Final Report

Towards operational hydrological forecasting in Botswana

A capacity building cooperation

Partner Driven Cooperation between the Botswana Department of Water Affairs, the Botswana Department of Meteorological Services and the Swedish Meteorological and Hydrological Institute

26 May 2014

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EXCECUTIVE SUMMARY

This cooperation aimed to improve the capability of the Botswana Department of Water Affairs (DWA) to provide hydrological forecasting and water-related warnings for the territory of Botswana. This was pursued through capacity building at DWA and included enhanced collaboration with the Botswana Department of Meteorological Services (DMS). Cooperation activities focussed around three key areas for development: 1) DWA Forecasting Routines, 2) Data and IT, and 3) Hydrological Forecasting. The partners were DWA, DMS and the Swedish Meteorological and Hydrological Institute (SMHI).

Hydrological modelling capability at DWA has increased and there is better understanding how to apply it to areas of the country subject to quickly occurring rainfall and subsequent flooding situations. Standard operating procedures and simple checklists have been established to routinely ensure that important tasks are consistently performed, which ensures better quality and expediency for issuing warnings where appropriate. Communication between DWA (water) and DMS (meteorology) has improved, including better access of data and forecasts from DMS to DWA. These developments contribute directly toward improving DWA's possibility to react to severe weather situations

As it was estimated that some four years of development would be required, the project is just the first step in establishing operational hydrological forecasting in Botswana. However, there is unfortunately no sign that cooperation between SMHI and DWA will continue. Although both parties are interested in continuation, adequate financial means to do so have not been found.

These activities benefit the people of Botswana by improving information and preparedness for assessing hydrological conditions.

Anna Johnell – SMHI Project Manager

George Thabeng – DWA Project Manager

PURPOSE AND OBJECTIVES OF THE PROJECT

The *overall objective* was to contribute to development, welfare, health and social life in Botswana by enhancing the capability of the Department of Water Affairs to provide better hydrological monitoring and forecasting services for community planning, safety and protection of the environment.

The *specific objective* was to strengthen capacity at DWA in its role as the national service in Botswana for hydrological monitoring, forecasting and warnings, and provider of future hydrological outlook services to both public and private sectors.

This benefits the citizens of Botswana by providing up-to-date information on present and future hydrological conditions so that they can plan and manage related activities, such as agriculture, livestock, water supply and tourism, during both normal and disaster conditions.

SMHI with its experience within both meteorology and hydrology has acted as a catalyst and mentor organization to provide training and improve operational dialogue between DWA and DMS.

PROJECT APPROACH AND DESIGN

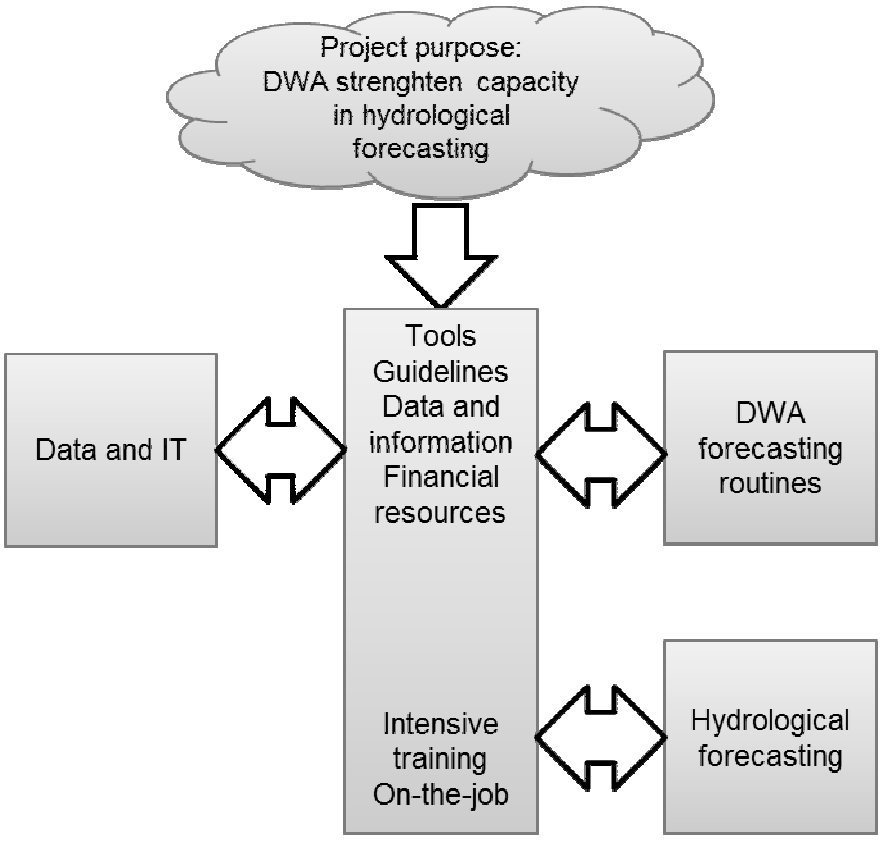
The activities carried out within this cooperation focussed on building capacity at DWA toward providing up-to-date hydrological information and forecasts for use by both internal and external DWA stakeholders. Enhanced communication and data sharing between DWA and DMS was an integral feature of the cooperation. DWA, SMHI and DMS worked together to: 1) establish the structure and procedures necessary, 2) incorporate the data needed and IT support to make this happen, and 3) proceed with identifying and setting up appropriate models and tools for hydrological forecasting.

