polonnaruwa districts attended the two day training.
  - After the training, field offices of Puttlam, Vavuniya and Ratmalana have made budgetary requests to HQ, so that they may buy parts and install devices to support water management. HQ is working with the field staff to grant these budgetary requests.
  - The HQ of the Irrigation Department have emerged as a strong policy and implementation partner, who have demonstrated that they would like to create a friendly environment for using such devices in water management even without the presence of IWMI. We think that one additional training for the same staff that attended the November training would exponentially contribute towards such sustainability.

- COSTI
  - COSTI has emerged as a strong knowledge and policy partner
  - They have brought IWMI and MET closer, as described above.
  - COSTI has been working on the idea of creating a National Weather Observatory. They have requested that IWMI be a knowledge partner to COSTI to expedite the implementation of such a program.
  - This is a string partnership, because COSTI has a strong -pen-source mandate; for example; COSTI is issuing tenders to private companies on behalf of the NBRO to install weather stations for testing, so that the NBRO can identify suitable models for deploying in areas prone to landslides.

- MET Department: they are emerging as a policy partner, because they are using an IWMI weather station to compare data between WMO and Open source devices. This is a new,

and developing knowledge partnership. The Met Department would be the ideal agency for weather monitoring, and a policy partner for disaster management.

- Lanka Rainwater Harvesting Forum; A&T Labs; University of Moratuwa; IHE—SUPSI continue to remain knowledge partners, and have also developed relationships between themselves. For example, A& T labs is now supporting LRWHF to troubleshoot their weather stations. LRWHF is working on their 5th and 6th phase of weather stations, with independent funding and development. A & T labs are an important source for low-cost weather stations in Sri Lanka; they have successfully bid on tenders issued by the national government.

IV. Description of capacity building of local stakeholders.

Did you conduct training in Phase II for local communities or beneficiaries in the use of your tool? If yes, please describe the type of the training and the number/type of beneficiaries trained. Did you measure change in knowledge as a result of your training? If yes, please provide results. Did you follow up in any way after the training to see if what you discussed was put into practice? If yes, please explain.

Phase II focused on repeated trainings—both formal and in field—to increase the probability of uptake.

In Phase II, 4 in-field trainings with staff that manage the Nachchaduwa reservoir took place; Mr. Lasindu and his team of 6-8 people were repeatedly trained on the devices in field conditions.

- These training focused on repair and maintenance; troubleshooting, replacing parts and battery issues.
- To see if the training was put to practice, we left a set of instructions on how to reset devices in the event of a power failure. The field staff managed to reset two devices on their own after the batteries were depleted following a long period in which solar power could not be generated.

One in-class training was organized in November 2017. This was done in-response to a request by the Irrigation Department Headquarters that staff from other districts of Sri Lanka also be trained in this technology. HQ received positive feedback from staff involved in the pilot project in Anuradhapura, and made a decision to extend this knowledge to other field staff from other districts. HQ instructed field offices to select members of their staff, and bore the costs of their travel, accommodation, and time to send them to a 2-day training organized by IWMI in November 2017. The staff selected for this training were technical, and all had a background in using electronic equipment. Irrigation Engineers from Wariyapola, Puttalam, Vavuniya, Ratmalana, Anuradhapura, Nachchaduwa, Hiriyala, and Polonnaruwa districts attended the two day training. In addition to the engineer from the Nachchaduwa tank (1), 18 other engineer staff members were trained.

- The training was around assembling, activating, installing, programming, maintaining and troubleshooting devices

- The 19 trainees were organized into 5 groups of 4, and were provided with all parts, codes and computers.
- To test if the training was well received, we gave trainees a programming test during the training; each group was asked to alter a sample program themselves to produce a specific results, which they were able to do. We also altered the device and created a glitch, and asked them to troubleshoot it, which they were able to complete. All groups built the device completely themselves.
- The success of the training can be seen in Vavuniya, Ratmalana and Puttlam; all three trainees have requested budgetary allocations from HQ, who is working with them to accommodate these requests. In Anuradhapura, Mr. Lasindu has replaced the solar charger on one of the weather stations himself.

V. **Did you leverage private or public sector resources**? If yes, please describe the source of the leverage as well as the total USD amount of combined cash and in-kind contributions. If relevant, please describe the nature of your relationship with the source(s) of leverage.

