Review

Of

Monitoring and assessment of changes in Glaciers, Snow and Glacio-hydrology in the Hindu Kush - Himalayas with a special focus on strengthening the capacity of Nepalese organizations

The HKH Cryosphere Monitoring Project

Final Report

5th March 2015

Preface

Norway has given financial support to the HKH Cryosphere Monitoring Project since the first contract (agreement) was signed in 2010 and later by a revised frame agreement covering the period 2013-2017. According to the contract between the Norwegian Embassy in Kathmandu and International Centre for Integrated Mountain Development (ICIMOD) signed on 30th November 2010, a mid–term review and an end-review shall be carried out. This review will focus on the status of the Project until December 2014 and provide some advice on future work, as outlined in the Terms of Reference (Annex I).

The Review Team consisted of the following members, who shared the responsibilities on an equal basis as experts on review methodology and cryospheric related issues, respectively:

- Torgrim Asphjell; Review Expert; Norwegian Environment Agency
- Geir Moholdt; Technical Expert; Norwegian Polar Institute

The field trip (Annex II) was undertaken in the Kathmandu area in December 2014 and preliminary conclusions were presented to the Embassy and ICIMOD at the end of the fieldwork. A draft report was submitted to relevant parties for comments on 20th January 2015. Comments were received from the Embassy, Norad and ICIMOD and have been incorporated into the final report where the Review Team finds this relevant (Annex IX).

The Review Team would like to thank the Embassy and ICIMOD for excellent cooperation and facilitation of the review. We are also grateful to other people and institutions who have contributed by sharing information and insight. A special thanks to Helle Biseth (Norad), Jan Eriksen (Embassy), Farid Ahmad and Pradeep Mool (ICIMOD) for all assistance during the preparations and visit in Kathmandu.

5th March 2015

Geir Moholdt and Torgrim Asphjell

List of acronyms and abbreviations

BSc	-	Bachelor of Science (degree)
CDHM	-	Central Department of Hydrometeorology (of TU)
CHARIS	-	Contribution to High Asia Runoff from Ice and Snow (US project)
CMP	-	HKH Cryosphere Monitoring Project
DHM	-	Department of Hydrology and Meteorology (Nepal)
DHMS		Department of Hydro-Met Services (Bhutan)
ETH	-	Swiss Federal Institute of Technology (in Zürich)
FW	-	FutureWater (research institute, Netherlands)
GLIMS	-	Global Land Ice Measurements from Space
HKH	-	Hindu-Kush Himalayas (region)
ICIMOD	-	International Centre for Integrated Mountain Development
IPCC	-	Intergovernmental Panel on Climate Change
IPPAN	-	Independent Power Producers Assosiation (Nepal)
KU	-	Kathmandu University (private)
LoA	-	Letter of Agreement
MFA	-	Ministry of Foreign Affairs (Norway)
MODIS	-	Moderate Resolution Imaging Spectroradiometer
MSc	-	Master of Science (degree)
MTAP	-	Medium-Term Action Plans (for ICIMOD)
NOK	-	Norwegian kroner (1 USD ≈ 7 NOK at time of review)
Norad	-	Norwegian Agency for Development Cooperation
NVE	-	Norwegian Water Resources and Energy Directorate
PD	-	Project Document
RMC	-	Regional Member Countries of ICIMOD (Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan)
SnowAMP	-	Snow Accumulation and Melt Processes in a Himalayan watershed: observations and modelling (ICIMOD/NVE project)
The (CMP) Project	-	The HKH Cryosphere Monitoring Project
The (Review) Team	-	The Review Team that conducted this Review
The Embassy	-	Royal Norwegian Embassy; Kathmandu
ToR	-	Terms of Reference
TU		Tribhuvan University, Kathmandu (governmental)
USAID	-	United States Agency for International Development
UU	-	Utrecht University (Netherlands)
WECS	-	Water and Energy Commission Secretariat (Nepal)
WGMS	-	World Glacier Monitoring Service
WMO	-	World Meteorological Organization

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Executive summary

The Review Team has assessed the progress, efficiency, effectiveness and relevance of the HKH Cryosphere Monitoring Project (CMP). Considerations are also given to sustainability and recommendations for future work, while specific questions raised in the ToR are dealt with separately.

The rationale of the Project is to increase the knowledge of glaciers, hydrology and other cryospheric issues in the Hindu-Kush Himalayas (HKH), which is a little studied mountain region highly affected by climate change. Better data on cryospheric variability is important for water management, flood control and the energy sector in the HKH and downstream countries as well as the international climate research community and the IPCC.

The Project is managed by ICIMOD, with whom Norway has a long tradition of support. The main focus is on Nepal, with two universities (KU and TU) and two governmental institutions (DHM and WECS) as national project partners. Other Regional Member Countries (RMCs) of ICIMOD are mainly involved in capacity building and knowledge sharing. The main international partners from Switzerland (ETH) and the Netherlands (FW/UU) provide scientific support and play an active role in the research activities.

The Team got the clear impression that the project is very professionally designed and managed. The Project Document, if being somewhat short on involvement of partners, is generally comprehensive and very well structured. Meetings have been arranged as scheduled and everything is well documented and audited.

The Project was originally funded by a Norwegian grant of NOK 35 million for the period 2010-15, but was in 2013 substituted by a new agreement covering the period 2013-17. The review of the financial statements in the period 2010-13 shows that expenditures have been roughly as planned and below the budget with a reasonable margin on all main budgetlines. About half of the budget and expenditure is allocated under Project Management, but closer inspections revealed that most of these costs are actually related to scientific activities, purchases and other expenditures. For future budgeting, the Team proposes that this budget post is re-examined to sort out the pure administrative costs.

The scientific activities have been carried out according to the agreed workplans and are up to international standards. The main achievements have been the establishment of two glaciological and hydrological monitoring sites, a complete regional HKH glacier inventory, and a MODIS satellite data processing facility for near real-time snow cover mapping. This has been done in a professional and cost-efficient way and forms a solid basis for future Nepalese and regional cryosphere monitoring and research, though most activities are still highly dependent on ICIMOD involvement.

Not all activities can be continued beyond CMP, so it is important for the Project to consider all field elements and determine which are of a temporary character, e.g. to reach specific science goals, and which are suitable for long-term monitoring within the mandate of governmental institutions. Sufficient resources also need to be allocated to the transformation

of scientific findings into operational hydrological models and assessments that can be utilized by Nepalese and regional institutions for water management on a regular basis.

A central part of the Project has been to build capacity on cryospheric issues among Nepalese and RMC institutions. A MSc Glaciology program has been established at KU, and ICIMOD has organized numerous training courses in fieldwork and data analyses, as well as hosting workshops for scientific discussion and data sharing. These initiatives have been very well received among the participants and have contributed to a higher professionality as well as an arena for collaboration and data sharing. The "Cryosphere Knowledge Hub" website provides another arena for regional data- and knowledge sharing, but the participation from other partners than ICIMOD needs to be increased to fully serve the purpose.

ICIMOD is not only the management-hub of the Project, but also the main scientific actor. Out of the other Nepalese Project partners, only KU has a dedicated Project budget and is performing larger autonomous Project activities through its MSc Glaciology program and associated fieldwork. The Team recommends a more active involvement of Nepalese partners, because this is crucial for the long-term sustainability of the Project. TU should get opportunity to contribute more to the MSc program, to training activities and to hydrological research. DHM should be the core actor when the Project enters a more monitoring oriented phase, and WECS is the key institution as regards practical use of results and on putting the issue on the political agenda. To improve national involvement, the Team recommends that an intermediate planning exercise is initiated. A cross-institutional strategy and funding plan should be developed to attain a more active and autonomous involvement of Nepalese partners.

1 Introduction

1.1 Project Rationale

The Hindu-Kush Himalayas (HKH) is one of the most glaciated mountain regions in the world and provides the main water source for major Asian rivers such as Indus, Ganges, Brahmaputra and Yangtze, which flow through densely populated areas with more than a billion people that rely on their water resources (Figure 1).

Most river discharge occurs from rain and snow melting during the summer monsoon season (June –August), whereas the winter season is much drier, especially in the east. Recent glacier mass losses have been found to account for approximately 5-15% of the annual river discharge from the HKH mountains. The glacier contribution is expected to increase over the next decades due to regional warming, but will likely decrease again at some point as the glaciers retreat to higher altitudes. The fate of the summer monsoon precipitation is even more uncertain, and different types of climate models disagree on whether the monsoon will weaken or strengthen under global warming.

The 5th Assessment Report of IPCC suggests a future weakening of the monsoon at a *low confidence*, and it recognizes that glacier characteristics in the HKH mountains are "only poorly known" due to too few observations and a "large variety of glacier types and climatic conditions". More and better measurements of high-mountain climate and hydrology are highly needed in order to improve climate models and make robust assessments of present and future water availability at both local and regional scales.

Figure 1: *Map of the Hindu-Kush Himalaya (HKH) region with glaciers and the major river basins (Source: ICIMOD)*

Under these circumstances, the HKH Cryosphere Monitoring Project (CMP) comes very timely. It seeks to establish long-term monitoring programs for glacier mass balance and hydrometeorology in a mountain region that has previously only seen occasional field activities at a few locations, mainly carried out by international scientists without much local involvement. The intention is twofold, aiming to both perform research at an international level, and to build sustainable capacity among local institutions (universities and governmental agencies) such that routine monitoring can be continued into the future.

The activities in the first phase of the Project (2011-2013) focus mainly on the Nepalese part of the HKH, but they are meant to be blueprints for other Regional Member Countries (RMC), who are invited to participate in field trainings, workshops and data sharing. The Project also aims to provide important baseline data sets to the wider community such as satellite-derived glacier inventories and snow cover maps for the entire HKH region. Moreover, the intention is to develop ICIMOD into a regional resource center on cryosphere related issues for the mutual benefit of all RMC countries and the general public.

1.2 Norwegian support to ICIMOD

Norway has long traditions in polar exploration, cryospheric research and mountain-related management. Nepal and the HKH region face many of the same challenges and have been natural targets for bilateral development projects. The strong support to ICIMOD is also a part of the Norwegian government's priority on climate issues, aiming to document and mitigate the effects of climate change worldwide. The CMP Project builds on the foundation work on cryosphere monitoring that began in ICIMOD through earlier support from the Norwegian and Swedish governments in the Medium-Term Action Plans 2003–2007 (MTAP) and 2008–2012 (MTAP-II).

Norway contributed NOK 25 million to the core budget of MTAP-II, besides giving separate funding to the CMP Project (initially NOK 35 million for 2010–2015), the Reduced Emission from Deforestation and Degradation project (REDD, NOK 3.5 million for 2009), and the Himalayan Climate Change Impact and Adaptation Assessment (HICIA, NOK 79 million for 2009–2013) in which there are two central Norwegian partners; Center for International Climate and Environmental Research – Oslo (CICERO) and GRID-Arendal. Norway is also involved in the financing of ICIMOD's Atmospheric initiative, which was established in 2013.

All specific programs have now been financially merged with the core funding in the new Action Plan (MTAP-III) where Norway has committed to support ICIMOD with NOK 150 million for 2013–2017, including NOK 7.8 million for the continuation of the CMP Project. In MTAP-III there is also an assignment of NOK 6 million for a collaboration between ICIMOD and the Norwegian Water Resources and Energy Directorate (NVE) on the project "Snow Accumulation and Melt Processes in a Himalayan watershed" (SnowAMP). Hence, Norway is continuing its strong support to ICIMOD and CMP-related activities until at least 2017.

1.3 Methodology and practical implementation

The Review Team have tried to keep the methodology used in this Review aligned with Norad's guidelines for project reviews as outlined in the *Development Cooperation Manual* and to the overall principles described in *Results Management in Norwegian Development Cooperation*. However, due to minor differences in terminology and structure, the Team has made some small adjustments (see Section 2.2 for details).

The Norwegian Embassy in Kathmandu prepared the Terms of Reference (ToR, Annex I) with input from Norad. The ToR states that "the purpose of the review is to assess progress up to date on ICIMOD`s work on cryospheric issues and to advice on the way forward". This is further detailed with specific questions related to progress, efficiency, effectiveness, relevance and other issues.

The review is based on a desk study of written documentation and on personal- or telephone meetings with the main partners and stakeholders. The Team has not done a detailed review of all documentation, but all reports and other material produced in the Project (Annex VII) have been assessed with a focus on relevance for the Project partners, regional governments, the wider scientific community and the general public. A key question has been whether the Project in the longer run will contribute to better understanding of cryospheric issues in the region and, ultimately and indirectly, lead to improved water management and better living conditions in the Hindu-Kush Himalayas (HKH) and downstream regions.

The Review Team visited the following institutions in Kathmandu (field program, Annex II):

- Royal Norwegian Embassy;
- International Centre for Integrated Mountain Development (ICIMOD);
- Kathmandu University (KU);
- Tribhuvan University (TU);
- Water and Energy Commission Secretariat (WECS);
- Department of Hydrology and Meteorology (DHM);
- Independent Power Producers Association, Nepal (IPPAN);

In addition the Team had telephone interviews with European Project partners from Swiss Federal Institute of Technology (ETH) and FutureWater/Utrecht University (FW/UU), and with representatives from the RMC partners in; China, Pakistan, India and Bhutan (people met, Annex III). The Team also had a meeting with the Norwegian Water Resources and Energy Directorate (NVE) in Oslo before departure to Nepal.

In this report, project design and management are discussed in Chapter 2. Thereafter, technical progress compared to plans is assessed systematically and in detail in Chapter 3. In Chapter 4 and 5, progress is assessed in a broader perspective in terms of efficiency, effectiveness, relevance and the specific questions raised in the ToR. Chapter 6 deals with sustainability and gender issues. Finally, conclusions and recommendations are given in Chapter 7.

2 Project description and comments on project design

2.1 Project background and development

On 30th November 2010 a contract (this agreement was called a Contract) was signed between the Norwegian Ministry of Foreign Affairs (MFA) and ICIMOD regarding the HKH Cryosphere Monitoring Project (CMP). The contract had a financial frame of NOK 35 million over five years, which covers the full funding of the project, and was based on a draft Project Document (PD) prepared by ICIMOD. The draft was refined during an inception phase, which also included a workshop with participation from key stakeholders, including international partners ETH and FW/UU. The revised PD was finalized in April 2011.