With this in mind, activities were organised under three work themes. Relevant training to build capacity at DWA was included under each theme within formats applicable to the specific tasks. The project work themes were:

1) DWA Forecasting Routines
2) Data and IT
3) Hydrological Forecasting

This project has followed a focused approach around the three work themes. As much was unknown at the onset of project activities, a high level of flexibility was an important aspect and adjustments were made as needed in cooperation with DWA. The work themes describe a structure of interdependent components, all of which needed to be addressed to ensure effective and efficient capacity development toward the project objectives. A weakness in one element would affect the results of the others.

The figure below shows the overall structure of project activities. Training is the driving force that reaches out from all project activities. The outputs within these activities are all important elements to hydrological forecasting and serve as the building blocks that define a capable forecasting authority.



The project required competence in various topics. Ten experts from SMHI were involved on a regular basis. When DWA visited Sweden additional SMHI experts were engaged. The work was centred on SMHI missions to DWA in Botswana, typically of 2 week duration and usually two experts each time. Mission activities included on-the-job training, workshops and lectures. Occasionally field visits were made for the Swedish experts to learn more about Botswana's hydrological conditions.

Project management was carried out by two project managers, one at SMHI and one at DWA. They reported to the project steering group. The steering group provided direction, budget and time schedules for the project. The members included senior staff from SMHI and DWA, two from each organization.

Through the capacity building process, experienced officers at DWA have gradually become involved in conducting training of co-workers. The development of technical skills and problem solving was combined with development of procedures and checklists to ensure that capacity can be maintained in the organization even when human resources may fluctuate. When new staff are employed or rotated in the organization, the procedures and checklists will ensure that the skills on how to carry out activities are not lost.

PROJECT WIDE RESULTS

The work in this project was aimed at improving the capability of the DWA to provide hydrological forecasting and water-related warnings for the territory of Botswana. As noted in the project title, "Towards operational hydrological forecasting … ," it was not expected that the partners would be able to fully develop a hydrological forecasting system within the initial two-year period. Rather, expectations were that progress would be made *towards* reaching the goal of such a system within a longer timeframe. Project activities can be seen as the capacity building blocks toward such a system.

The project has resulted in a number of developments that improve the way staff at DWA performs its duties. Some have been strictly technical while others have been more organisational in nature. Examples of these developments are given below.

Baseline: Unclear and inconsistent response to emergency situations

Activity: Introduce more standard operating procedures and checklists

Has led to:

- Better definition on how a task is to be performed to achieve an outcome.
- Standardization of the way a task is performed to minimize variation and ensuring consistency.
- Form the basis of training of staff.
- Better provision of clear information and instructions to the staff involved so they know how to perform a task.