While it is difficult for us to assign dollar values, we have listed the types of in-kind contributions that we have received from the public sector:

- Irrigation department:
  - travel and accommodation for field staff to attend November training;
  - Organized a community of practice meeting in March 2017 at headquarters in Colombo;
  - Steel structures for mounting the devices around Nachchaduwa were fabricated by the Irrigation Department in their workshops;
  - Electricians for the electric work were supplied by the irrigation department
  - Field staff were provided to accompany IWMI team when we were in the field;
  - The Irrigation Department provided vans for transporting weather stations and metal works around the reservoir;
  - Concrete works for installing the upgraded rain-gauges were undertaken by the irrigation staff; they hired a firm to do this.
- MET department:
  - provided space to host IWMI device
  - are comparing WMO weather data to weather stations data to calibrate the instrument
- Lanka Rainwater Harvesting Forum:
  - contributed to one in-field training and the classroom training in November; staff were co-trainers.
- IHE—SUPSI:
  - installed software on IWMI computers so that data from weather stations can be shared between the GFDRR project server and the server of the 4ONSE project.
- COSTI:
  - Cross-hosting IWMI's knowledge platform on COSTI's platform called IdeaBoard
  - Connected IWMI to the Met Department
  - Are comparing WMO weather data to IWMI weather stations data at the Met Department to calibrate the instrument

VI. How did your project consider gender in any aspect of project planning or implementation? Was a gender analysis or assessment conducted? If yes, did your project address any gap identified in the assessment? If yes, please describe how. All Phase II projects are required to integrate gender into their work. *Please use what you wrote in your inception report on gender as the starting point for this section.*

Reservoirs are the main form of water supply in the north and north-central provinces of Sri Lanka. These reservoirs are maintained at full capacity, to ensure that enough water is available for irrigation and drinking. In December 2014, an extreme rainfall event led to the Nachchaduwa reservoir in Anuradhapura district spilling over and flooding the downstream area. To contain damages, the reservoir manager breached the irrigation channel downstream. Eight villages were affected due to this flooding event.

A community-level assessment was undertaken to understand the hardships faced by the local communities in the aftermath. Four villages were randomly selected for community consultations (Ashokaramaya, Nuwarawewa, Mahenelubewa, Madawalosamn). These villages were rural, with agriculture a major economic activity. Paddy cultivation was common, but vegetables were also cultivated for consumption and sale. In each selected village, a group of 15-20 adult individuals was convened, with women comprising 50% of each group. In each of the four villages, a majority of households were temporarily displaced temporarily for 14-31 days.

1. Respondents from all four villages reported that after returning to their dwellings, their households had to temporarily rely on coping strategies such as eating lower quality rice, or reducing consumption of vegetables. This is because incomes were compromised; males and females were not able to seek casual wage employment for about a month after the floods and cultivation was also not possible until flooded agricultural land had drained. Research conducted by Harris-Fry et al., 2017 and Hadley et al., 2008 demonstrate that when households are food insecure and have to lower quantity or quality of food consumption, scare resources are disproportionately allocated to males; and females take on a disproportionate burden of bearing such coping strategies.

2. An important challenge reported by almost all women present at each of the four consultations was the loss of privacy and security at the camp while waiting for the water levels to recede. This was especially the case while accessing toilets during the evenings and night times, with women reporting to wait until morning to access toilets. Males did not report having to wait until daylight hours to use toilets. Stomach infections were a common occurrence after the floods, further adding to the distress of people, especially women.

3. Another important hardship identified through these consultations was access to schools. The floods took place over the New Year between 2014 and 2015, during school holidays. However, villages continued to be inundated after the school term resumed. Families that had relocated to camps were further away from their schools. Respondents reported making their children—especially female children—skip school due to the longer commuting time, until the family moved back to its home in their village.

Respondents were asked what measures could be taken to improve management during the flood season. A popular response was greater advance warning. Respondents reported that for the 2014 flood, police forces used loudspeakers only 3-4 hours before the village was inundated to advise people to move. When asked whether respondents would benefit from receiving alerts via text message in addition to the loudspeaker announcements, all respondents agreed.