In 2013 a reorganization of the cooperation between Norway and ICIMOD was undertaken. This resulted in the signing of an agreement on 10th December covering both core and earmarked financing of ICIMOD activities for the period 2013-2017 (MTAP-III). This general frame agreement includes NOK 7.8 million earmarked for the CMP Project, and it transfers the rights and obligations of the Project to the new agreement. The reorganization also includes new agreements on cryosphere monitoring in Bhutan by Department of Hydro-Met Services Bhutan (DHMS) and snow monitoring in Nepal by NVE. In this review, the Team will focus on progress up to date and will not go into details on this new financial arrangement. Since no new detailed project documents have been produced after the signing of the new agreement, the original final PD from April 2011 will be the baseline document used for this review.

Due to the reorganization of project finances, a Project Final Report covering the period up to December 2013 was submitted by ICIMOD, and it has later been approved by the donor. This report is a key document for the review and is, together with updated information covering the period until the time of review (December 2014), the basis for the assessment of Project Components (Section 3) and Financial Issues (Section 2.5). The CMP continuation after this review and until the end of the MTAP-III funding in 2017 is referred to as "the next phase of the Project".

2.2 Project design

The PD of April 2011 is comprehensive and well structured and gives a good overview of the background and justification for the Project. Important project elements like goal, outcomes, outputs, activities and indicators are all in place and used in the right way. A comprehensive risk assessment has been undertaken and Project activities have been scheduled. The document has hallmarks of having been produced by professional project developers and the Team has no remarks to the PD as such.

The terminology used in the PD is slightly different from the one used in Norad's guidelines, on which projects financed by Norway are commonly based, and the structure is more multi-layered. However, the PD is easily adaptable to the methodology used in this review, so this does not represent a serious practical problem.

With respect to the different Project partners, the PD could have been more specific on responsibilities, expectations and allocation of resources. For the Nepalese partners (KU, TU, DHM, WECS) Letters of Agreement (LoAs) signed after the PD had been finalized contain information on involvement on a sub-activity level and some information on budget (KU). For European partners ETH and FW/UU, LoAs were signed in 2012. Ideally, partner-specific activity schedules and budgets should have been included in the PD. More information on project management structure and the interactions between the different Project partners would also be preferable.

For this review, the Team will assess the progress based on the "Component level" in the PD (i.e. the main tasks corresponding to "Outputs" in "Norad terminology"). This implies that progress is assessed separately for each of the project Components *(short names in brackets):*

1. Monitoring of glacier mass balance and surface motion, and measurement of glacier geometry (*Glacier Monitoring*).
2. Assessment of current and future water resources at catchment and sub-basin scale (*Hydro-Meteorological Monitoring*).
3. Multi-level remote sensing based observation system for snow and glaciers monitoring in basins and sub-basins (*Remote Sensing*).
4. Strengthening of ICIMOD as regional knowledge hub for sharing and disseminating cryosphere related data and information (*Regional Knowledge Hub*).
5. Capacity building (*Capacity Building*).

In addition to these five Components, the budget in the PD contains a budget line on project management. This is by far the largest budget post and constitutes more than half of the total budget. Upon further investigation, much of this is actually covering costs that are indirectly related to the five Components in form of staff/salary, consultants, travels, publications and some equipment. The budget overview could have been improved if some of these costs were reallocated so that the post on project management only constituted pure administrative costs (see also Section 2.4).

2.3 Participating institutions

International Centre for Integrated Mountain Development (ICIMOD)

ICIMOD is an intergovernmental learning and knowledge sharing center for environmental and economic changes in the HKH mountain region, serving eight regional member countries (RMCs) - Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. It was founded in 1983 on initiative from UNESCO and has its headquarter in Kathmandu, Nepal. ICIMOD's vision is to enable and facilitate the equitable wellbeing of people in the HKH region by supporting sustainable mountain development through an active regional cooperation. ICIMOD brings together a partnership of RMC countries, partner institutions and donors in a range of different programs aimed at specific topics and development goals. ICIMOD coordinates the CMP Project and has a leading role in all project Components except the MSc Glaciology program in Component 5.

Kathmandu University (KU)

KU is an independent non-government university established in 1991 in Dhulikhel, about 30 km east of Kathmandu city center. It provides undergraduate and graduate programs in engineering, science, management, arts, education and medical sciences. The Department of Environmental Sciences and Engineering (DESE) is offering education in environmental sciences, among them cryospheric science, glaciology and climate change under the umbrella of the Himalayan Cryosphere, Climate and Disaster Research Centre (HiCCDRC). As a CMP partner, KU co-organizes the field expeditions in Components 1-2, and is responsible for the MSc Glaciology program in Component 5.

Tribhuvan University (TU)

TU is a governmental university established in 1959 in Kathmandu. It provides undergraduate and graduate education in most fields and has more than 600 affiliated colleges throughout the country. Since it is governmentally financed, it is less expensive than private universities. The Central Department of Hydrology and Meteorology (CDHM) is the leading Nepalese institution for education and research in hydrology and meteorology and offer both BSc, MSc and PhD programs. As a CMP partner, TU participates in the field activities under Components 1-2.

Department of Hydrology and Meteorology (DHM)

DHM is a department under the Ministry of Science, Technology and Environment with mandate to collect and disseminate meteorological and hydrological data (including data on glaciers and snow) and to work on cryospheric issues. They are operating a network of manual and automatic stations that collect meteorological or hydrological data used in various public services such as weather and discharge forecasting. DHM is currently increasing their activity as a consequence of a funded project from the World Bank. As a CMP partner, they are involved in the field activities of Components 1-2 concerning new and upgraded monitoring stations.

Water and Energy Commission Secretariat (WECS)

WECS is the Nepalese Government policy body on water and energy and has mandate to formulate and assist in developing policies and strategies in the water resources and energy sector. As a CMP partner, they have so far not been much involved in the Project except from participating in a few of the field trainings and study tours.

Reginal Member Countries (RMC)

RMC partners outside of Nepal have not had a formalized role in the CMP Project, but have participated in training courses, workshops and study courses with expenses covered. In the next phase of the Project, the Department of Hydro-Met Services (DHMS) in Bhutan will enter the Project as an official partner, and there will also be closer links with other RMC institutions.

European partners (ETH and FW/UU)

The glacio-hydrological research groups at the Swiss Federal Institute of Technology (ETH) and FutureWater/Utrecht University (FW/UU) in the Netherlands were invited to join the Project due to their extensive experience with high-alpine research, particularly in Himalaya. They contributed in the inception phase of the Project and have been strongly involved in the field activities and research activities of Components 1-2. They are not formally a part of the next phase of the Project, but will likely be involved in research activities through their own funding. Another European institution worth to mention is the French Institute for Research Development (IRD,) which has been a strong partner in other CMP-related glacier research with separate funding. In the next phase of the Project, there are new sub-projects on snow monitoring with the Norwegian Water Resources and Energy Directorate (NVE) and on glacier remote sensing with the University of Zürich and the Technical University of Dresden.

2.4 Project implementation structure

The core implementing institution in the Project is ICIMOD, which in addition to project management also performs many scientific and practical tasks. The relationship between ICIMOD and The Embassy is defined in the contract of November 2010 (and from December 2013 regulated by the new frame agreement) and involves annual meetings and reporting. A steering committee with representatives from all Nepalese Project partners also meets annually. Letters of Agreement have been signed with the four Nepalese partners and European partners ETH and FW/UU (Figure 2). There are no formalized relationships or transfers of funds between ICIMOD and other RMC partners, but costs related to participation in workshops and field trainings have been covered.

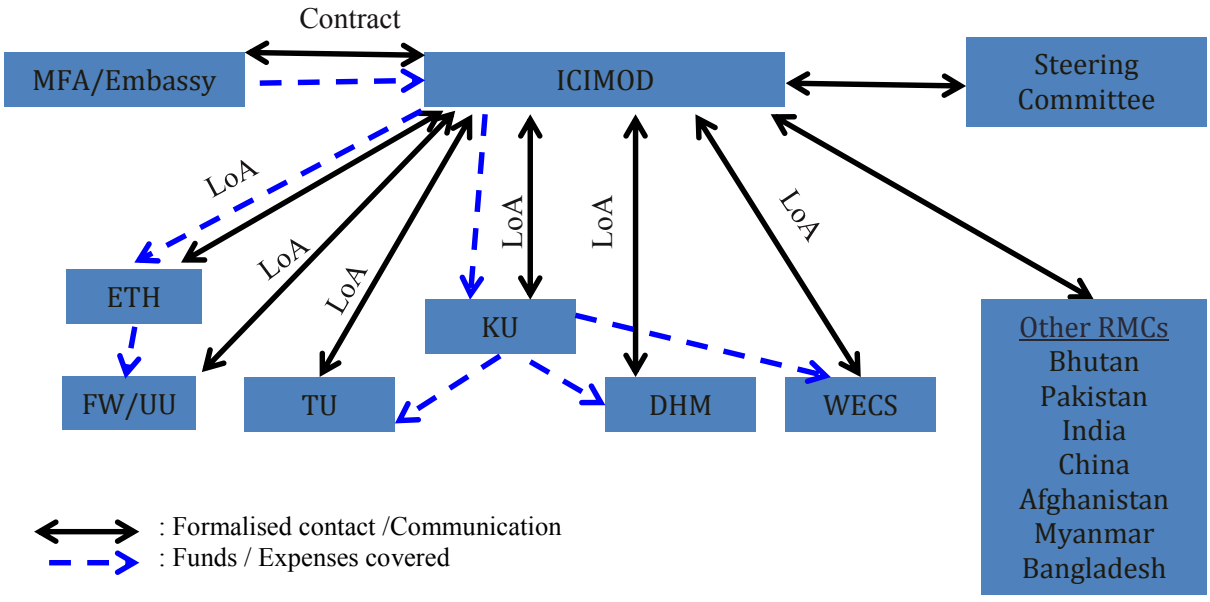

Figure 2: *Project implementation structure.*

It is the Team's impression that this arrangement has been working well. The formal documents appear to be thoroughly written and meetings and reporting has been conducted as planned. Funds are transferred from the The Embassy to ICIMOD on a semi-annual basis. Most of the funds are spent by ICIMOD, but some are transferred to KU and ETH to cover expenses related to fieldwork and capacity building. No funds have been transferred to other Nepalese institutions, but KU covers the field expenses for TU, DHM and WECS.

Technical progress and expenditure are reported from the main project partners to ICIMOD by annual technical and financial progress reports, field reports and other technical reports.

2.5 Financial issues

This review of finances will focus on the period up to 2013, which is the last financial year included before the new frame agreement (MTAP-III) with the Embassy took effect. As illustrated in Table 1, the expenditures on both Project Management and the five Components are roughly as planned, and all are below the budget with a reasonable margin. The only exception is Component 4 - *Regional Knowledge Hub*, on which very little expenditure has been recorded under the Project. However, this is due to additional co-financing from the US Embassy and also this Component has proceeded according to plan.

About half of the budget and expenditure is allocated under Project Management, which indicates apparently very high administrative costs. Upon consultation with ICIMOD it was revealed that most of these costs actually are related to scientific- and technical work at ICIMOD, equipment purchases, events (workshops, training) and overhead. It would be beyond the scope of this review to go into details on this issue, but additional information from ICIMOD (Annex VI) indicates that at least 60%, of reported Project Management costs actually represent other types of costs. (The actual fraction is probably much higher, depending on how costs are classified. In this example, the Team has only extracted the costs for purely scientific personnel, equipment, arrangements and overhead).

Component	Budget	Expenditure	% expenditure
1 Glacier Monitoring	1 887	1 392	74
2 Hydro-Meteorological Monitoring	1 813	1 557	86
3 Remote Sensing	2 796	2 332	83
4 Regional Knowledge Hub	741	47	6
5 Capacity Building	3 145	2 014	64
Project Management	11 865		
Overhead (6%)	1 335		
PM+Overhead	13 200	10 940	83
Total	**23 582**	**18 282**	

Table 1: *Project finances 2011 – 2013 (1000 NOK)*

For future budgeting, the Team proposes that the costs now occurring under Project Management are re-exanimated to sort out the purely administrative costs. This should possibly include reallocation of costs to the five project Components, inclusion of new budget posts and splitting of costs related to personnel involved in both scientific and administrative tasks.

Most of the costs are occurring within ICIMOD, while minor funds are going to KU and ETH (Table 2) - as budgeted in the LoAs and reported annually in audited financial project reports. The Nepalese Project partners TU, DHM and WECS get no direct funding, but have some expenses covered by the funding to KU. The Dutch partner institutions FW/UU get CMP funding through collaborator ETH. The European institutions have also succeeded to obtain national funding as a consequence of their involvement, and this has in turn strengthened the scientific part of the Project.

Comp-onent	**ICIMOD**				**Partner KU**				**Partner ETH**				**Grand**
	2011	2012	2013	**Total**	2011	2012	2013	**Total**	2011	2012	2013	**Total**	**total**
1	75	53	43	**171**	11	31	27	**69**					**240**
2	79	70	20	**169**		25	41	**66**		23	11	**34**	**269**
3	0	355	49	**404**									**404**
4	0	3	5	**8**									**8**
5	2	54	109	**165**	39	57	53	**149**		20	12	**32**	**346**
Project Man.	581	558	608	**1747**						75	62	**137**	**1884**
Total	737	1 093	834	**2 664**	50	113	121	**284**		118	85	**203**	**3 151**

Table 2: *Expenditure by Partner (1000 USD)*

The Team is of the opinion that direct access to funds for Project partners is important for ownership and commitment to the Project. It is also a necessity if partners are to complete larger and more autonomous project modules. Consequently, it is important to overcome the bureaucratic obstacles that may hamper such transactions with respect to the Nepalese governmental institutions (TU, DHM, WECS).

About 85% of the funding is spent by ICIMOD, which is a very high fraction. There might be good reasons for this at the early stage of the Project, but to ensure long term sustainability also outside ICIMOD, it is crucial that more funding (and tasks) is transferred to Nepalese, and possibly also regional, Project partners. The Team would also point out that personnel costs are generally lower in local institutions than at ICIMOD.

As regards accounting, all transactions are well documented and audited according to international standards. Though not being a financial auditing team, the Team got no indications of illegal or suspicious financial practices.

3 Project progress assessment

3.1 Assessment of progress compared to original plans

This assessment of the status of the five project Components is based on the project-related publications and reports (Annex VII) and on meetings/interviews with the Project scientists and coordinators at ICIMOD and partner institutions (field trip program in Annex II and list of people met in Annex III). The reference for the evaluation is the planned activities and the corresponding results (outputs and outcomes) as they appear in the PD, Section 2.2. A quantitative summary of progress until the time of review is given in Annex VII and VIII and used as basis for the qualitative assessment here.