This can be seen in the form of standardised documents such as these:

1. Checklist for hydrologist on duty
2. Several checklists and operation procedures to perform hydrological modelling
3. Template for a flood warning
4. Template for how to calculate warning criteria
5. Standard operating procedures weekly hydrological report
6. Template for how to calculate annual max flow frequency
7. Template for how to calculate duration curve
8. Standard operating procedures for performing a hydrological forecast at Mohembo in the Okavango delta

9. Specification of requirements for operational setup for hydrological forecasting in the Limpopo catchment, Botswana

Baseline: Poor level of information exchange

Activity: Exposure of new methods and management approaches through training in Botswana and study visits to Sweden

Has led to:

- Greater knowledge of how hydrologists on duty work, this organization could work in Botswana.
- The importance of good communication to various stakeholders.
- Improved capacity for the Swedish partners to work with hydrological issues in Botswana and Southern Africa.
- Networking with leading professionals from Botswana and Sweden.
- Better understanding of cooperation between departments, e.g. meteorology and hydrology.

Baseline: Poor communication on disaster management

Activity: Review and update current and future communication channels

Has led to:

- Networking with leading professionals in Botswana.
- Better cooperation with Department of Meteorology.
- Better cooperation with National Disaster Management Office
- Insight in the latest research through meeting with staff from University of Botswana.

Baseline: No standard for hydrological warnings existed

Activity: Establish criteria for hydrological warnings

Has led to:

- A warning means that a weather condition poses a threat. By knowing the warning criteria DWA understands better when to issue a flood warning.
- Better knowledge of statistical methods.

Baseline: No regular exchange of data and forecasts between DMS and DWA

Activity: Establish a data link between DMS and DWA

Has led to:

- DWA are able to receive meteorological data from observations and forecasts into their system.
- Data can later be put into DWA's hydrological modelling system to perform hydrological modelling and.
- Better understanding of meteorological data from DMS

Baseline: Lack of capacity in hydrological modelling

Activity: Perform training in hydrological modelling for operational applications

Has led to:

- A basic understanding of hydrological models and their requirements among the hydrologists in the DWA hydrology unit.

- DWA staff has an appreciation of what Hydrological modelling is all.

Baseline: Poor understanding of suitable hydrological models for Botswana

Activity: Conduct Hydrological model testing and evaluation for application in Botswana

Has led to:

- A clarification of the restrictions caused by:
  - Limited access to rainfall and discharge data
  - Little previous experience with modelling in the DWA hydrology unit
- The recommendation to use an event-based model, HEC-HMS, flood forecasting. It is freeware, widely used all over the world, has low data requirements and is easy to understand.
- Established communication with the Hydrology group at the University of Botswana.

Baseline: Little experience in using hydrological models for flood forecasting

Activity: Assess and choose pilot forecast basins to be targeted. Setup hydrological model, including specific training

Has led to:

- A hydrological model set-up that can be used for flood forecasts in the Shashe Mooke catchment.
- An understanding of the challenges in hydrological modelling and flood forecasting in an arid country with large spatial variations in rainfall.
- Increased knowledge at DWA in the use of data bases and data quality checks of rainfall and discharge data.
- Increased knowledge at DWA in the use of GIS (Geographical Information Systems) to gather information on catchment characteristics.

Baseline: No experience in operational hydrological forecasting

Activity: Specify requirements for operational setup for hydrological forecasting, including specific training needs

Has led to:

- A short report defining the requirements.
- A deeper understanding within DWA of the skills, staff and procedures required for operational flood forecasting.
- Improved communication with DMS and NDMO on the joint efforts that are required as well their respective roles.

Several changes have come about due to this project. Before cooperation began, hydrological modelling efforts were limited to a few individuals at DWA for a few specific cases. This was primarily directed toward modelling of inflows to the Okavango basin and flood assessment in that region, characterised by slowly developing processes that start in the upstream areas of Angola and work their way towards Botswana over a long time. Although an important process that affects Batswana living in the north, this has little to do with rains that fall over Botswana. This project has focussed on other areas of Botswana that are influenced by heavy rainfall that is more local in nature. These are quickly occurring events where the timing of appropriate warnings can play an important role in the severity of consequences.

Due to project activities, hydrological modelling capabilities have increased. There are now several officers that have been exposed to the same training in hydrological modelling more focused to

rainfall-runoff over shorter time scales and more influenced by local rainfall events. These officers sit in the same group where they can exchange experiences and reflections on how to best use the knowledge and information that they have gained. The group is now also better prepared to receive benefit from the training that returning officers bring with them from abroad.