An FAO study from 2016 notes that around 73% of rural males and 67% of rural females own a phone, with ownership higher among younger men and women. In that regard, the mobile weather stations are a handy device. If the Disaster Management Committee were to coordinate with the Irrigation Department at Anuradhapura, they would be able to send text messages to people living in vulnerable areas and provide a few additional hours of time.

This information has been shared via fax with the following individuals, increase awareness of how males and females are differently affected by a disaster, and to demonstrate that there is a demand at the civilian level for an advance warning system.

- Eng. Palugaswewa, Director of Irrigation (Water management and Training) , Department of Irrigation, Colombo
- Eng. K. K. A. Piyasena, Director of Irrigation (Information and Communication Technology), Department of Irrigation, Colombo
- Eng. W. M. P. De Silva, Director of Irrigation (Anuradhapura)
- Eng. P.U.K. Thilakarathna, Divisional Irrigation Engineer (Anuradhapura)
- Eng. L. Kotawila Arachchi, Divisional Irrigation Engineer (Nachchaduwa)

References:

Harris-Fry, H., Shrestha, N., Costello, A., Saville, N.A. 2017. Determinants of intra-household food allocation between adults in South Asia-A systematic review. International Journal for Equity in Health, Vol. 16: 107.

Hadley, C., Lindstrom, D., Tessema, F., Belachew, T. 2008. Gender bias in the food insecurity experience of Ethiopian adolescents. Social Science and Medicine, Vol.66: 427.

VII. Discussion of how tool or approach can be brought to scale in the future.

The Irrigation Department has already taken this to scale. The Irrigation Department in HQ requested IWMI to organize a training for field staff from several districts, beyond Anuradhapura. It appears that HQ received positive feedback from staff involved in the pilot project in Anuradhapura, and made a decision to extend this knowledge to other field staff from other districts. HQ instructed field offices to select members of their staff, and bore the costs of their travel, accommodation, and time to send them to a 2-day training organized by IWMI in November 2017. The staff selected for this training were technical, and all had a background in using electronic equipment. Irrigation Engineers from Wariyapola, Puttalam, Vavuniya, Ratmalana, Anuradhapura, Nachchaduwa, Hiriyala, and Polonnaruwa districts attended the two day training. After the training, the irrigation engineers from Puttlam, Ratmalana and Vavuniya have made a budgetary request to HQ in Colombo to install devices for water management, and the HQ is working with them to grant these requests.

COSTI has been our knowledge partner through the project. They have recently placed a tender on behalf of the NBRO to invite private companies that build weather stations to install demonstration gadgets for the NBRO. 4 contracts have been made, to test several alternative designs, so that the NBRO may identify a model for deployment in landslide prone areas in Sri Lanka

In addition, we are aware of the following organizations that are also using weather stations, many of whom have used IWMI materials at early stages of development

- Sri Lanka: A&T labs have successfully won government bids to install weather stations
- Pakistan (UNESCO-IHE): flood monitoring along the Indus in Punjab
- Solomon Islands (UNDP): weather monitoring
- Vanuatu (Ministry of Agriculture): monitoring weather
- Togo (Red Cross/ Red Crescent Climate Change): monitoring rainfall; research purposes
- Haiti (Ecole Supérieure d'Infotronique d'Haïti): education and research
- USA (World Wildlife Fund): reporting on weather options available locally in Sri Lanka
- Canada (Farmer's Edge): monitoring soil moisture
- Japan (International Centre for Water Hazard and Risk Management): research and education on climate change
- Bhutan (Mountain Hazelnut Venture Pvt. Ltd.): weather monitoring

VIII. What were main points of learning from this phase of the project?

Technically: Field-proofing of the weather stations is a larger undertaking than initially expected. Apart from various animals and insects which can disturb the operation, we found it difficult to ensure a reliable and good quality power source, and regulation of it thereof. Electronic glitches also created occasional false readings. We initially thought that heat within the box was making the electronics reach their designed upper temperature of operation (50-60 degrees Celsius), but it turned out to be caused by induced current from power spikes in the power supply sub-system. The open-source circuit boards were not designed for this. This problem was resolved by adding additional capacitance and voltage regulation to the electronics. These changes are documented with the system.