3.1.1 Component 1: Glacier Monitoring

Unlike most other countries with sizeable glaciers, Nepal has not had any long-term climatic monitoring programs for glacier mass balance. One of the main goals of the Project has been to establish two field-based monitoring programs on suitable glaciers in the Nepalese part of the HKH. The largest obstacles towards achieving that are the difficult access (4-7 days of trekking), the high altitude (4-6000 m a.s.l.) and the alpine character (steep and crevassed surface) that are typical for glaciers in the region. The CMP Project has chosen two small glaciers for regular monitoring; the Yala Glacier in Langtang Valley and the Rikha Samba Glacier in Hidden Valley (Mustang district). These are reasonable choices that comply with international recommendations and have the additional advantage of some historical data from previous Japanese field expeditions. If continued, the new monitoring programs will provide unique records of climate impacts on high-mountain glaciers in the HKH region, and the results will be of interest to the glaciological community as well as international fora on climate change such as the IPCC.

Fieldwork has been carried out twice a year on Yala Glacier (Apr/May and Oct/Nov) and once a year on Rikha Samba (Sept/Oct) since 2011. The main setup is a longitudinal profile of bamboos stakes that can be used to derive snow accumulation and melting when accompanied by density measurements in snow pits or shallow cores. Automatic weather stations have been installed near the fronts of both glaciers and give the opportunity to link the glacier measurements with continuous weather data as well as contributing to the larger scale glacio-hydrological modelling in Component 2. Altogether, the fieldwork and instrumentation has been very well documented and is in accordance with international standards. The first publication has already come out (Baral et al. 2014), and more papers are in preparation. Mass balance results will soon be freely available through the ICIMOD Regional Database System (http://rds.icimod.org) and the World Glacier Monitoring Service (WGMS).

Extensive studies of debris-covered ice have been carried out on the Lirung and Langtang glacier tongues (both Langtang Valley) under lead of European partners ETH and FW/UU, partly under own funding. These are more research-oriented activities, but could potentially develop into some form of ablation monitoring in the future. An interesting paper on the use of

unmanned aerial vehicles for mapping changes in debris-covered ice has been published (Immerzeel et al. 2014) and several more are in progress.

One of the original goals of Component 1 was to provide useful data for water resources assessment by operational services in Nepal such as DHM, WECS and IPPAN. The Team considers that this can only be achieved in combination with Components 2 and 3 because the selected glaciers cannot be seen as "typical" or "representative" for their catchments or regions. Such glaciers would not be feasible to measure in the field, and hence some kind of sophisticated upscaling or modeling is needed to derive operational products for regional water management.

3.1.2 Component 2: Hydro-Meteorological Monitoring

Until now weather- and water discharge measurements in the Nepalese mountains have been limited to a scattered network of stations operated by DHM without sufficient resources for maintenance and quality control. The Project has resulted in crucial upgrades of the DHM station in Langtang Valley as well as the setup of an extensive hydro-meteorological observation network in this catchment which also comprises Yala Glacier from Component 1. This has been done in close collaboration with ETH and FW/UU. The good coverage and detailed level of measurements in Langtang Valley is unique for a hydrological basin of this scale in the HKH region and provides an excellent base for model calibration and basin-scale analyses. This is the first step towards developing operational products and future projections of water availability in the region - a main goal of the next phase of the Project.

TOPKAPI-ETH has been selected as the main hydrological model and has been set up and validated against the extensive field data from Langtang Valley. This work is led by ETH and several papers have been submitted (Ragettli, Pellicciotti et al.). However, for students and training activities, it has been found that simpler models are more efficient, and one KU-lead publication with discharge estimates has resulted from this (Pradhangana et al. 2014). A few high-profile papers have been published under lead of FW/UU (Immerzeel et al.), but those stem from the period before the recent CMP data became available. Several relevant papers are also in progress under lead of ICIMOD (Shea et al.), and the Team is of the impression that these works are well founded and on track for publication within a few years.

The other selected hydrological catchment, that of Rikha Samba Glacier in Hidden Valley (Component 1), has not been as intensively studied, but an automatic weather station and a hydrological station has been set up near the glacier. From a modeling perspective, it makes sense to first focus on Langtang Valley and then potentially expand the activities in Hidden Valley later. The use of Langtang as a research laboratory for glacio-hydrological modeling will be further strengthened by the involvement of NVE who is coming in as a funded partner for snow monitoring and modeling. There are also plans for permafrost studies in the next phase of the Project. Both topics are excellent fits to the current activities.

3.1.3 Component 3: Remote Sensing

Large-scale glacier analyses in the HKH region have until recently been severely limited by the lack of complete and accurate glacier maps. This has now been solved with the Project's release of the HKH glacier inventory which is available both digitally on ICIMOD's websites (Annex V) and in book form (Bajracharya et al. 2011). The inventory is mainly based on Landsat imagery from 2005 ± 3 years, and the processing methods are semi-automated such that remapping can be done regularly, for example every 5-10 years. Previous decades back to the 1980s have also been mapped and used to estimate glacier area changes, published in several papers and books by Bajracharya et al. (2014). The inventory has also been submitted to global initiatives like GLIMS and the Randolph Glacier Inventory, which ensures that it will be the reference data set for the cryospheric community worldwide, including the IPCC.

Near real-time monitoring of snow cover and melting at a large scale is only possible if satellite data are readily available and processed. A major step towards that has been the installation of the MODIS receiving antenna at the roof of ICIMOD in 2012 (Annex IV). Image processing for snow cover mapping became operational one year afterwards, and eight-day composite maps of MODIS-derived snow cover for the HKH region are now freely available from the ICIMOD online database. Some more work is likely needed in terms of quality control and research applications, but that is a natural follow-up activity in the next phase of the Project, hopefully resulting in a number of scientific publications.

With these two aerial data sets as a reference, it would be natural to combine them with estimates of snow thickness and glacier elevation changes in order to derive mass-equivalent cryospheric changes that are relevant for water-resources management and research. This would tie Component 3 closer to Components 1-2 and provide essential validation for those results. The new sub-projects on geodetic glacier mass balance (in collaboration with University of Zürich and the Technical University of Dresden) and snow monitoring (in collaboration with NVE) are good steps in that direction for the next phase of the Project.

3.1.4 Component 4: Regional Knowledge Hub

The main purpose of the "Cryosphere Knowledge Hub" is that ICIMOD should be a regional center for cryospheric knowledge and data sharing within the HKH region. The centerpiece of the Hub is a webpage of the same name (http://www.icimod.org/cryosphere). The webpage contains cryopheric news bulletins, ICIMOD publications and information on events, and a near real-time "station watch" for the meteorological stations in the Langtang and Hidden valleys made possible through a satellite link (though out of operation at the time of review). There are also links to the GeoPortal where the glacier inventory and drainage catchments can be easily viewed and to the Regional Database System where the inventory and snow cover maps from different points of time can be downloaded.

The Knowledge Hub webpage has a nice, clear layout and is easy to navigate. However, as an intended forum for all RMC partners, it is very focused on ICIMOD itself and data/activities in the Nepalese part of the HKH region. The Team also found that there is little introductory material for interested readers with limited background and knowledge in cryospheric topics.

These aspects could be improved in the future and possibly linked with some of the existing training material (Component 5) and the very appealing map interface of the Mountain GeoPortal (http://geoportal.icimod.org/). The goal must be that other RMC partners get more actively involved in the Knowledge Hub; sharing information, news and data with each other. To facilitate this, ICIMOD needs to approach other institutions about their cryospheric activities and support the generation of web-articles and standardized data for sharing. Once the RMC partners realize the benefits of broader outreach and shared databases, they will probably also be willing to commit resources into the development of the Knowledge Hub. The Team suggests that ICIMOD and the most relevant RMC institutions get together to discuss the needs and wishes for the Knowledge Hub, and to make a coordinated plan for its future development.

3.1.5 Component 5: Capacity Building

A central part of the Project is to build sustainable capacity among Nepalese institutions and other RMC partners regarding cryosphere monitoring and research. The main strategy to achieve this has been to establish a MSc program in glaciology at KU and to run a series of practical training courses in conjunction with the monitoring activities in Components 1-3. This has brought the different Nepalese and RMC institutions closer together, built up crucial competence, and provided an educational path for students that want to do glaciological work.

The MSc program in Glaciology was started at KU in 2011, and since then 4-10 new students have been enrolled each year, all from Nepal or other RMC countries (Table 3). The student places are highly competitive, and full scholarships are granted from the CMP Project and the CHARIS project of USAID. Students are generally motivated and satisfied with the program, and they foresee to get relevant jobs afterwards. A few of them even have a clause in a contract with their home institution/university that they will return to work there for at least a couple of years. The first batches of students graduated in 2013 and 2014, and most have them found relevant jobs at institutions like DHM or ICIMOD. Several current students wish to pursue an international PhD after completing their MSc. The Team is of the opinion that the best candidates will be suited for that although the curriculum is somewhat weak on the more theoretical aspects of glaciological research (see also ToR questions in Section 5.2).

No.	Admission Year	Graduate Year	No. of students	Female	Male	From	Remarks
1	2011	2013	4 (CMP)	1	3	3 - Independent (Nepal) 1 - DHM (Nepal)	
2	2012	2014	4 (CMP)		4	4 - Independent (Nepal)	
			2 (CHARIS)		2	2 - Kabul Univ. (Afghanistan)	
3	2013	2015	4 (CMP)	2	2	4 - Independent (Nepal)	
			1 (CHARIS)		1	1 - Independent (Nepal)	
4	2014	2016	4 (CMP)	1	3	4 - Independent (Nepal)	Students from India are one term participants
			6 (CHARIS)	1	5	1 - Independent (Nepal) 2 - Karakoram Univ. (Pakistan) 1 - WAPDA (Pakistan) 2 - Sharda Univ. (India)	

Table 3: *Overview of student admission to the MSc Glaciology program at Kathmandu University (Note: students from outside Nepal are financed by the CHARIS project of USAID)*

ICIMOD and TU have been involved in some guest lecturing at KU, but there seems to be little synergy between the MSc program and relevant studies within meteorology and hydrology at TU. The Team is of the impression that more financial resources are available at the private KU than the governmental TU, partly due to the steering of Project funds towards KU and the MSc program. It has also been difficult for TU students to get accepted for the MSc program at KU because it requires a 4-year BSc degree, whereas BSc programs at TU have until now been of 3 years duration. These are unfortunate circumstances, and the Team suggests that TU, as the main educational institution for meteorology and hydrology, get more involved in both the educational and research aspects of the Project. This can be achieved by facilitating more exchange of students and lecturers between TU and KU, making coordinated courses and curriculums, and implementing TU/KU-led research activities within the Project framework.

Several training courses (see list in Annex VII) have been held for each Component 1-3. They have been very well attended with participation from KU, TU, DHM, WECS and several other RMC countries. The courses contain a good mix of lectures, tutorials and practical activities in the field, lea by very qualified personell from ICIMOD and relevant partners. Participants are generally very satisfied, but DHM expressed that more practice in field planning and equipment maintenance is needed in order for them to operate similar monitoring programs on their own. This needs to be a main purpose for the next phase of the Project in order to achieve a sustainable transfer of the monitoring activities to local institutions. Some funding probably needs to be steered towards that since the relevant institutions (mainly DHM and TU) have very limited resources (funds and equipment) despite being relatively strong in manpower.

3.2 Main achievements and main challenges

Of the more concrete results, the Team will highlight six major achievements:

- Two new sites for glacier/hydrology monitoring and research have been established
- Complete glacier inventory for the HKH region has been issued
- MODIS satellite facility for snow cover mapping is operational
- MSc program in glaciology established at KU
- Nepalese and RMC institutions have been trained and brought closer together
- Regional center for cryospheric data and knowledge established at ICIMOD

All these achievements are important stepping-stones for future glacio-hydrological monitoring and research in the HKH region, especially in Nepal where most of the Project activities have taken place.

A lot of resources has inevitably gone into the establishment of the two glacier/hydrology monitoring sites (Components 1-2) and the associated training courses (Component 5). The Team has a clear impression that the field activities have been professionally planned and carried out, with modern equipment/instruments and a strong focus on health (sufficient time for acclimatization) and safety (roping up in crevassed terrain). The two European partners ETH and FW/UU have played an essential role in the more science-oriented activities, and this has undoubtedly strengthened the Project although also introducing issues concerning local

sustainability of highly advanced instruments, models and methods. Even if these partners are formally leaving the Project, they still have research interests in the area, so it is important that they stay informed and involved from a collaborative and advisory side.

The scientific productivity has been high with 10 first-authored peer review papers and another 15-20 papers submitted or in preparation (Annex VII). Of those, about half are a direct outcome of the CMP Project, whereas the other half is more loosely related through other projects and collaborators. Most papers are published in well-known international journals like "The Cryosphere" and "Journal of Glaciology". Since a lot of resources have been put into establishing the monitoring programs and infrastructure, it is not until the next phase of the Project that the key scientific results will mature. At this stage it is very important to coordinate the data and results in publications between institutions. There has already been some tension between ICIMOD researchers, who have designed most of the field experiments, and KU students who want to use use the same data for research papers as a part of their dissertation. At the same time, TU is somewhat on the sideline with few research projects that make use of CMP data.

The scientific publications will undoubtedly contribute to a better understanding of water resources in the region, but the full potential is only reached if the scientific data and findings are also materialized into operational models, products and programs that can be managed over a longer term by institutions like DHM. The results need to become publicly available with some associated outreach activities and training. It is important that sufficient resources are allocated to this in parallel with the peer review scientific publishing.

To sum up the more challenging sides of the Project, the Team will highlight six points:

- Fieldwork at high altitude is time-consuming and requires experience and good health
- Instruments need to be robust and well designed to endure rough weather conditions
- ICIMOD and KU has built up strong capacity, but DHM and TU are lagging behind
- There are many project partners, so research needs to be carefully coordinated
- Scientific findings must be transformed into locally useful data and assessments
- RMC partners need to be more involved, but should also commit to share data

The two first points are inevitable characteristics of fieldwork in the HKH region, and the Project has done a tremendous job to promote field safety, training and good instrument design. However, the commitment of time and effort will always be high to keep up such monitoring programs, and that will be an obvious challenge in the wake of CMP funding. The other four points are challenges that the Project is already working on, but they will need a stronger focus in the next phase of the Project to ensure a long-term positive effect of the Project in both Nepal and the remainder of the HKH region.

4 Assessment of project efficiency and effectiveness

4.1 Project efficiency

Efficiency is a measure of productivity, meaning comparing inputs against outputs; a measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results/outputs.