Forecasting rainfall floods was not routinely discussed before cooperation began. The only forecasting activities relied on using observed riverflow measurements. Although such methods are beneficial for slow responding systems such as the Okavango, they are not effective for the shorter timescales of rainfall that affect basins such as the upper Limpopo. Although we have not established operational modelling for such events, DWA staff are now much better equipped to do so.

Many details of operations for emergency conditions were performed on an ad hoc basis before cooperation. There are now a number of standard operating procedures and simple checklists established that can be routinely followed. This ensures better quality and consistency, particularly when situations develop quickly and can become life threatening.

Communication between DWA (water) and DMS (meteorology) was at a low level before cooperation and data exchange was infrequent. There is now an established IT structure for direct access of data and forecasts from DMS to DWA. Communication channels have been improved, both at personal level and institutionally.

A lot remains to be done to ensure that development toward operational forecasting continues. For instance, the newly established communication and data channels need to be maintained between DWA and DMS. This is in part reliant on DMS continuing to move forward in their efforts to improve IT operations. Officers within the hydrology unit at DWA also need to continue using and developing the tools that have been established during the project.

Establishment of standard procedures will help DWA to maintain the positive changes that have been made. Changes in staff, for instance, will not be as critical to development as before, as relevant documentation remains even if trained staff disappear. However, a critical mass in terms of human resources must be maintained to ensure that the knowledge gained is passed from trained officers to newly recruited ones.

At project onset, it was estimated that some four years of development would be required before reaching a first level of operational forecasting. This has not changed and the additional development is still needed. This project was therefore just the first step in establishing operational hydrological forecasting in Botswana.

ONE CONCRETE EXAMPLE

The impact of project activities on individuals and individual development is an important outcome, although assessing this can be difficult. We highlight here the experience of one officer at DWA.

Civil engineer Onalekutlo Kenabatho joined the Department of Water Affairs on 1st August 2012. She had only worked three days when she was introduced to this cooperation project and she had no idea what hydrological modelling was all about. At the time she was the only junior hydrologist, trained together with one person who later left the department. After an initial two weeks spent with SMHI experts learning what modelling is all about and recommended literature to further refine her knowledge in hydrological modelling, she was then given tasks such as collecting input data into the models. Because she had no modelling experience at all, she did a lot of research about hydrological processes with the guidance of SMHI that helped her gain confidence with what she was doing. She went on to become the person who started engaging stakeholders such as the National Disaster Management Office, DMS and University of Botswana. The head of the hydrology unit realized her interest in modelling so he gave her the platform to carry out all assignments relating to the project – she became in effect the DWA coordinator. After that, in most cases she would come up with ideas of how the trainings should be structured and he would support the idea. According to Onalekhutlo, “Ultimately the success of the project came about because of the commitment of both the SMHI team and the DWA modelling team. The cooperation has lead DWA to not only know each other on a

professional level but also on a personal level. Through this project it was very easy to communicate with each other."

THE OVERALL GOAL OF SWEDISH DEVELOPMENT AID: POVERTY REDUCTION

Unfavourable flooding problems can cause serious losses of life and property, particularly in areas where those who are worst off economically are forced to live. Reliable warning regarding severe water related events, such as flooding, contributes towards minimising losses and damages. By improving DWA's ability to make hydrological forecasts and issue hydrological warnings, this project helps to alleviate such hazards for those people most at risk – the poor.

CHALLENGES

It was stated already in the project proposal that the biggest risk for the success of this project was procuring adequate human resources at the division for surface hydrology. DWA was then in the midst of a major reorganisation and many experienced staff had been transferred to other divisions and to Botswana Water Utilities (a separate organisation). Other staff were away for extended training. Management at DWA was aware of this problem and were able to react to improve the situation.

Within six months from project start, new staff were in place, not as many as desired but a critical mass to move forward with. By project end, the hydrological modelling group consists of 6 DWA officers. However, the experience within this group varies considerably between newly examined graduates to masters graduates recently returned from studies abroad.

Another challenge was that the original project plan had been designed to cover an initial period of 3-years, to be followed by a 2-year extension. This was reduced to an initial period of 2 years to fit into the timeframe of the Sida PDC Programme. Activities therefore needed to be accelerated during the project. Although much was achieved, this was not completely successful, particularly considering competing interests from parallel projects.