Sustainability and entrepreneurship: Once users have reach a certain level of understanding of the internals, sourcing, operation and maintenance, they take over the technology and move on according to their need and funding (i.e. LRWHF). On the other side, start-ups find a new niche in the market (A&T Labs) by lowering the market cost of entry-level weather stations in Sri Lanka, driving the market to lower prices, while improving the technical specifications of the products proposed at given price steps. Actual entry price for weather stations in Sri Lanka has halved from 2014 (was 200K LKR is now 70K LKR).When enterprises enter the game; open source may become proprietary. While this not necessarily a problem, in that it does still benefit society through greater competition and lower prices, new developments are not openly accessible.

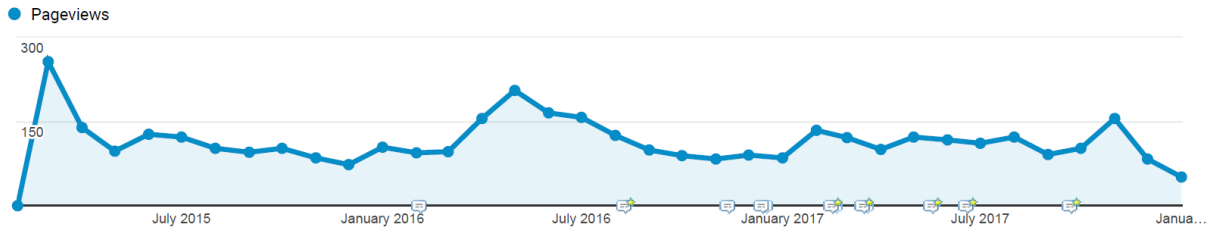
Institutional learning: Training must happen across the entire institution managing the devices. Staff of the ID often change locations, which can result in loss of knowledge and capacity locally. Incoming staff are not adequately informed of the stations, or operations and maintenance of those stations. This problem can be solved if technical and training staff across the entire institution are informed and trained, so that the institution has as a whole has capacity to manage the technology and train its own staff. Significant time must be invested in capacity-building over many years before the institution feels comfortable enough to manage the devices themselves. Regular maintenance schedules must also be a part of institutional policy.

IX. Additional Monitoring Data regarding Tool Uptake

a. Is your tool openly available to the broader user community? If yes, please provide the name of the platform.

The tool is made from open source hardware and open source software; all materials may be downloaded at: http://www.iwmi.cgiar.org/resources/mobile-weather-stations

b. How many downloads of your tool have occurred throughout both Phase I and Phase II? How is this being measured?



Page	Source / Medium	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances	Bounce Rate	% Exit	Page Value
		5,904 % of Total: 0.48% (1,241,536)	4,832 % of Total: 0.48% (1,010,341)	00:02:31 Avg for View: 00:02:06 (19.42%)	2,560 % of Total: 0.46% (555,073)	66.67% Avg for View: 7.07% (842.46%)	49.56% Avg for View: 44.71% (10.85%)	$0.00 % of Total: 0.00% ($0.00)

There have been 4,832 unique page views since the start of the GFDRR project. We don't know how many downloads have occurred.

	Page	Country	Pageviews ▼	Pageviews ▼
			5,902 % of Total: 0.48% (1,241,536)	5,902 % of Total: 0.48% (1,241,536)
1.	/resources/mobile-weather-stations/index.php	United States	1,672	28.33%
2.	/resources/mobile-weather-stations/index.php	Sri Lanka	1,140	19.32%
3.	/resources/mobile-weather-stations/index.php	India	363	6.15%
4.	/resources/mobile-weather-stations/index.php	Germany	169	2.86%
5.	/resources/mobile-weather-stations/index.php	France	160	2.71%
6.	/resources/mobile-weather-stations/index.php	Italy	135	2.29%
7.	/resources/mobile-weather-stations/index.php	Mexico	135	2.29%
8.	/resources/mobile-weather-stations/index.php	United Kingdom	118	2.00%
9.	/resources/mobile-weather-stations/index.php	Brazil	76	1.29%
10.	/resources/mobile-weather-stations/index.php	Vietnam	76	1.29%
11.	/resources/mobile-weather-stations/index.php	Spain	68	1.15%
12.	/resources/mobile-weather-stations/index.php	Kenya	68	1.15%
13.	/resources/mobile-weather-stations/index.php	New Zealand	68	1.15%
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16.	/resources/mobile-weather-stations/index.php	Egypt	59	1.00%
17.	/resources/mobile-weather-stations/index.php	Japan	59	1.00%
18.	/resources/mobile-weather-stations/index.php	Philippines	59	1.00%
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22.	/resources/mobile-weather-stations/index.php	Netherlands	51	0.86%
23.	/resources/mobile-weather-stations/index.php	Peru	51	0.86%
24.	/resources/mobile-weather-stations/index.php	Pakistan	51	0.86%
25.	/resources/mobile-weather-stations/index.php	Australia	42	0.71%