Expenditure reported in the Project Final Report covering November 2010 until December 2013 was 18.3 million NOK. Extrapolation of this figure indicates expenditure at about 24 million NOK by the time of review. According to the financial reporting (see Section 2.5) around 85% of the funding is used by ICIMOD. Although some of this funding is used to cover expenses related to activities performed by other Project partners, it is the Teams clear impression that a very large portion of funds is used to cover costs related to administration, equipment and scientific- and technical work within ICIMOD.

As the Progress assessment shows, ICIMOD has to a large degree succeeded in building up a regional hub and contact network for cryospheric issues in the HKH region. This has, understandably, included high costs related to establishment of technical and administrative infrastructure and the hiring of highly qualified international expertise to establish the scientific basis of the work. To a large degree this has been pioneering work, including studies of little known and difficultly accessible glaciers and challenges related to cultural and political differences among the RMC partners. However, as the Project is now moving into a more established phase, appropriate funding and resources should be allocated to local and regional institutions performing routine-based monitoring. This is important to ensure that essential data records get maintained and developed.

About 9 % of the funding has been allocated to KU, which from this moderate amount has established a fully operational MSc program in glaciology. This is a key component for the future efficiency of the Project since it will contribute to increased levels of knowledge in local and regional institutions – enabling more work to be done by qualified local personnel. In the future the practical training programs, until now administered by ICIMOD, should also be organized in the same way by enabling local handling of the training (i.e. train the trainers).

Taking the challenges mentioned above into account, the Team considers that the efficiency until now has been good. Future efficiency will to a large degree depend on how the transfer of more routinely monitoring work and other tasks to local institutions is handled.

Specific question raised in the ToR:

Q1: *Has comparable studies been done on glaciers at the same altitudes. Are comparable cost estimates available?*

A1: Comparable glacier studies, though typically at a smaller scale, have been done in several of the other RMC countries such as Pakistan, India and China. High-altitude glacier monitoring

has also been carried out in the Pamir and Tien Shan mountains (north of HKH), on Mount Kilimanjaro, and several places in the Andes mountains. Field costs are generally not available, and they are difficult to compare due to the large variation in project scales, site access and local cost levels. However, the Team is under the clear impression that the CMP field work has been carried out in a cost-efficient way considering the necessity for at least a week of trekking/acclimatization, the relatively large field groups due to coincident training courses, and the need for new instruments that have to be carried in and installed. In total over the three first years, the Project has spent about USD 160,000 on the actual fieldwork and about USD 300,000 on equipment and instruments for Components 1-2. These costs will likely be reduced considerably in the next phase of the Project as the monitoring becomes more of a routine operation, gradually transferred to local institutions such as DHM.

4.2 Project effectiveness

Effectiveness is a measure of the extent to which a project is successful in achieving its objective.

The overall objective is manifested in the Goal as this is stated in the PD:

> "Contribute significantly to improved knowledge and understanding on cryosphere by analyzing changes in glaciers, snow and glacio-hydrology in relation to impacts of climate change for water resources management in the HKH region."

This Goal is further detailed and itemized with respect to the five Components and named as Outcomes, Outputs and Sub-Outputs. The Team has assessed this fulfillment in Annex VIII and Chapter 3.

At the time of writing, about four years after the Project started, the Team assesses that the Project is well on its way towards achieving the overall goal. A good infrastructure has been established, the monitoring and scientific work is up to international standards, and training and education programs are well developed and ongoing. The main remaining challenge is to develop and calibrate models that are able to upscale the field-based results to individual drainage basins within the HKH region, and to feed the results to relevant institutions for support in management and decision-making.

Specific questions raised in the ToR:

Q: *Assess applied methodology. Are the research activities in compliance with internationally accepted standards? Has any innovative activities/approaches been carried out?*

A: Yes, the measurement methods and monitoring strategies are up to international standards following the guidelines of the Global Terrestrial Network for Glaciers (GTN-G) and the World Meteorological Organization (WMO). Of more innovative research, it is worth to mention the extensive studies of debris-covered ice processes on the Lirung Glacier tongues, especially the use of unmanned aerial vehicles to map down-wasting, movement and the development of ice

cliffs and melt ponds. This provides the opportunity to monitor changes and develop models of important glacier processes that are not well understood. Care should be taken that these activities are also carried on to the next phase of the Project even though the leading institutions of this research (ETH and FW/UU) will not receive future CMP funding.

Q: *To what extent has ICIMOD and their member countries utilized lessons learned from relevant international work?*

A: There is generally a good amount of available information from international work through research publications, monitoring reports and international services like WGMS and WMO. ICIMOD is a key connection point for the RMCs to the international community through the organization of internationally attended workshops and training courses. The ICIMOD personnel is highly qualified and strive to follow international standards on measurement techniques and data quality control. It is largely up to the different RMC institutions to follow up on international recommendations and take part in ICIMOD's initiatives with regards to capacity building and sharing of data and knowledge.

5 Project relevance and other issues raised in the ToR

The ToR raises some specific question on relevance and other issues. Although some of these questions have been partly or fully answered in other parts of the report, the Team will try to present comprehensive answers in a systematic manner in this chapter.

5.1 Relevance

Q: *To what extent is ICIMOD's cryospheric research coordinated with other cryosphere research ongoing in the region? Synergies or unnecessary overlaps? In particular, the cooperation with the Norwegian funded project in Bhutan where the Norwegian water resources and energy directorate (NVE) is a partner should be assessed. Assess modalities for possible further cooperation. Can the cooperation be further enhanced?*

A: The CMP research has so far focused on the Nepalese part of the HKH mountains, and coordination with other RMCs has mainly been on developing standardized methodologies and formats for data sharing. Regional cooperation will be increasingly important in the next phase of the Project as the geographical focus expands to other parts of the HKH region, potentially rising issues related to data compatibility, sharing and authorship of publications.

Within Nepal, there are obvious synergies among the CMP partners that work on related topics and use the same data pool. However, there is also some overlap in research interest among the institutions, especially between ICIMOD and KU. The KU MSc program prescribes that students submit a peer-review research paper upon graduation, which puts a high demand on the field data for rapid publication, potentially at the cost of ICIMOD researchers who have developed much of the measurement strategies and also need to publish themselves. It is

questionable whether it is beneficial for the students and the Project to be so focused on student papers given that some of them will be rejected due to the high peer-review standards.

ICIMOD has not been formally involved in the Bhutan project of NVE, but has contributed in terms of advising and hosting of workshops and training courses. The fieldwork and glacier monitoring in Bhutan follow the same standards as CMP although operated at a smaller scale and budget. In the next phase of the CMP Project, ICIMOD is getting formally involved in extending cryosphere monitoring activities to other parts of the HKH region, including Bhutan where an agreement has been signed with DHMS. Separately, ICIMOD and NVE have initiated a snow monitoring project in Nepal that builds on the observational network in Langtang Valley and the snow modeling experience of NVE. This will increase cooperation between ICIMOD/CMP and the Norwegian cryospheric community, and the cooperation could be further enhanced by involving other relevant institutions such as the University of Oslo (general cryospheric research) and Statkraft (snow monitoring for hydropower purposes).

Q: *To what extent do the cryosphere activities support other things ICIMOD is involved in?*

A: The CMP Project is highly relevant for all ICIMOD programs related to climate change, water resources and geohazards. It has also a strong focus on capacity building and knowledge sharing, gaining experience on institutional development and public outreach.

Q: *To what extent has or will results be used in national plans?*

A: This is too early to say, but the collected data are unique and the initial results look promising, so if the continued Project is well managed with a successful transfer of monitoring activities to governmental institutions, the Team believes that the results will gradually become more and more relevant for national plans and public services.

Q: *What is the relevance for Nepal's hydro power sector?*

A: The results will become useful for the hydropower sector as soon as robust routines are developed for data sharing, catchment upscaling and hydrological modeling - all major goals in the next phase of the Project. It is critical that governmental institutions get a strong involvement in this operationalization to make the work sustainable beyond the CMP Project. Both DHM, WECS and IPPAN expressed a strong interest and need for improved data and forecasts on water discharge throughout Nepalese mountains areas. The Team suggests that ICIMOD invites the relevant Nepalese institutions to discuss the current state of hydrological data and models, with the aim of developing plans for how the CMP Project and its continuation can best contribute to improved hydrological management in Nepal.

Q: What is the relevance of the cryosphere activities funded by Norway for the Intergovernmental Panel on Climate Change?

A: To be relevant for the IPCC, regional assessments are dependent on accurate input data that are well distributed in space. One of the regions with largest climate variability and fewest data related to climate change is the HKH mountains, and the outputs of the CMP Project thus provide important pieces to the larger puzzle. The Project's development of a complete

inventory of HKH glaciers has been a key step forward, as glacier- and climate modelers worldwide are dependent on such baseline data sets to make reliable assessments of glacier changes, contribution to sea level rise and other climate change indicators. Parts of the inventory were already used in contributions to IPCC's 5th Assessment Report.

5.2 Other issues

Q: *Further activities: Assess whether ICIMOD should do more/new measurements on the same glaciers or whether ICIMOD should start measurements on new glaciers? In the latter case: Which geographical areas/glaciers are the most relevant?*

A: For the next phase of the Project until 2017, the Team is of the clear opinion that field activities should focus on further developing the two established monitoring sites (glaciers and rivers in the Langtang Valley and Hidden Valley) and to gradually transfer monitoring reponsibilities to DHM and the universities for long term sustainability. For research, there is enough data to work on from the existing sites for at least another couple of years. In the longer term, ICIMOD could initiate similar activities in the Khumbu Valley (or other semi-accessible Nepalese regions) or even better; support other RMC partners to establish sustainable monitoring programs in their own countries. The latter suggestion has already been implemented in the new agreement with ICIMOD for the CMP continuation.

Q: *Does ICIMOD have sufficient human resources and capacity to expand? Assess sustainability of possible expansion. In which professional areas would ICIMOD benefit from recruiting new professionals and/or cooperate with new partners? In this regard also assess the relevance and opportunities of increased cooperation between ICIMOD and Norwegian institutions.*

A: ICIMOD is well staffed and very professional in terms of project management and human resources. With more resources they certainly have capacity to expand, and they have recently strengthened their scientific profile by hiring several highly qualified researchers, partly enabled through the CMP Project. Although this is desirable in many ways, it can also in the worst case diminish the need for engaging local expertise in future projects. The Team does not have a sufficient overview to judge ICIMOD's general capacity and needs, but in terms of cryospheric sciences, they have built up a strong group in glacio-hydrology and remote sensing through the CMP Project, whereas other important cryosphere-related topics like permafrost and geohazards (avalanches, landslides and floods) have had less focus. This could be an area of future expansion, potentially involving relevant Norwegian institutions such as NVE, the Norwegian Geotechnical Institute (NGI), the Geological Survey of Norway (NGU) and the geoscience research groups of the universities (mainly UiO and NTNU).

To ensure sustainability, expansion of ICIMOD should ideally be initiated and funded by the RMC countries. However, many of them have limited financial resources, and the two largest of them, China and India, also have an interest to build up strong national research centers such as the Institute of Tibetan Plateau Research (ITP) in China and the Wadia Institute of Himalayan

Geology (WIHG) in India. It is therefore likely that ICIMOD will still be dependent on donor funding, especially with regards to coordinated efforts across national borders.

Q: *What are the main knowledge gaps on cryospheric issues in the Hindu Kush Himalayas?*

A: See the first paragraph of Section 1.1, a scientific introduction to the Project.

Q: *Assess the cooperation between ICIMOD and national partners. In particular assess the curriculum of the Cryosphere Course at Kathmandu University (KU), including:*

- *Synergies with KU's energy education*
- *Assess the relevance and transparency of KU's criteria for awarding scholarships to this course*
- *Quality of student reports*
- *Student ability/motivation to undertake fieldwork in high altitude areas*

A: See Chapter 3 and 6 for general descriptions and assessments of the institutional cooperation. Regarding the MSc Glaciology curriculum, the Team finds it strong in traditional glaciology and practical research training, with a generally good level on dissertation thesis. However, the curriculum is fixed around a structure of six general courses, with few opportunities for students to take more technical courses in selected fields of specialization. The program could benefit from more flexibility and interaction with other relevant KU programs (e.g. the energy education) and with TU in particular since they are the main educational institution for meteorology and hydrology. However, the physical distance of about 30 km between the two universities could hamper the feasibility of student exchange, so mutual guest lecturing/advising on selected topics could be a more realistic option.

Concerning student admission, the Team found it encouraging to meet such a good blend of students (Table 3 and Annex III-IV) with different backgrounds and plans for their postgraduate work life. Besides academic qualification, KU gives priority to qualified female candidates, minority groups, and candidates with good physical health and field experience from high altitude. The students' ability to undertake high-altitude fieldwork is, however, difficult to predict, and although the students generally seemed very motivated, there had been a few difficult cases in the field. The academic requirement of a relevant 4-year BSc degree secures well trained students, but has had the unfortunate consequence that 3-year BSc graduates from TU do not get admitted or need to go through preparatory courses. This problem will gradually disappear as TU has also started with 4-year BSc programs, but until then, it is in the Project's interest that admission for 3-year graduates is made as smooth as possible with clear requirements for additional courses that are agreed upon by both KU and TU.

6 Sustainability and cross-cutting issues

Sustainability is a measure of whether the positive effects (or assumed measurable effects) of the Project is likely to continue after the external support is concluded, meaning: will the project lead to long term benefits.

Although sustainability is not directly addressed in the ToR, many of the topics in the previous chapters deal with related issues. The Team will here address sustainability based on impressions from the review and feedback on the presentation of preliminary results from the review. The focus is on Nepal, but many of the comments might be relevant for the other RMCs as well – especially those with less developed activities on cryospheric issues.

The Project has allowed ICIMOD to build up a very strong capacity on cryospheric issues through hiring of scientific staff, purchase of modern instruments and managing most of the Project activities. The extensive training courses for other institutions (DHM, TU, KU, WECS and RMCs) have given them essential competence and field experience for the future, but unless they get more direct responsibility and financial resources (within the Project or externally), it will be difficult for them to carry on the monitoring programs beyond the CMP Project. The next phase of the Project needs to focus on a gradual transition of responsibilities from ICIMOD to local institutions, with appropriate funding and dedication from all parties involved.

The two European partners ETH and FW/UU have played an essential role in the more science-oriented activities. This has undoubtedly strengthened the Project, although also introduced some concerns regarding the sustainability and dependence on highly advanced instruments, models and methods. Some activities will be naturally phased out when scientific goals are reached, whereas others are more important to keep, such as the capability to model discharge from hydrological basins. The first training courses showed that it was difficult for participants to master advanced physical models since most of them have limited theoretical background. The course content was then adjusted to include more basic tutorials on physical processes and computational programming, which was well received by the participants. For the future, it is important that instruments, methods and models are within the capability of local institutions. Development should go from simple to advanced techniques rather than the other way around. With some adjustments, all this is achievable within the next Project phase.