The timeline of this project coincided with that of other Sida-supported projects to DWA in cooperation with Stockholm International Water Institute (SIWI) and Chalmers University. These projects also had ambitious schedules toward achieving their project goals. Consequently, there were at times scheduling conflicts between projects and competition for time from DWA officers.

Other challenges include:

- Sometimes DWA staff had to leave the trainings for other duties.
- Communication and responsiveness by email was not optimal.
- Lack of experience by trainees; many were new recruits that had just completed their University studies.
- License problems with the hydrological database called HYDSTRA. Sometimes no access to the database.
- Uncertain future at DWA. The participants from the trainings might be transferred to other groups than the surface hydrology group. It is important that they still can work as hydrologists on duty.
- The agreement between DWA and DMS for data exchange came quite late in the project. This postponed some of the tasks.
- IT activities got off to a good start as DWA had a well-functioning IT unit at project start-up. However, IT functions were then centralised to the Government IT Department and much of DWA's IT capacity was lost. Collaboration on IT became quite difficult, hampering progress toward data exchange between DWA and DMS.

- Limited support from IT; in the beginning of 2013 only 3 of 8 databases were working. This was because the software was too old for the servers upgraded by the Government IT Department, who did little to fix this.
- For the process towards operational hydrological forecasting to continue, the trainees must have enough confidence to continue the learning and testing on their own. This is a challenge considering their lack of experience at the beginning of the project.
- A PDC would hopefully lead to sustainable relations between the Swedish and Botswana partner. This project has not found further funds to do so.

LESSONS LEARNED

For this project to have lasting impact, it is important that DWA can now take the leading role to continue the activities started. The DWA modelling team has shown that it can perform well when roles and responsibilities are clear. Therefore, it is crucial to have a group leader at DWA who can establish goals, make time lines for development, and plan and delegate the tasks needed.

Organisational

Regarding organisation of capacity building activities:

- The project group was dedicated and competent.
- This project lead to understanding the importance of cooperation between Government Departments to achieve better results.
- Some training modules needed more time.
- Shorter time between training missions would have been advantageous.

The timeline of this project coincided with that of other Sida-supported projects to DWA in cooperation with SIWI and Chalmers. These projects also had numerous activities and training that at times involved the same DWA officers working in the SMHI project. This made it difficult at times to schedule the timing of training modules, as all projects were on a tight schedule. There is a lesson to be learned here for both Sida as a donor agency and DWA as a receiving organisation.

On-the-job training

Structured on-the-job training sessions, with clear goals was successful as there was:

- Continuous identification of needed training
- Time to discuss technical aspects and clarify doubts
- High level of motivation

Standard operating procedures (SOP) and checklists

Throughout the project there has been a strong demand for elaboration of SOPs and checklists. The checklists were mostly developed by the intended users, i.e. DWA staff members.

It is important to highlight that SOPs and checklists are helpful to perform DWA activities; however they cannot replace scientific knowledge and background insight.

The lesson learned is that success depends on dedication and commitment from core staff members and support and instructions from Management. It is very important that all staff members are instructed and encouraged to be actively involved in the design and development.

Hydrological modelling and forecasting

The hydrology trainees had no previous experience or training in modelling. The modelling task required a new way of thinking, and the training within the project would have benefitted from starting with a more basic discussion of the concept of hydrological modelling.

A lesson that has to be learned over and over again is that acquiring data of acceptable quality for hydrological modelling is time consuming, and often takes longer time than the actual modelling exercises. Attaining data from more rain and discharge gage stations, and particularly more real-time discharge stations, is important as well.

Data and Cooperation

The data needs for this project should have been better highlighted to DWA management from the start, including emphasising IT needs. Getting the agreement between DMS and DWA on exchange of data took far too long.

A better relation between DWA, ongoing relevant projects, universities in Botswana and other institutions would enhance hydrological forecasting work. For example, the MESA Programme (Monitoring for Environment and Security in Africa) addresses the need for improved environmental monitoring towards sustainable management of natural resources in Africa and has a regional office for SADC situated at DMS. MESA produces satellite-derived data products in near real time that could be used at DWA.