26.	/resources/mobile-weather-stations/index.php	Switzerland	42	0.71%
27.	/resources/mobile-weather-stations/index.php	Singapore	42	0.71%
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31.	/resources/mobile-weather-stations/index.php	China	34	0.58%
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37.	/resources/mobile-weather-stations/index.php	Ecuador	25	0.42%
38.	/resources/mobile-weather-stations/index.php	Ghana	25	0.42%
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40.	/resources/mobile-weather-stations/index.php	Jordan	25	0.42%
41.	/resources/mobile-weather-stations/index.php	South Korea	25	0.42%
42.	/resources/mobile-weather-stations/index.php	Malaysia	25	0.42%
43.	/resources/mobile-weather-stations/index.php	Oman	25	0.42%
44.	/resources/mobile-weather-stations/index.php	Taiwan	25	0.42%
45.	/resources/mobile-weather-stations/index.php	Tanzania	25	0.42%
46.	/resources/mobile-weather-stations/index.php	Argentina	17	0.29%
47.	/resources/mobile-weather-stations/index.php	Austria	17	0.29%
48.	/resources/mobile-weather-stations/index.php	Costa Rica	17	0.29%
49.	/resources/mobile-weather-stations/index.php	Ethiopia	17	0.29%
50.	/resources/mobile-weather-stations/index.php	Hong Kong	17	0.29%
51.	/resources/mobile-weather-stations/index.php	Haiti	17	0.29%
52.	/resources/mobile-weather-stations/index.php	Laos	17	0.29%
53.	/resources/mobile-weather-stations/index.php	Libya	17	0.29%
54.	/resources/mobile-weather-stations/index.php	Myanmar (Burma)	17	0.29%
55.	/resources/mobile-weather-stations/index.php	Norway	17	0.29%
56.	/resources/mobile-weather-stations/index.php	Somalia	17	0.29%
57.	/resources/mobile-weather-stations/index.php	Yemen	17	0.29%
58.	/resources/mobile-weather-stations/index.php	Zambia	17	0.29%
59.	/resources/mobile-weather-stations/index.php	Belgium	8	0.14%
60.	/resources/mobile-weather-stations/index.php	Burundi	8	0.14%
61.	/resources/mobile-weather-stations/index.php	Chile	8	0.14%
62.	/resources/mobile-weather-stations/index.php	Cameroon	8	0.14%
63.	/resources/mobile-weather-stations/index.php	Cyprus	8	0.14%
64.	/resources/mobile-weather-stations/index.php	Czechia	8	0.14%
65.	/resources/mobile-weather-stations/index.php	Faroe Islands	8	0.14%
66.	/resources/mobile-weather-stations/index.php	Indonesia	8	0.14%
67.	/resources/mobile-weather-stations/index.php	Iran	8	0.14%
68.	/resources/mobile-weather-stations/index.php	Cambodia	8	0.14%
69.	/resources/mobile-weather-stations/index.php	Lebanon	8	0.14%

70.	/resources/mobile-weather-stations/index.php	Latvia	8	0.14%
71.	/resources/mobile-weather-stations/index.php	Poland	8	0.14%
72.	/resources/mobile-weather-stations/index.php	Romania	8	0.14%
73.	/resources/mobile-weather-stations/index.php	Russia	8	0.14%
74.	/resources/mobile-weather-stations/index.php	Saudi Arabia	8	0.14%
75.	/resources/mobile-weather-stations/index.php	Swaziland	8	0.14%
76.	/resources/mobile-weather-stations/index.php	Tunisia	8	0.14%
77.	/resources/mobile-weather-stations/index.php	Ukraine	8	0.14%

In 2017, 28% of our page views were from the US, while 19% were from Sri Lanka. Individuals from 77 countries have visited the website.