The purchased scientific instruments will be useful for many years to come although some basic level of funding is needed for maintenance and upgrades. The instrument-related costs have already started to decline within the project, and this development will likely continue. The most basic glaciological monitoring needs little advanced equipment and should be possible to keep up even with a substantially lower budget as long as there is a dedicated team that is capable in crevassed terrain at high altitude. Automatic weather stations are obviously more costly, but important to keep for at least another few years. The MODIS satellite facility is physically installed at ICIMOD (Annex V), so the Project needs to look into other sources of funding to secure a longer term continuation.

The Project focus will gradually shift from research to more monitoring related tasks. This is a good sign for the financial sustainability of the Project, since locally based monitoring in general is relatively cheap. Added to this comes the benefits of a local base of new scientist from the MSc Glaciology program.

Until now KU has been the main Nepalese partner in the Project. They have established a professional and popular MSc Glaciology program, which is a key contribution to technical sustainability both in a Nepalese and regional context. The theoretical and collaborative aspects of the program could be strengthened by a more active involvement of TU with its meteorological and hydrological expertise. A gradual transfer of more research-related activities from ICIMOD to the universities would also contribute to long-term institutional sustainability. So far, most research publications seem to be driven by the individual institutions rather than the Project consortium.

Comprehensive involvement of DHM is crucial for the long term-sustainability of CMP monitoring activities. Until now they have mainly participated in field-related activities and capacity building, with few direct responsibilities within the Project. Given their long experience and expanding capacity, they should be increasingly involved in operational tasks and scientific work. They have expressed willingness to take over the responsibility of CMP glacier monitoring programme in cooperation with KU starting from 2017, but the modality like funding and dedication need to be worked out.

WECS has so far been little involved in the Project. Their responsibility is mainly at the policy level, and hence data and results need to be applicable for management of water and energy resources. This will be more relevant in the continuation of the Project when the monitoring activities develop from a research phase to an operational phase. A close dialogue between WECS, DHM and ICIMOD on data provision and needs should be established. A more active involvement of WECS in the future is crucial for the political foundation of the Project, and for attaining action that can benefit the Nepalese people and society as a whole.

The Team realizes that obstacles related to, among others, frequent mobility of government staff and financial routines might be serious. Nevertheless, the Team recommends that ICIMOD and the Nepalese partners get together in the near future to make plans and allocate resources for a more active and autonomous involvement of the governmental institutions.

The Team also made some investigations on issues related to gender and minority groups. In the institutions visited, there are a significant male dominance on leader- and scientific level (Annex III). ICIMOD, the main Project partner, appears to be well aware of this issue and has formulated a Gender Equity Policy. They are working to improve the gender balance, and three women have recently been recruited to scientific positions. KU prioritizes qualified minority groups and females, and 5 out of 25 admitted students are female (Table 3). Consequently, there are signs that the gender balance will be more equal in the future.

7 Conclusions and recommendations

7.1 Technical issues

The Project is performing very satisfactory with respect to the planned activities, outputs and outcomes in the PD (Annex VIII), especially considering that the plans were initially scheduled until the end of 2015. The two glaciological and hydrological monitoring sites are well established, and the Langtang site has even been developed beyond the Project ambitions, much due to the extensive involvement of the European partners ETH and FW/UU. This has made it a unique field-laboratory for glacio-hydrological research within the HKH region, and it is not until the next phase of the Project that the full merits will be seen in terms of scientific publications and useful results/models for relevant authorities.

Since all field activities cannot be continued in the future, it is important that the Project carefully considers all observational programs and finds out what is of a temporary character (e.g. to reach specific science goals) and what is essential for longer term monitoring and local water management. This planning need to include both the Nepalese and European partners, and should build a local foundation for future monitoring activities that can be sustainable beyond the CMP funding.

The Projects scientific productivity has been high (10 first-authored papers) and will probably be even higher in the next phase of the Project as the field data get fully analysed and synthesized (15-20 papers in progress). Most of the research is at an internationally high level and in line with standards and priorities of the cryospheric community. The Project is on a good scientific track, and there will be a lot of data to work on and publish also in the next phase of the Project. It will be natural to gradually shift focus from the local scale to the regional scale by integrating locally validated models with remote sensing products such as the HKH glacier inventory, the MODIS snow cover maps and future satellite-based analyses of snow thickness and glacier elevation changes. This will also help to make the Project more visible and relevant for other RMC countries, with opportunities for more direct involvement.

As the scientific goals gradually are reached, sufficient resources need to be devoted into the operationalization of relevant scientific findings into locally usable hydrological models and assessments. This is not something that comes by itself, and local institutions like TU, DHM and WECS need to be closely involved from the start. Similar approaches can later be transferred to other RMC countries with support from ICIMOD. These aspects are extremely important for reaching the wider development goals of ICIMOD and its donors.

7.2 Management issues

Generally the project design and management are up to the highest standards. The PD is comprehensive and well structured, though somewhat short on the involvement of partners. Meetings have been held as scheduled and all activities are well documented. The financial management follows international standards and audits are carried out.

The review of the finances shows that expenditures have been roughly as planned and below the budget with a reasonable margin on all main budget posts. About half of the budget and expenditure is allocated under *Project Management*, but closer inspections revealed that most of these costs are actually related to other activities and purchases. For future budgeting, the Team proposes that this budget post is re-examined to sort out the pure administrative costs.

ICIMOD is not only the management-hub of the Project, but also the main scientific actor in the Project. Of other Nepalese Project partners only KU has a dedicated Project budget and is performing larger autonomous Project activities. The other national partners have until now only been involved in training and other capacity building activities. As regards the other RMC countries, the level of involvement appears to be more in line with expectations, but the involvement of RMC partners in the Knowledge Hub should be strengthened.

At this relatively early stage it is understandable that most activities are carried out by ICIMOD, and the Team also realizes that there might be considerable practical obstacles that hamper the involvement of Project partners. However, a more active involvement of Nepalese partners is crucial for the long-term sustainability of the Project. TU could contribute with meteorological and hydrological expertise to the KU MSc program and to research. DHMs competence and physical infrastructure will be crucial when the Project enters a more monitoring oriented phase. As the Project matures and more aggregated results become available, WECS will be the key institution as regards practical use of results and putting the issue on the political agenda.

To improve national involvement, the Team recommends that additional planning is initiated. The aim of this should be to attain more active, autonomous and scientific involvement from Nepalese partners. One concrete way to do this could be to run an intermediate planning exercise based on the PD from 2011 with increased focus on allocation of activities and budgets to national institutions. This would also be an opportunity to strengthen personal contacts between scientists and other people involved in the Project. Simultaneously the Project's budget on management should be re-examined to separate out the pure administrative costs from those related to project activities.

The Team proposes that additional measures to increase the activity level and integration of Project partners are also considered. This could for example be meetings between KU and TU with the aim of coordinating curriculums and research, as well as to bring TU more actively into the project activities. Additional efforts should be directed towards WECS, and possible also other high-level governmental bodies, to attain closer links between the project and planning- and budgeting processes on national level. The Team also proposes that an open workshop on data availability, -use and -needs is organized in the near future. This could be an opportunity to present the Project to other governmental or non-governmental stakeholders and possibly also to bring new partners into the Project.

7.3 Summary of recommendations

Based on the review as a whole, the main recommendations from the Team to the Project are:

1. Project activities should gradually move from a local to a regional and national focus.
2. All field activities should be assessed to determine which of them will be temporary (research within CMP) and which will be permanent (monitoring beyond CMP).
3. Potential expansions of the CMP Project could focus on permafrost and geohazards.
4. The KU MSc Glaciology program and ICIMOD training activities should be continued and developed, and with a stronger involvement from TU.
5. Coordination between ICIMOD and KU on research projects and publications need to be improved, and TU should get the same opportunities to do research within CMP.
6. Nepalese monitoring activities should be gradually transferred to governmental institutions (mainly DHM) with a sufficient allocation of funding and resources.
7. An open workshop on data availability, -use and -needs should be organized in the near future to promote more active data sharing and usage among relevant institutions.
8. A cross-institutional strategy, involving at least DHM and WECS, should be developed to fully utilize the Project results in Nepalese water management.
9. ICIMOD should strive to strengthen, and possibly expand, external partnerships and responsibilities within their projects, especially among RMC government entities.
10. The experiences of the CMP Project in Nepal should be utilized to develop similar monitoring programs in other RMC countries in the future.
11. An intermediate planning exercise (revision of the current PD) should be carried out to increase the autonomous involvement of Nepalese partners and relevant RMCs.
12. The Project's budget on management should be re-examined to separate out the pure administrative costs from those related to project activities.

These recommendations are not indicative of current shortcomings in the project, but are a suggestive guideline for future work to reach the full potential of the CMP Project in a sustainable way. The Team realizes that some of the recommendations might not be feasible due to limited resources, changes in the Project, and different prioritizations within ICIMOD and among stakeholders. However, the Team is under the impression that ICIMOD take these matters very seriously and are well on way to address many of them in the nearest future.

Annexes

Annex I	Terms of Reference
Annex II	Field trip - program
Annex III	Field trip – people met
Annex IV	Field trip – a few pictures
Annex V	List of Project documents and web-links
Annex VI	Additional information from ICIMOD on budget
Annex VII	Table of publications and reports
Annex VIII	Assessment of outputs compared to plans
Annex IX	Comments on Draft Report (and responses)

Terms of Reference for a Review of ICIMOD's work on cryospheric issues

I. Background

Norway is supporting ICIMOD in the period 2013-2017. Details are provided in the Annex 1 of the agreement signed on 10 December 2013 and further described in the Document "A Strategy and Results Framework for ICIMOD." Together with the "Medium Action Plan 2013-2017" and previous Norwegian cooperation with ICIMOD, such as the Cryosphere project (NPL-08/036) and the HICAP (Himalayan Climate Change Adaption Programme) (QZA-11/0747) are being continued through the new agreement as part of the support to ICIMOD's Regional Programmes.

The previous cryosphere project is being continued as part of the Regional Programme 4 "Cryosphere and Atmosphere."

According to the Cryosphere contract between ICIMOD and the Embassy signed on 30 November 2010 "A mid-term review and an end-review focusing on progress and the effectiveness of the Project, i.e. the extent to which the objectives are being/have been achieved shall be carried out. Also the cooperation with Partners may be addressed. The cost of the reviews shall be covered by MFA over and above the Grant."

II. Purpose/Scope of Work

The purpose of the review is to assess progress up to date on ICIMOD's work on cryospheric issues and to advice on way forward.

The scope of work has the following main areas:

Progress

- What are the main results so far?
- Assess progress in terms of used funds, achieved results and particular challenges related to high altitude research
- Assess progress compared to objectives and original plans (2011 Inception Report). Identify deviations and assess whether these can be justified. Has lessons learned been used to undertake relevant adjustments?
- Number of Peer Review articles and quality

Efficiency

- Assess cost efficiency. Has comparable studies been done on glaciers at the same altitudes. Are comparable cost estimates available?

Effectiveness

- Assess applied methodology. Are the research activities in compliance with internationally accepted standards? Has any innovative activities/approaches been carried out?
- To what extent has ICIMOD and their member countries utilized lessons learned from relevant international work?

Relevance

- To what extent is ICIMOD's cryospheric research coordinated with other cryosphere research ongoing in the region? Synergies or unnecessary overlaps? In particular, the cooperation with the Norwegian funded project in Bhutan where the Norwegian water resources and energy directorate (NVE) is a partner should be assessed. Assess modalities for possible further cooperation. Can the cooperation be further enhanced?
- To what extent do the cryosphere activities support other things ICIMOD is involved in?
- To what extent has or will results be used in national plans?
- What is the relevance for Nepal's hydro power sector
- What is the relevance of the cryosphere activities funded by Norway for the Intergovernmental Panel on Climate Change?

Other issues

- Further activities: Assess whether ICIMOD should do more/new measurements on the same glaciers or whether ICIMOD should start measurements on new glaciers? In the latter case: Which geographical areas/glaciers are the most relevant?
- Does ICIMOD have sufficient human resources and capacity to expand? Assess sustainability of possible expansion. In which professional areas would ICIMOD benefit from recruiting new professionals and/or cooperate with new partners? In this regard also assess the relevance and opportunities of increased cooperation between ICIMOD and Norwegian institutions
- What are the main knowledge gaps on cryospheric issues in the Hindu Kush Himalayas?
- Assess the cooperation between ICIMOD and national partners. In particular assess the curriculum of the Cryosphere Course at Kathmandu University (KU), including:
    - Synergies with KU's energy education
    - Assess the relevance and transparency of KU's criteria for awarding scholarships to this course
    - Quality of student reports
    - Student ability/motivation to undertake field work in high altitude areas

III. Implementation

The Report should be based on a desk review of relevant documents as well as a visit to Nepal. For the team to be able to assess to what extent results has been or will be used in national plans, email or phone interviews with country focal points might be necessary. The team should also meet with NVE regarding the Bhutan project.

The team [consultant] will report to Norad [the client]. A debriefing where the Team presents its preliminary conclusions should be held with the Embassy and ICIMOD before the team leaves Kathmandu.

The team will consist of 2 Norwegian/international experts who combined should have the following knowledge:

- The Himalayan region or other high altitude regions
- Applied glaciology from Norway or other countries
- Cryospheric research
- Experience in undertaking reviews of development projects

Norad, the Embassy, and ICIMOD will make relevant documents available to the team.

The Review will include:

- Desk study of relevant documents
- A one week stay in Nepal (the week starting December 8th 2014)
- Preparation of a draft appraisal report (comments by Norad, Embassy, ICIMOD)
- Preparation of Final Report

IV. Reporting

The review should include an executive summary with clear main conclusions and recommendations.

The appraisal should not exceed 20 pages (excluding executive summary and annexes).

The appraisal report should be in English language and delivered electronically in Microsoft Word/PDF.