PARTNER DRIVEN COOPERATION

As we write, there is unfortunately no sign that the cooperation partnership between DWA and SMHI will be able to continue directly. Although DWA has the possibility to finance its own participation, there are no resources to finance SMHI. Cooperation between SMHI and DMS continues, however, in a separate cooperation project that has improved weather forecasting for disaster management as one of its goals. This will allow some additional development for DMS components to continue, in particular toward sharing weather forecast and observations data, but the DWA components will have to be pursued solely by DWA. Financing for continued cooperation between DMS and SMHI comes directly from the Government of Botswana through the Ministry of Environment, Wildlife and Tourism.

BENEFIT TO THE PARTNER ORGANISATIONS

The cooperation benefited DWA by improving capacity to keep Government and society updated on hydrological conditions in the country. This was tested in pilot activities toward creating an operational hydrological system. It also provided the opportunity for DWA to review its current operations in the context of international standards and formulate how hydrological monitoring and forecasting can best be incorporated into daily operations. The cooperation benefitted DMS with important insight into providing tailor-made weather and climate services to an important sector of Botswana society. DWA and DMS have come into closer cooperation whereby together they can further investigate how their combined monitoring and forecasting activities can complement each other in providing hydrology and weather services to Botswana.

The cooperation benefited SMHI by building additional capacity for working with hydrological forecasting in the region. Each region of the world has its own specific climate and water characteristics, which dictate how forecasting systems should be implemented. Although hydrological forecasting experience at SMHI is extensive, the cooperation enhanced this with operational experience in Southern Africa that can be used in other endeavours. SMHI could also test and

implement other versions of hydrological models under semi-arid and arid climate conditions, which is highly relevant for future activities in other dry regions.

SIDE EFFECTS/SPIN-OFF EFFECTS

During this two year period, Sida had also granted a PDC project to the Stockholm International Water Institute (SIWI) to work with DWA. SMHI established a fruitful cooperation with SIWI and conducted two of the short courses included in the SIWI/DWA cooperation project. These were, 1) Integrated Data Management, and 2) Climate Change. This also led to a successful PDC project between SMHI, SIWI and water organisations in neighbouring Namibia, and can potentially lead to additional cooperation with SIWI in this part of the world.

THE THEMATIC PRIORITIES

Gender Perspective

The Botswana Government is an equal opportunity employer. Women and special Groups are given equality in recruitment and employment. The goal of the government is to empower women and eliminate gender disparities in primary and secondary schools by 2015. DWA is a government institution and is therefore guided by the same principles and policy, as are activities within the DWA/SMHI cooperation.

To promote gender equality and monitor progress, the Government of Botswana founded a Department of Women's Affairs under the Ministry of Labour and Home Affairs. A National Gender Programme Framework was established with the purpose of serving as a "useful reference point for a multi-sectorial and coordinated response to gender issues and concerns for Botswana." The government hopes that policy-makers, implementers and donors interested in supporting the gender programme will operate within this framework. The objectives are to:

- Enhance the status and role of women in decision-making and leadership at all levels,
- Promote access to and control of factors of production and to remove all forms of legal and socio-cultural constraints to women's participation across all sectors of development,
- Promote health, especially reproductive health and rights, including family planning,
- Enhance the education and skills training of women and girls,
- Eliminate the growing poverty among women particularly female headed households, and
- Create awareness of gender issues at all levels.

This project is technical in nature and was not directly oriented towards activities of gender equality. However, the project strived toward appropriate balance of genders in project responsibilities and participation. From the Botswana side, 2 of 3 theme leaders and 2 of the 6 DWA officers that conducted missions abroad are women. From the Swedish side, 2 of 3 theme leaders and 5 of the 10 SMHI experts that conducted missions to Botswana are women. A larger proportion of the SMHI staff that participated in DWA training missions in Sweden are women. Providing accurate hydrological forecasts affects all of Botswana society, regardless of gender.

Environment perspective

This is an environmental project. It addresses the interaction between the environment, manifested through weather and climate, and the people of Botswana as below:

- Short-term hydrological forecasts benefit various sectors in Botswana and reduce vulnerability to floods.
- Optimisation of water resources.

At the organizational level, SMHI is certified according to the environmental standard ISO 14001:1996, and SMHI's personnel are well-versed in conducting good environmental practise.