c. How many decision makers have accessed your tool throughout Phase I and Phase II? Of these, how many access your tool on a regular basis? How is this measured? (it can be through conversations, email, direct observation or another way)

Around 4,832 unique views have been made, while the total number of views is 5,904. The devices installed by IWMI were accessed directly by 5 decision-makers (field staff for the Nachchaduwa reservoir). Many more have made planning decisions concerning the devices at Irrigation Department Headquarters, several regional offices, and at the MET department and COSTI. In addition, we are aware of the following who have used our materials over the course of the project:

- Sri Lanka: A&T labs have successfully won government bids to install weather stations
- Pakistan (UNESCO-IHE): flood monitoring along the Indus in Punjab
- Solomon Islands (UNDP): weather monitoring
- Vanuatu (Ministry of Agriculture): monitoring weather
- Togo (Red Cross/ Red Crescent Climate Change): monitoring rainfall; research purposes
- Haiti (Ecole Supérieure d'Infotronique d'Haïti): education and research
- USA (World Wildlife Fund): reporting on weather options available locally in Sri Lanka
- Canada (Farmer's Edge): monitoring soil moisture
- Japan (International Centre for Water Hazard and Risk Management): research and education on climate change
- Bhutan (Mountain Hazelnut Venture Pvt. Ltd.): weather monitoring
- COSTI is cross-hosting our website
- The Irrigation Department in Sri Lanka is also using materials on our website. 19 staff members have used these materials.

Because it is open, we are likely underestimating the number of people how have viewed and used the weather stations.

d. Have any policies, plans or investments been informed/influenced by your tool? If yes, please provide a bit more detail on how your tool has informed/influenced investment/policy/plans; if possible, provide USD amounts of local budgetary changes or other investments. If the influence was policy-based, please describe the policy change your tool informed. If the influence was in planning, please provide detail.

Yes, investments have been influenced by the tool. After the November training, staff from Puttlam, Vavuniya and Ratmalana have made budgetary requests to HQ for purchasing parts, installing stations and using these devices in water management. HQ is now working with these field offices to grant the budgetary requests.

We are informed by COSTI that the Met department is looking into making a budget for assembling and deploying few hundred low cost units for an educational/civic technology project in schools. The DG of the Met Department is interested in this solution in terms of price efficiency and its educational side not only for climate education but also for technical education.

COSTI is making tenders on behalf of NBRO, and is inviting private companies that build weather stations to install demonstration gadgets for the NBRO. Four contracts have been made, to test several alternative designs, so that the NBRO may identify a model for deployment in landslide prone areas in Sri Lanka

e. Was your sustainability goal for the project achieved? Please provide the metric used and explain the results achieved.

We are very close to the project being sustained as far as the Irrigation Department is concerned, in the light of the budgetary allocations being made. We think that an additional in-class training for the same staff that attended the training in November would be appreciated by the irrigation Department. Another meeting of the community of practice, some additional technological test and upgrades, and field support for the Nachchaduwa staff would also help the sustainability of the project.

With respect to COSTI, the project has achieved sustainability in the sense that there is an institutional push to improve take-up. COSTI is working with the Met Department and the NBRO to usher in the use of these devices. Given COSTI's open source mandate, they remain committed to building a National Weather Observatory. However, COSTI still requests support in the form of additional tests and adjustment to the stations.

Knowledge partners such as the Lanka Rainwater Harvesting Forum, A& T Labs and the University of Moratuwa are independently working with such devices for research and commercial purposes.

f. Do you have an exit strategy for your project? If yes, please explain.

COSTI has set up its own innovation platform (IdeaBoard). IWMI's website is mostly self-sustaining, will continue to be updated as needed, and the discussion board will also continue to be available. The Irrigation Department is nearly at the point that it can manage the continued development and deployment of similar devices themselves.We think an additional training would be the perfect exit strategy because it would help to more firmly institutionalize the technical knowledge into Irrigation Department staff. There are many organizations—Lanka Rainwater, A&T Labs and others—who are now more than able to offer such services to others.