Annex II

Field trip - program

Time		Venue	Responsible
8 December 2014 Monday			
11:00 – 11:30 Hrs	Preparatory meeting at ICIMOD: Discussion and clarification about the agenda and logistics	Kanchenjunga Meeting Room, ICIMOD	Mr. Farid Ahmad
11:30-12:00 Hrs	Monitoring of Glaciers Group • Meeting with Dorothea Stumm and Sharad Joshi	Kanchenjunga Meeting Room, ICIMOD	Mr. Pradeep Mool
12:00-12:30 Hrs	Glacier Hydrology Group • Meeting with Dr. Arun Shrestha and J. Shea	Kanchenjunga Meeting Room, ICIMOD	Mr. Pradeep Mool
12:30-13:00 Hrs	Remote Sensing Group • Meeting with Samjwal Bajracharya, Deo Raj Gurung and Kiran Shakya	Kanchenjunga Meeting Room, ICIMOD	Mr. Pradeep Mool
13:00 – 14:00 Hrs	Lunch	ICIMOD Canteen	
14:00 -14:30 Hrs	Meeting with Budget and Finance Unit of ICIMOD • Mr. Shekhar Ghimire, Director Administration and Finance • Mr. Rajendra Prakash Mali, Senior Finance Officer/Unit Head, Budget and Finance • Mr. Prem Manandhar, Senior Officer/Programme Finance, Budget and Finance	ICIMOD	Mr. Pradeep Mool
14:30 – 16:00 Hrs	Joint meeting between Review Team members, Norwegian Embassy and ICIMOD team	Kanchenjunga Meeting Room, ICIMOD	Mr. Farid Ahmad
16:00-17:30	Discussion project management, organisation, planning and implementation- Review Team and Project Team	Kanchenjunga Meeting Room, ICIMOD	Mr. Farid Ahmad
9 December 2014 Tuesday			
10:00 – 16:000 Hrs	Visit to Kathmandu University and discussion with Dr. Rijan Kayastha, MS Glaciology students, faculties and management	Kathmandu University, Dhulikhel	Dr. Rijan Bhakta Kayastha
16:00 --17:00 Hrs	Recap of the day by Review Team		
10 December 2014 Wednesday			
10:00 – 11:000 Hrs	Visit to Water and Energy Commission Secretariat. Dr. Sanjaya Sharma, Joint Secretary, Water and Energy Commission Secretariat	WECS Office at Singha Durbar	Dr. Sanjaya Sharma

11:15 – 12:30 Hrs	Visit to Department of Hydrology and Meteorology, Government of Nepal. Dr. Rishi Ram Sharma, Director General, DHM Mr. Gautam Rajkarnikar, Deputy Director General, DHM Mr. Suresh Chand Pradhan.	DHM Office at Nagpokhari	Dr. Rishi Ram Sharma
13:00 -14:00 Hrs	Lunch		
14:30 – 16:00 Hrs	Visit to Central Department of Hydrology and Meteorology, Tribhuvan Univeristy	Kirtipur	Dr. Tirtha Adhikari
11 December 2014 Thursday			
10:00 – 12:30 Hrs	Skype meeting with Regional Member Country (RMC) Partners and other Project Partners: . ETH- Zurich . Utrecht University- the Netherlands . NVE- Oslo . CAREERI- China . WIHG-India . DHMS- Bhutan . PMD- Pakistan . KIU- Pakistan	ICIMOD (Noshaq Meeting Room)	Mr. Pradeep Mool
12:30 -13:30 Hrs	Lunch		
14:00 – 16:00 Hrs	Clarification and further consultation at ICIMOD	Shisha Pangma Meeting Room, ICIMOD	Mr. Farid Ahmad Mr. Pradeep Mool
16:00 -16:30 Hrs	Meet the MS Glaciology graduate from KU	Shisha Pangma Meeting Room, ICIMOD	Mr. Pradeep Mool
12 December 2014 Friday			
10:00 – 11:00 Hrs	Debriefing of the initial findings to Norwegian Embassy and ICIMOD (*see list of participants)	Kanchenjunga Meeting Room, ICIMOD	Mr. Farid Ahmad
11:00 – 12:30 Hrs	Clarification and further consultation at ICIMOD	Shisha Pangma Meeting Room, ICIMOD	Mr. Farid Ahmad
15 December 2014 Monday			
08:00 – 09:00 Hrs	Wrap-up meeting with Norwegian Embassy by Review Team	Norwegian Embassy	Mr. Håkon Arald Gulbrandsen
10:30 – 11:30 Hrs	Meeting with Independent Power Producers Association, Nepal (IPPAN)	IPPAN	Mr. Kumar Pandey

Field trip - people met

Royal Norwegian Embassy, Kathmandu
Mr. Jan Eriksen, Counsellor (Energy)
Mr. Håkon Arald Gulbrandsen, Minister Counsellor

ICIMOD
Mr. Farid Ahmad, Head strategic planning, monitoring and evaluation
Mr. Pradeep Mool, Programme coordinator, Cryosphere initiative
Mr. Arun Shrestha, Regional programme manager
Mr. Eklabya Sharma, Director programme operations
Mr. Shekhar Ghimire, Director administration and finance
Mr. Philippus Wester, Chief scientist, Water resources management
Ms. Dorothea Stumm, Glaciologist
Mr. Sharad Joshi, Glacier analyst
Mr. Joseph Shea, Glacier hydrologist
Mr. Samjwal Bajracharya, Remote sensing specialist
Mr. Deo Raj Gurung, Remote sensing specialist
Mr. Rajendra Bahadur Shrestha, Cryosphere specialist
Mr. Kiran Shakya, Database specialist
Mr. Rajendra Prakash Mali, Senior finance officer
Mr. Prem Manandhar, Senior finance officer
Mr. Ghulam Muhammad Shah, Evaluation specialist
Ms. Sonika Shahi, MSc glaciology from KU
Mr. Prashant Baral, MSc glaciology from KU

Kathmandu University (KU)
Mr. Rijan Bhakta Kayastha, Ass. Prof.
Ms. Sarina Shrestha, Project finance officer
Mr. Roshan Dahal, MSc student, Nepal
Mr. Naveen Kunia, MSc student, India
Ms. Iram Bano, MSc student, Pakistan
Mr. Tenzing Sherpa, MSc student, Nepal
6 students without individual meetings

Tribhuvan University (TU)
Mr. Tirtha Raj Adhikari, Ass. Prof.
Mr. Tek Bahadur Chhetri, Ass. Prof.
Mr. Madan Sigdel, Ass. Prof.
Mr. Deepan Aryal, Researcher
Mr. Binod Shakya, Researcher
7 students, 3 post-graduates

Department of Hydrology & Meteorology (DHM)
Mr. Rishi Ram Sharma, Director general
Mr. Gautam Rajkarnikar, Deputy director general
Mr. Keshav Raj Sharma, Hydrologist engineer
Mr. Suresh Chand Pradhan, Hydrologist
Mr. Jagadishwor Karmacharya
Mr. Niraj Shankar Pradhananga

Water and Energy Commission Secretariat (WECS)
Mr. Sanjaya Sharma, Joint secretary

Independent Power Producers Association, Nepal (IPPAN)
Mr. Kumar Pandey, General secretary

Norwegian Water Resources and Energy Directorate (NVE)
Mr. Morten Johnsen, Section head (meeting in Oslo)
Mr. Kjell Repp, Programme director (meeting in Oslo)
Ms. Miriam Jackson, Research scientist (meeting in Oslo)
Mr. Tuomo Saloranta, Research scientist (phone interview)

Federal Institute of Technology (ETH), Switzerland
Ms. Francesca Pellicciotti, Glaciologist/hydrologist (phone interview)

FutureWater / University of Utrecht (FW/UU), Netherlands
Mr. Walter W. Immerzeel, Hydrologist (phone interview)

Regional Member Countries (RMC), phone interviews
Mr. Karma Tsering, Dept. of Hydro-Met Services, Thimphu, Bhutan
Mr. Tshering Tashi, Dept. of Hydro-Met Services, Thimphu, Bhutan
Mr. Wu Lizong, CAREERI Chinese Academy of Sciences, Gansu, China
Mr. Dwarika P. Dobhal, WIHG Centre for glaciology, Uttarakhand, India
Mr. Muhammad Asif Khan, Karakoram International University, Gilgit, Pakistan
Mr. Adnan Shafiq Rana, Pakistan Meteorological Department, Islamabad, Pakistan

Field trip - a few pictures

Upper left: ICIMOD headquarter, Kathmandu
Upper right: MODIS satellite facility, in foreground P. Mool, A. Shrestha and T. Asphjell
Lower: KU glaciology students, instructor (Ass. Prof. R. B. Kayastha) and Review Team

List of Project documents and web-links

This list includes the reviewed administrative documents and links to some relevant websites. All publications and reports related to the outcome of the Project are summarized in Annex VII.

Project documents

Inception Workshop Report, February 2011
Project Document (Revised), April 2011
Project Implementation Guidelines Development Workshop Report, May/June 2011
Monitoring Plan submitted to the Embassy
Annual Progress Report 2011
Annual Progress Report 2012
Project Final Report, Nov. 2010 - Dec. 2013
ICIMOD Annual Progress Report 2013

Contract between MFA and ICIMOD, November 2010
Terms of Reference for Project Steering Committee, 2011
Letters of Agreement between ICIMOD and DHM, WECS, KU and TU, 2011-12
Letters of Agreement between ICIMOD and ETH Zürich and FW/UU Netherlands, 2012-13
Letters of collaboration/understanding between ICIMOD and IRD France, University of Zürich, Switzerland, and Department of Hyrdo-Met Services Bhutan, 2011-14
Letter of agreement between ICIMOD and NVE for snow monitoring, 2014
Agreement between MFA and ICIMOD regarding support for the period 2013-17

Minutes from 3 annual Project Steering Committee Meetings, 2011-13
Minutes from 3 Project meetings between the Embassy and ICIMOD, 2012-13

Various letters, shorter reports and financial statements

Web-links

ICIMOD: http://www.icimod.org
Cryosphere Knowledge Hub: http://www.icimod.org/cryosphere
Regional Database System: http://rds.icimod.org
Mountain GeoPortal: http://apps.geoportal.icimod.org/hkhglacier/

Cryosphere Monitoring Project

Notes to the financial accounts 2010-13

This note is to clarify further on some components of the financial accounts of the Cryosphere Monitoring Project as presented to the project review team and discussed at length on 08 December 2014 at ICIMOD headquarters, Kathmandu.

1. Explanation of "Project Management"

The Project Management budget was formulated as an assemblage of various personnel and non-personnel inputs as follows:

Break-up of project management line item				
Line item	***Acct Code***	***Budget:$***	***Actual:$***	***% of Actual Total***
Project Coordinator	A-101	548,622	406,131	21.55
Expertise in glaciology	A-102	548,622	403,506	21.41
Expertise in glacio-hydrology	A-103	548,623	227,877	12.09
Project Asst Coordinator	A-1-101	183,690	93,486	4.96
Additional Support Staff	A-1-102	183,691	77,394	4.10
GIS/RS Specialist Snow	A-1-103	183,690	54,313	2.88
GIS/RS Specialist Glaciers	A-1-104	183,691	177,939	9.44
Inception Consultants	B-201	40,078	50,919	2.70
International Consultants	B-202	149,921	20,310	1.08
Travel	C-301	35,000	35,760	1.90
Hardware and software	D-401	149,921	107,951	5.73
Workshops	E-501	71,132	34,674	1.84
Publication	F-601	74,218	3,004	0.16
Office Expenses	G-701	15,023	13,169	0.70
Overhead	H-801	294,075	178,412	9.46
Total		**3,209,997**	**1,884,845**	**100.00**

It is to be noted that most of these inputs were mobilized to implement different components of the project and not for solely managing the project.

In line with the above table, the actual Administrative Cost included in the Project Management Cost is as follows:

Line item	***Acct Code***	***Budget:$***	***Actual:$***	***Remarks***
Additional Support Staff	A-1-102	183,691	77,394	
Office Expenses	G-701	15,023	13,169	
Overhead	H-801	294,075	178,412	
Total		**492,789**	**268,975**	

The project administration cost as computed comes to USD 268,975 out of the total project expenditure of USD 3,151,942.

Points 2-6 in this note from ICIMOD is not included here, but is available on request.

Table of publications and reports

No.	Scientific papers, per reviewed	Output	1st author
1	Wagnon, P., C. Vincent, Y. Arnaud, E. Berthier, E. Vuillermoz, S. Gruber, M. Ménégoz, A. Gilbert, M. Dumont, J. Shea, D. Stumm & B. K. Pokhrel, Seasonal and annual mass balances of Mera and Pokalde glaciers (Nepal Himalaya) since 2007, The Cryosphere, 7, 1769-1786, 2013.	1.2	ICIMOD
3	Tang, B-H; Shrestha, B; Li, Z-L; Liu, G; Ouyang, H; Gurung, DR; Giriraj, A; Aung, KS. Determination of snow cover from MODIS data for the Tibetan Plateau region. International Journal of Applied Earth Observation and Geoinformation 21: 356-365, 2013	3.1	ICIMOD
2	Bajracharya, SR; Maharjan, SB; Shrestha, F: The status and decadal change of glaciers in Bhutan from 1980's to 2010 based on the satellite data. Annals of Glaciology. 55(66): 159-166, 2014.	3.2	ICIMOD
4	Baral P, Kayastha R, Walter I., Pradhananga N., Bhattrai B.C., Shahi S., Galos S., Springer C., Joshi S.P and Mool P. K.; Preliminary results of mass balance observations of Yala Glacier and analysis of temperature and precipitation gradients in Langtang Valley, Nepal; Annals of Glaciology 55(66), 2014.	1.1	KU
5	Pradhananga, N.S., Kayastha, R.B., Bhattarai, B.C., Adhikari, T.R., Pradhan, S.C., Devkota, L. P, and Mool, P. Estimation of discharge from Langtang River basin, Rasuwa, Nepal, using a glacio-hydrological model. Annals of Glaciology, 55(66), 223, 2014.	2.3	KU
6	Adhikari, T R, Devkota, L D & Shrestha, AB, 2014, Climate change scenarios and its impact on water resources of Langtang Khola Basin, Nepal, Evolving Water Resources Systems: Proceedings of ICWRS2014, Bologna, Italy, IAHS Publ. 364, 2014.	2.4	TU
7	Immerzeel, W. W., Pellicciotti, F., & Bierkens, M. F. P. Rising river flows throughout the twenty-first century in two Himalayan glacierized watersheds. Nature Geoscience, 6, 742-745, 2013.	2.2	FW/UU
8	Immerzeel, W. W., Beek, L. P. H., Konz, M., Shrestha, A.B., & Bierkens, M. F. P. (2012). Hydrological response to climate change in a glacierized catchment in the Himalayas. Climatic Change, 110, 721-736, 2012.	2.4	FW/UU
9	Immerzeel, W. W., Petersen, L., Ragettli, S., and Pellicciotti, F. The importance of observed gradients of air temperature and precipitation for modeling runoff from a glacierized watershed in the Nepalese Himalayas. Water Resources Research, 2014.	2.4	FW/UU
10	Immerzeel, W.W., Kraaijenbrink, P.D.A., Shea, J., Shrestha, A.B., Pellicciotti, F., Bierkens, M.F.P., de Jong, S.M. High-resolution monitoring of Himalayan glacier dynamics using unmanned aerial vehicles. Remote Sensing of Environment, 150, 93-103, 2014.	3.2	FW/UU
11	Bolch, T., Kulkarni, A., Kääb, A., Huggel, C., Paul, F., Cogley, J.G., Frey, H., Kargel, J. S., Fujita, K., Scheel, M., Bajracharya, S., Stoffel, M. (2012). The State and Fate of Himalayan Glaciers Science 336, 310, 2012.	1.1	Other
12	Zemp, M., Thibert, E., Huss, M., Stumm, D., Rolstad Denby, C., Nuth, C., Nussbaumer, S. U., Moholdt, G., Mercer, A., Mayer, C., Joerg, P. C., Jansson, P., Hynek, B., Fischer, A., Escher-Vetter, H., Elvehøy, H., and Andreassen, L. M. Reanalysing glacier mass balance measurement series. The Cryosphere, 7, 1227–1245, 2013.	1.1	Other
13	Ménégoz, M., G. Krinner, Y. Balkanski, O. Boucher, A. Cozic, S. Lim, P. Ginot, P. Laj, H. Gallée, P. Wagnon, A. Marinoni, H. W. Jacobi, Snow cover sensitivity to black carbon deposition in the Himalayas: from atmospheric and ice core measurements to regional climate simulations, Atm. Chem. Phys., 14, 4237–4249, 2014.	1.1	Other