THE PERSPECTIVE OF THE POOR AND THE RIGHTS PERSPECTIVE

The government of Botswana has accorded priority status to poverty alleviation in all national development plans. It has initiated a wide array of direct poverty reduction/alleviation programs over the last two decades, focusing on employment creation and social safety nets. Botswana's long term strategies including the Vision 2016 emphasizes that "no citizen of the future Botswana will be disadvantaged as a result of gender, age, religion or creed, colour, nationality or ethnic origin, location, language or political opinions. All Government departments and associated development projects should pursue this goal in their daily activities.

Flooding can cause serious losses of life, property and land, particularly in areas where poor people live. Reliable flood warning contributes to minimize damages and this project thus helps to alleviate such hazards. Enabling Government to provide the best available information to its citizens in times of threat, whether it be weather, climate or civil strife, fulfils a basic citizen right.

FINANCIAL STATEMENT OF TOTAL COSTS

The total budget for the project was estimated to 9 238 020 SEK over two years, shared between Sweden and Botswana as listed below. Swedish funds covered staff and per diem costs for SMHI. DWA contributed with costs for their staff, travel and hotel costs for SMHI staff in Botswana and travels for DWA staff abroad. DMS contributed with costs for their staff time; no travel was included for DMS in this project.

The budget as originally proposed is listed below:

FEES

		Sida		DWA		DMS
Work Themes	SMHI time	SMHI fees	DWA time	DWA fees	DMS time	DMS fees
1) DWA Forecasting Routines	1090	1090000	2180	654000	420	126000
2) Data and IT	600	600000	1600	480000	680	204000
External consultanat IT	200	200000				
3) Hydrological Forecasting	1040	1040000	2080	624000		
Management & Coordination	1060	1060000	2120	636000	240	72000
Regional Consultants				300000		
Sub-Total	3990	3990000	7980	2694000	1340	402000

REIMBURSABLE COSTS		**Sida SMHI costs**	**DWA SMHI costs**		**DWA DWA costs**	**DMS**	**DMS costs**
Airfares, train & car	30 tr @ SEK 18000		540000	21 tr @ SEK 17000	357000		
Travel, Botswana				12 tr @ SEK 3000	36000		
Travel, Region				15 tr @ SEK 5000	75000		
Accomodation, Botswana & Region				108 d @ SEK 850	91800		
Daily allowance, Botswana & Region				108 d @ SEK 440	47520		
Accomodation, Botswana	510 d @ SEK 850		433500				
Daily allowance, Botswana	510 d @ SEK 420	214200					
Travel Sweden				21 tr @ SEK 1600	33600		
Accomodation, Sweden				210 d @ SEK 1100	231000		
Daily allowance, Sweden				210 d @ SEK 440	92400		
Sub-Total		214200	1238100		699720		0

Total		4204200	1238100		3393720		402000

Note: At the time of the proposal, 1 SEK ≈ 1 BWP

The actual expenditures are listed below. Reallocation of funds from reimbursable to fees was approved by Sida in December 2013, allowing the Swedish contribution to be used in full. Less expensive airfare and accommodation costs together with reduced per diem rates from the time of budgeting were contributing factors to lower reimbursable costs. In addition, there were fewer missions from DWA to Sweden than were originally anticipated. Furthermore, the budget item for external consulting originally included in the DWA contribution did not prove necessary.

Actual expenditures:

FEES

		Sida		DWA		DMS
Work Themes	SMHI time	SMHI fees	DWA time	DWA fees	DMS time	DMS fees
1) DWA Forecasting Routines	1129	1129000	2180	654000	210	63000
2) Data and IT	331.5	331500	650	195000	290	87000
External consultanat IT		50000				
3) Hydrological Forecasting	1501.2	1501200	3360	1008000		
Management & Coordination	1083.5	1083500	2000	600000	170	51000
Regional Consultants						
Sub-Total	4045.2	4095200	8190	2457000	670	201000

REIMBURSABLE COSTS		**Sida SMHI costs**	**DWA SMHI costs**		**DWA DWA costs**		**DMS DMS costs**
Airfares, train, car			311400				
Accomodation, Botswana			122266				
Daily allowance, Botswana		109577					
DWA reimbursable					341618		
Sub-Total		109577	433666		341618		

Total corrected to fit budget		4204200	433666		2798618		201000

Note: Changes in exchange rates for the Botswana contributions have not been accounted for here.