X. Please detail how the budget was spent through the course of phase II?

	GFDRR Funding	*In kind Funding*	*Other Funding*	**Total Funding**
CONSULTING SERVICES (fees, travel, per diem) Description: this consists of the salaries of staff and consultants.	**85,950**			85,950
TASK TEAM SUPERVISION (fees, travel, per diem) This consists of our overheads.	**15,000**	7,000[1]		22,000
DISSEMINATION (Translation, editing, publication, etc.) Description: here we include printing and publication; building an online knowledge platform (website) for dissemination; and knowledge sharing activities with global knowledge partners; attending CGIAR platform for Open Source Data to introduce weather stations	Printing/publishing: 2,000 Online platform (website): 5,500 Knowledge sharing activities: 13,600 **21,100**			21,100
LOGISTICS (Training, workshops, consultations, etc.) Description: this includes training of SL officials in various agencies; workshops and consultations with stakeholders in Sri Lanka	Training of officials (in house, in field): 10,000 Workshops and consultations with SL stakeholders: 5,000 **15,000**	3,000[2]		18,000
GOODS AND WORKS Description: this includes the cost of the mobile weather stations' components as well as the costs of spares that were shared with the Irrigation Department Officials	**10,000**	5,000[3]		15,000
OTHER Description: here we include the CGIAR Levy (2%) which IWMI is required to pay to the Consortium Office. This is not an IWMI overhead. It is calculated as 2% of the sum of all the other costs above.	**2,950**		650,000[4]	652,950

[1] Estimated in-kind funding that came from the Irrigation Department in Sri Lanka, who provided field staff and pickup for transporting metalwork

[2] Estimated in-kind funding that came from the Irrigation Department in Sri Lanka, who bore the accommodation, travel and time-costs of 19 officers attending a 2-day training session organized at IWMI HQ.

[3] Estimated in-kind funding that came from the Irrigation Department in Sri Lanka, who provided all metalwork and fabrication services

[4] This is the budget of the 4 TIMES OPEN & NON-CONVENTIONAL TECHNOLOGY FOR SENSING THE ENVIRONMENT project (4ONSE), led by the Institute of Earth Sciences—SUPSI and the University of Moratuwa, with Irrigation Department as a project partner. None of this money accrues to IWMI. The deliverables of the GFDRR Phase II project are NOT dependent on those of the SUPSI project. The SUPSI project staff have installed software on IWMI machines to facilitate data exchange in the future. We include this funding in the table, to demonstrate the demand for this type of action-research around weather stations.

Sub total				
Total	**150,000**	15,000	650,000	815,000

XI. Please attach any additional project related documents you may have to the final report.

PRESS COVER

Please look at: http://www.iwmi.cgiar.org/resources/mobile-weather-stations/ and click on the "Media Coverage" tab for links to all new and media articles.

ONLINE RESOURCES

General

- http://www.iwmi.cgiar.org/resources/mobile-weather-stations/ - The home page for IWMI's mobile weather stations, containing technical manuals, maintenance manuals, presentations, news articles, links to the code, and a discussion board to discuss experiences.
- https://www.arduino.cc – Arduino homepage where Arduino products, software, information, tutorials, and examples can be found.
- https://github.com/YannChemin/MWS - location of latest versions of weather station code and field experiences
- https://wiki.osgeo.org/wiki/Open_Monitoring_Systems_Working_Group - wiki page for the Open Monitoring Systems Working Group for links to more information to similar developments

Component Suppliers

Sri Lanka Electronics Stores

- http://atlabslanka.com/web/ - Local supplier of weather stations, adapted from IWMI's weather stations.
- http://www.lankatronics.com/ - Dehiwala
- https://www.arduino.lk/ - Homagama
- http://www.senith.lk/ - Borella
- http://scionelectronics.com/ - Malabe
- Unitech Trading – 15 1st Cross Street, Colombo-11, Pettah

International

- https://www.arduino.cc – official Arduino site sells Arduino products

- https://www.sparkfun.com/products/13956 - supplier of weather shield that has been used in IWMI's weather stations. They also supply weather meters, gps receivers, data loggers, and much more. Links to libraries are also available from their product descriptions.
- https://www.aliexpress.com/ - online retail aggregator, where just about anything can be found, including data loggers, solar chargers, Arduino boards, sensors, etc. For example, a search for openlog data loggers provides many results: https://www.aliexpress.com/wholesale?catId=0&initiative_id=SB_20171106071558&SearchText=openlog+data+logger