14	Lejeune, Y., J. M. Bertrand, P. Wagnon & S. Morin, A physically based model for the year-round energy and mass balance of debris-covered glaciers, J. Glaciol, 59(214), 2013.	1.1	Other
15	Vincent, C., Al. Ramanathan, P. Wagnon, D.P. Dobhal, A. Linda, E. Berthier, P. Sharma, Y. Arnaud, M. F. Azam, P.G. Jose & J. Gardelle, Balanced conditions or slight mass gain of glaciers in the Lahaul and Spiti region (Northern India, Himalaya) during the nineties preceded glacier shrinkage, The Cryosphere, 7, 1–14, 2013.	1.2	Other
16	Azam, M. F., Wagnon, P., Vincent, C., Ramanathan, AL., Favier, V., Mandal, A., and Pottakkal, J. G.: Processes governing the mass balance of Chhota Shigri Glacier (western Himalaya, India) assessed by point-scale surface energy balance measurements, The Cryosphere, 8, 2195-2217, 2014.	1.2	Other
17	Azam, F. M., P. Wagnon, C. Vincent, A. Ramanathan, A. Linda, & V. B. Singh, Reconstruction of the annual mass balance of Chhota Shigri Glacier (Western Himalaya, India) since 1969, Annals Glaciol., , 55(66), 2014.	1.2	Other
18	Frey, H., Machguth, H., Huss, M., Huggel, C., Bajracharya, S., Bolch, T., Kulkarni, A., Linsbauer, A., Salzmann, N., and Stoffel, M.: Estimating the volume of glaciers in the Himalayan–Karakoram region using different methods, The Cryosphere, 8, 2313-2333, 2014.	3.2	Other
19	Paul, F., Barrand, N. E., Baumann, S., Berthier, E., Bolch, T., Casey, K., Frey, H., Joshi, S. P., Konovalov, V., Lebris, R. , Molg, N., Nosenko, G., Nuth, C., Pope, A., Racoviteanu, A., Rastner, P., Raup, B., Scharrer, K., Steffen, S., Winsvold, S. On the accuracy of glacier outlines derived from remote sensing data, Annals of Glaciology 53(63), 2013.	3.2	Other
No.	**Scientific papers, in preparation/review**	**Output**	**1st author**
1	Gurung S, Bhattarai B, Kayastha RK, Stumm D, Joshi SP, Mool PK (2014) Mass Balance (2012-2013) and Terminus Retreat (1974-2012) of Rikha Samba Glacier, Hidden Valley, Mustang, Nepal (Manuscript submitted on 12 August 2014 to Journal of Glaciology)	1.1	ICIMOD
2	Joshi S., Stumm D., Holzer N, Wagnon P, Fujita F, Bolch T, J Shea and P. Mool "Geodetic mass balance of Yala Glacier in Langtang Valley Nepal using SRTM DEM and high resolution stereo images from 2000 to 2012". (Draft manuscript preparation)	1.1	ICIMOD
3	Stumm D., Joshi SP, P. Wagnon (not yet complete): Comparison of Yala and Rikha Samba glacier mass balance with other Himalayan glaciers, Journal: Annals of Glaciology, IGS 2015, submission date: January 2015	1.2	ICIMOD
4	Stumm D, Joshi SP, MacDonell S, Salzmann N: In situ measuring and monitoring of mountain glaciers – experiences of mountain ranges in the world and recommendations for the Himalayas (Manuscript submitted to POUT, to be published in International Journal of Water Resources Development, special issue on Himalayan Waters)	1.2	ICIMOD
5	Shrestha, A., , S. Bajracharya, D. Gurung, W. Immerzeel, S. Joshi, R. Kayastha, P. Mool, F. Pellicciotti, J. Shea, D. Stumm, (author list and order not final). A new paradigm for glacier research in the Himalayas, Part I: The Cryosphere Monitoring Project. In preparation for submission to Mountain Research and Development, December 2014.	1-3	ICIMOD
6	Schmid, M.-O., Baral, P., Gruber, S., Shahi, S., Shrestha, T., Stumm, D., and Wester, P.: Assessment of permafrost distribution maps in the Hindu Kush–Himalayan region using rock glaciers mapped in Google Earth, The Cryosphere Discuss., 8, 5293-5319, 2014.	1-3	ICIMOD
7	Shea, J.M. and Wagnon. P. Implications of high-altitude meteorological investigations on downstream hydrology. In preparation for submission to International Journal of Water Resources Development.	2.1	ICIMOD
8	Shea J.M., Immerzeel W.W.; Variability in glaciological and hydrological sensitivities to climate change in the Hindu-Kush Himalayas. In preparation for submission to Geophysical Research Letters.	2.4	ICIMOD

9	Shea, J. M., Immerzeel, W. W., Wagnon, P., Vincent, C., and Bajracharya, S.: Modelling glacier change in the Everest region, Nepal Himalaya, The Cryosphere Discuss., 8, 5375-5432, doi:10.5194/tcd-8-5375-2014, 2014.	2.4	ICIMOD
10	Bajracharya, SR; Maharjan, SB; Shrestha F, Gao W, Shiyin L, Immerzeel WW, Shrestha B, The glaciers of the Hindu Kush Himalaya: current status and observed changes from 1980s to 2010. In review for special issue of International Journal of Water Resources Development.	3.1	ICIMOD
12	Shahi, S., Kayastha, R., Baral, P., Mool, P. Influence of a debris layer on the melting of ice on Lirung Glacier, Langtang Valley, Rasuwa, Nepal. In review, Journal of Hydrology and Meteorology.	1.1	KU
12	Bhattarai, B., Kayastha, R., Adhikari, T., Mool, P. Estimation of peak discharge and selection of Manning's coefficient for Sangda River and Langtang River of Nepal. In review, Journal of Hydrology and Meteorology.	2.2	KU
13	Lama L, Kayastha, RB, Maharjan SB, Bajracharya SR, Mool PK. Glacier change mapping of Hidden Valley, Nepal using remote sensing and GIS technologies from 1980s to 2010.	3.2	KU
14	Immerzeel W.W., Wanders N., Lutz A.F., Shea J.M., Bierkens M.F.P.; Reconciliation of Indus high altitude precipitation with glacier mass balances and runoff. Submitted to Nature Geoscience, February 2014.	2.3	FW/UU
15	Ragettli, S., Pellicciotti, F, Immerzeel, W.W., Miles, E.S., Petersen, L., Heynen, M., Rimkus, S., Shea, J., Stumm D., Joshi S., Shrestha A.; Unraveling Himalayan hydrology through systematic integration of high resolution in-situ ground data and remote sensing with an advanced simulation model, Advances in Water Resources, submitted May 2014.	2.3	ETH
16	Pellicciotti, F., J. Shea, W. Immerzeel, S. Ragettli, D. Stumm, A. Shrestha, R. Kayastha (author list and order not final). A new paradigm for glacier research in the Himalayas, Part II: glaciers and hydrology in the Nepalese Himalaya. In preparation for submission to Mountain Research and Development, December 2014.	2.3	ETH
17	Ragettli S., Pellicciotti F., Immerzeel W.W., Shea J., Petersen L., Heynen M., Stumm D., Joshi S., Shrestha A.; Modelling the glacio-hydrological response of the upper Langtang catchment to climate: getting runoff right for the right reasons, multi-step calibration and uncertainty assessment. Submitted to Advances in Water Resources.	2.2	ETH
18	Savean, M., F.Delclaux, P. Chevallier, P. Wagnon, N. ,S. Gonga, R. R. Sharma, L. Neppel, Y. Arnaud, Modeling the Dudh Koshi River basin (Nepal) and discussion on precipitation inputs, J. Hydrol., Submitted on Nov 4, 2013.	2.3	Other
19	Brun, F., Dumont, M., Wagnon, P., Berthier, E., Azam, M. F., Shea, J. M., Sirguey, P., Rabatel, A., and Ramanathan, Al.: Seasonal changes in surface albedo of Himalayan glaciers from MODIS data and links with the annual mass balance, The Cryosphere Discuss., 8, 3437-3474, doi:10.5194/tcd-8-3437-2014, 2014.	3.1	Other
No.	**Books and book chapters**	**Output**	**1st author**
1	Bajracharya, SR; Shrestha, B (eds): The status of glaciers in the Hindu Kush-Himalayan region. Kathmandu: ICIMOD, 2011, http://lib.icimod.org/record/9419.	3.1	ICIMOD
2	Bajracharya, S. R.; Maharjan, S. B.; Shrestha, F.: Glaciers Shrinking in Nepal Himalaya. Kathmandu: ICIMOD, 2011, http://lib.icimod.org/record/20479.	3.1	ICIMOD
3	Bajracharya, SR; Maharjan, SB; Shrestha, F; Bajracharya, OR; Baidya, S: Glacier status in Nepal and decadal change from 1980 to 2010 based on Landsat data. Kathmandu: ICIMOD, 2014, http://lib.icimod.org/record/29591.	3.2	ICIMOD
4	Racoviteanu, A., Y. Arnaud, I.M. Baghuna, S. Bajracharya, E. Berthier, R. Bhambri, T. Bolch, M. Byrne, R.K Chaujar, R. Frauenfelder, A. Kääb, U. Kamp, J.S. Kargel, A. V. Kulkarni, G. Leonard, P.K. Mool, I. Sossna (2014): Himalayan Glaciers (India, Bhutan, Nepal): satellite observations of thinning and retreat. GLIMS Book: Chapter 24. ISBN-13: 978-3540798170. 549-582.	3.2	Other

No.	Technical reports	Output	1st author
1	ICIMOD Cryosphere Monitoring: Meteorological and Hydrological Station Summaries, Operating Protocol, and Data Processing	2.1	ICIMOD
2	Report on Installation and Commissioning of MODIS Receiving Facility at ICIMOD Premise	3.1	ICIMOD
3	A Report on Selection of Two Glaciers in Nepal for Glacier Mass Balance Monitoring in the HKH Cryosphere Monitoring Project	1.1	KU
4	Selection of two glaciers for mass balance measurements and hydro-meteorological monitoring (Annex – 1A)	1.1	KU
5	Using Unmanned Airborne Vehicles (UAV) for glacier monitoring in the Himalayas, December 2013	3.2	FW/UU
No.	**Field reports**	**Output**	**1st author**
1	Report on Cryospheric Expedition to Rikha Samba Glacier, Hidden Valley, 2–18 September 2011	1.1	ICIMOD
2	Report on Cryospheric Expedition to Yala Glacier, Langtang Valley, Nepal, 3–11 November 2011	1.1	ICIMOD
3	Cryospheric Expedition Guide, Yala Glacier, Langtang Valley, 26 October – 11 November, 2012	1.1	ICIMOD
4	Report on Joint Cryospheric Expedition to Yala Glacier, Langtang Valley by ICIMOD, ITP and partners, May 2013	1.1	ICIMOD
5	Report on Cryospheric Expedition to Yala Glacier, Langtang Valley and Training on Mass Balance Measurements, Oct/Nov 2013	1.1	ICIMOD
6	Report on Glacier-Hydrology Field Work in Langtang Valley, May 2013	2.2	ICIMOD
7	Report on Glacier-Hydrology FieldWork in Langtang Valley, October 2013	2.2	ICIMOD
8	Field report: Mera Glacier and Changri Nup Glacier, 23 March – 16 April, 2014	2.2	ICIMOD
9	Field Work Report: Cryosphere Studies in Langtang Valley, May 2014	2.2	ICIMOD
10	Report on Cryospheric Field Expedition to Sangda Khola at Tiri, Mustang, Nepal, 12 – 24 April 2012	2.2	KU
11	Report on Cryospheric Field Expedition to Rikha Samba Glacier, Hidden Valley, Mustang, Nepal, 25 September - 11 October 2012	1.1	KU
12	Report on Cryospheric Field Expedition for Glacier Mass Balance Training on Yala Glacier, Nepal, 26 October – 10 November 2012	1.1	KU
13	Final Report on Upgrading of the Kyangjing Hydrological and Meteorological Station in Langtang Valley, 2 May - 17 May 2013	2.2	KU
14	Field Report of the Cryospheric Field Expedition to Langtang Valley, Rasuwa, Nepal, 1 – 22 May 2013	2.2	KU
15	Field Report of the Cryospheric Field Expedition to Langtang Valley, Rasuwa, Nepal, 16 September – 6 October 2013	2.2	KU
16	Report on Cryospheric Field Expedition to Langtang Valley, Rasuwa, Nepal, 25 November – 15 December 2013	2.2	KU
17	Field Report of the Cryospheric Field Expedition to Langtang Valley, Rasuwa, Nepal, 2 April – 22 December 2014	2.2	KU
18	Field report Langtang 04/05/12 to 13/05/12	2.2	DHM
19	Field Visit: Langtang Station, Field Periods:18 Oct to 29 Oct 2013	2.2	DHM
20	Field report ETH: Langtang May 2012	2.2	ETH
21	Field report ETH: Langtang May 2013	2.2	ETH
22	Field report ETH: Langtang Oct 2013	2.3	ETH
23	DGPS survey – Lirung and Langtang glaciers – 12 to 17 May 2014	1.1	ETH

No.	Training reports/manuals	Output	1st author
1	Report of training on Remote Sensing Based Monitoring and Assessment of Cryosphere – Snow and Glaciers, 16 - 20 Sept. 2013	5.1	ICIMOD
2	Report on Training in Glacier Hydrological Modelling, December 2013	5.1	ICIMOD
3	Report on the Workshop on Geodetic Glacier Mass Balance Assessments, January 2014	5.1	ICIMOD
4	Training Report: Glacier Water Resource Monitoring and Assessments, April - May 2014	5.1	ICIMOD
5	Report on Training on Debris-Covered Glaciers, 3 - 6 June, 2014	5.1	ICIMOD
6	Report on Regional Glacier Mass Balance Training, April/May 2012	5.1	ICIMOD
7	Report on Glacier Mass Balance Training, November 2011	5.1	ICIMOD
8	Report on Regional Glacier Mass Balance Training , April/May 2012	5.1	ICIMOD
9	Hands-on Training Manual: Remote Sensing based Monitoring and Assessment of Cryosphere - Glacier, October 2011	5.1	ICIMOD
10	Hands-on Training Manual: Remote Sensing based Monitoring and Assessment of Cryosphere -Snow	5.1	ICIMOD
11	Remote Sensing Based Monitoring and Assessment of Cryosphere - Glaciers: Hands-on Training Manual, November 2012	5.1	ICIMOD
12	Remote Sensing Based Monitoring and Assessment of Cryosphere – Snow: Hands-on Training Manual- Accessing, September 2013	5.1	ICIMOD
13	Basics of Geographic Information Systems: Hands-on Training Manual, September 2013	5.1	ICIMOD
14	Remote Sensing Based Mapping and Monitoring of Cryosphere (Glaciers): Hands-on Training Manual, September 2013	5.1	ICIMOD
15	Report on Regional Training on Remote Sensing Based Monitoring and Assessment of Cryosphere - Snow and Glaciers, Nov. 2012	5.1	ICIMOD
16	Report on Introduction to Data Analysis Workshop - January 2013	5.1	ICIMOD
17	Field Guide Expedition Yala Glacier: Training and Measurements of Mass Balance, 5-20 November 2014	5.1	ICIMOD
18	SERVIR Applied Sciences Team Technical Training, May 6–9, 2013, ICIMOD, Kathmandu, Nepal	5.1	ICIMOD
19	Report on the training course of the J2000 hydrological model to KU Students, 10 and 12 July 2013	5.1	KU
20	Progress Report on M. S. by Research in Glaciology Course	5.3	KU
No.	**Conferences and workshops**	**Output**	**Host**
1	Conference Report: International Conference on the Cryosphere of the Hindu Kush Himalayas: State of the Knowledge and Workshop on Hindu Kush Himalayan Cryosphere Data Sharing Policy, 14 -18 May 2012, Kathmandu, Nepal	4.4	ICIMOD
2	Report on Second International Conference on Cryosphere of the Hindu Kush Himalayas: State of the Knowledge and the Hindu Kush Himalayan Cryosphere Data Sharing Workshop, 13 -16 May 2014, Kathmandu, Nepal	4.4	ICIMOD
3	Int. Glaciological Society: International Symposium on Glaciology in High-Mountain Asia, Kathmandu, Nepal, 2–6 March 2015	4.4	ICIMOD

Assessment of outputs compared to plans

These tables contain a detailed status assessment of the five project Components regarding planned outcomes, outputs and activities in the revised Project Document. The two left columns are extracted from Annex 2 and 3 in the PD, and the third column contains the assessment of the review team. Detailed sub-activities are not listed here, but are still considered when relevant. Details on the publications that are referenced below can be found in Annex VII. A general summary of the assessment for each Component is given in Section 3.1 of the main review report.

COMPONENT 1

Result	Indicator	Review assessment
Component 1: Monitoring of glacier mass balance and surface motion, and measurements of glacier geometry		
Outcome 1: Relevant and reliable cryospheric data (glacier and snow) timely produced and used for water resources assessments by operational services and research institutions.	Relevant cryosphere data in sustainable use for their intended purposes by operational services in Nepal and research institutions by 2015.	**Partly achieved, still in progress.** **Two glacier monitoring programs have been successfully established, but work remains to make these useful for operational services in Nepal. This can only be achieved in combination with Component 2 and 3, and cannot be expected from the short time frame of the Project so far (2011-14). The established monitoring activities give a good basis for achieving this outcome in the next Project phase.**
Output 1.1: Long-term monitoring of glacier mass balance and surface motion, and measurements of glacier geometry and snow course established and fully operational on two appropriate glaciers selected under the Project. **Activity 1.1:** Glacier monitoring. (with 5 sub-activities)	Annual glacier mass balance data and other related data of two selected glaciers of Nepal be available from 2012.	**Achieved, and according to international standards.** **Two glaciers were selected for regular monitoring; Yala Glacier in Langtang Valley and Rikha Samba Glacier in Hidden Valley. They were selected mainly because of accessibility (5-6 days trek), morphology (small, few crevasses, no debris cover), and availability of some earlier Japanese data. The two glaciers cannot be seen as "typical" or "representative" for their regions (those would not be possible to measure), but will still give useful climatic records of snow accumulation and surface ablation.** **The two monitoring programs are well established by ICIMOD/KU with standardized accumulation/ablation measurements (stakes and snow pits/cores) on both glaciers; twice a year for Yala and once a year for Rikha Samba. Meteorological data are collected continuously from automatic weather stations, and other more research-based measurements are occasionally carried out depending on time/resources, e.g. GPS surveys. Radar measurements of ice depth and/or snow cover is a future goal (sub-activity 1.1.3).** **Publications: One scientific paper (Baral et al., 2014) and several field reports from ICIMOD, KU and ETH. Further publications are in progress (Annex VII).** **Extensive studies of debris-covered ice (sub-activity 1.1.4) has been carried out on the Lirung Glacier tongue by KU amd CMP partners ETH-Zürich and FW/UU, Netherlands. These are more research-based activities, but could potentially develop into some form of ablation monitoring in the future. An interesting paper using unmanned aerial vehicles for debris-cover change has come out (Immerzeel et al. 2014), and several more are in progress.**
Output 1.2: An operational system established for comparison of data with other representative glaciers in the HKH region. **Activity 1.2:** System for comparison of data with other representative glaciers (with 1 sub-activity)	A comparative analysis between two pilot glaciers in the study with the HKH glaciers produced by 2013.	**In progress.** **The main focus so far has naturally been on the establishment of the two monitoring programs. A comparative study is on its way (Stumm et al., in prep.) and will benefit from more years of data than just until 2013 as planned.** **A HKH-wide comparison is also a goal, but data sharing among RMC partners is still and issue despite successful common trainings and workshops. The most comprehensive comparison so far is by Bolch et al. (2012) where ICIMOD contributed with data and co-authorship (see Annex VII).**
	Frequency of exchange of data of representative glaciers of Nepal with WGMS and other regional institutions (CAREERI/CAS in China and Center of Glaciology/WIHG in India) through joint publications and workshop/meetings from 2013 and beyond.	**In progress.** **Data are already available to all Project partners, and will be submitted to the World Glacier Monitoring Service as soon as they are sufficiently quality controlled. Data and results will also be published on ICIMOD web-pages through the Regional Database System and the Cryosphere Knowledge Hub.** **Workshops on data sharing among RMC partners were organized by ICIMOD in May 2012 and 2014 (reports available). The meetings were well attended, and some progress was made although some issues remain as regards data sharing, especially among governmental agencies where such data can be confidential.**

COMPONENT 2

Result	Indicator	Review assessment
Component 2: Assessment of current and future water resources at catchment and sub-basin scale		
Outcome 2: Relevant and reliable glacio-hydrological data and current and future water availability scenario timely produced and used for water resources assessments by operational services and research institutions.	Hydro-meteorological data of at least two stations are available for use for water resources management by RMC operational services and research institutions by 2015.	**Mostly achieved, still ongoing.** **A comprehensive network of hydro-meteorological stations are now established in Langtang Valley, and data are being processed and formatted for sharing over the Regional Database System. Products for operational use will require some more time and are dependent on efficient cooperation between research institutes/universities and governmental agencies.** **RMC partners have mainly been involved in training and workshops, and less so in research and development of operational products.**
Output 2.1: Strengthened and expanded long-term monitoring of hydrological and meteorological variables established and fully operational for the sub-basins catchments of selected glaciers in Nepal. **Activity 2.1:** Hydro-meteorological monitoring (with 4 sub-activities)	Hydrological and meteorological data set for two sub-basins / catchments of selected glaciers in Nepal available by 2012.	**Achieved.** **An extensive hydro-meteorological observation network has been set up in Langtang Valley, in the catchment of Yala Glacier. This has been done in close collaboration with European partners ETH and FW/UU, and building on a few existing stations from Nepalese Department of Hydrology and Meteorology (DHM) that needed upgrades. The good coverage and detailed level of measurements is unique for a hydrological basin of this scale in the HKH region and provides an excellent base for model calibration and basin-scale analyses. Scientific descriptions and results will come in future papers, e.g. Shea et al.** **The catchment of Rikha Samba Glacier (Hidden Valley) has not been as intensively studied, but an automatic weather station and a hydrological station was set up near the glacier. For model development, it makes sense to first focus on Langtang Valley and then potentially expand the activities in Hidden Valley in the next phase of the Project.**
Output 2.2: Short-term intensive hydro-meteorological campaigns conducted to obtain specialized information and parameterization for glacio-hydrological modelling. **Activity 2.2:** Short-term hydro-meteorological measurement campaigns (with 3 sub-activities)	Glacio-hydrological modelling prepared for selected sub-basins by 2012.	**Achieved.** **Detailed measurement campaigns were carried out in Langtang Vallay in 2013 and 2014 with participation from most partners in the Project; ICIMOD, KU, DHM, ETH and FW/UU. Data analyses are ongoing.**
Output 2.3: Glacio-hydrological and snow melt model set-up for the catchment of selected glaciers in Nepal and expanded to the sub-basin level. **Activity 2.3:** Glacio-hydrological and snow melt model set-up (with 4 sub-activities)	2 model outputs generated and validated for selected catchments by 2013.	**Mostly achieved, still ongoing.** **TOPKAPI-ETH has been selected as the main hydrological model and has been set up and validated against the extensive field data from Langtang catchment. This work is led by ETH and publications have been submitted (Ragettli et al.).** **Previous modeling of the catchment has been done by FW/UU before the recent CMP data became available (Immerzel et al. 2012). For student work and training activities, it has been found that simpler models are more efficient, and one KU-lead paper with discharge estimates has resulted from this (Pradhangana et al. 2014).** **The next phase of the Project will make use of a snow model from NVE who are coming in as a funded partner in the Project.**
Output 2.4: Scenarios of climate change are downscaled for the catchment and sub-basin scales, applied to the glacio-hydrological model and future water availability scenarios are obtained. **Activity 2.4:** Glacio-hydrological modelling of future climate scenarios (with 4 sub-activities)	Climate scenarios downscaled for the catchments and sub-basins are available for input into the hydrological model by 2013.	**Partly achieved, still ongoing.** **Some initial analyses have been published by KU (Pradhangana et al. 2014) and TU (Adhikari et al. 2014) and FW/UU (Immerzel et al. 2012). More comprehensive climate scenario modeling will be initiated after the completion of output/activity 2.3.**

COMPONENT 3

Result	Indicator	Review assessment
Component 3: Multi-level Remote Sensing based observation system for snow and glaciers monitoring in basins and sub-basins		
Outcome 3: The multi-level remote sensing system at ICIMOD fully operationalized for sustained mapping and monitoring of snow and glaciers for basins and sub-basins in the HKH region.	RS-based data and analysis for representative basins / sub-basins for glaciers and snow in cooperation with RMC partners by 2013.	**Achieved.** **There are two major achievements from Component 3:** **1. Download station for MODIS imagery with operational snow cover mapping and data sharing** **2. Complete glacier inventory for HKH that is available for the global community.** **These are data sets that will be useful for a wide range of users, well beyond the CMP partners. Parts of the inventory was already used for glacier change analyses in IPCC AR5.** **With these baseline data sets in place, it would be natural to develop the remote sensing work towards estimating geodetic glacier mass balance (from elevation changes) and snow water equivalent (from MODIS area and estimates of thickness and density). This would tie Component 3 closer to Components 1/2 and provide essential validation for those results. The new snow project of NVE is a good step in that direction.**
Output 3.1: The multi-level Remote Sensing system for representative basins / sub-basins for regular mapping and monitoring of glaciers and snow in the HKH region strengthened and fully operational at ICIMOD. **Activity 3.1:** Mapping, monitoring and modelling of snow and ice in the HKH region (with 4 sub-activities)	Snow cover analysis is available by 2013	**Achieved.** **A MODIS receiving station was installed on the roof of ICIMOD in 2012, and image processing for snow cover mapping became operational in 2013. Eight-day composite maps of MODIS-derived snow cover for the HKH region are freely available from the ICCIMOD web pages through the Regional Database System.**
	Glacier mapping and analysis is available for representative basins and sub-basins by 2013.	**Achieved.** **A complete inventory of HKH glaciers is completed. The results are published in book form (Bajracharya et al. 2014) and digital glacier outlines can be both viewed and downloaded from the ICIMOD web-pages (links in Annex V). The inventory has also been submitted to global initiatives like GLIMS and Randolph Glacier Inventory which ensures that it will be the reference data set for the cryospheric community worldwide.** **The inventory is mainly based on Landsat imagery from 2010 ± 3 years, and the processing methods are semi-automated such that remapping can be done regularly, e.g. every 5-10 years. Previous decades back to the 1980s have also been mapped and has been the basis for area change calculations, published in several papers and books by Bajracharya et al. (2014).**
Output 3.2: Detailed investigations in prioritized representative basins / sub-basins with glaciers regarding area change, glacier mass balance and variation of snow line carried out. **Activity 3.2:** Detailed investigations of glaciers in prioritized representative basins/sub-basins (with 3 sub-activities)	Detailed remote sensing based investigation report on glaciers (area change, glacier mass balance and variation of snow line) in representative basins/sub-basins scale available by 2013.	**Mostly achieved, still ongoing.** **Area and length-change estimates since the 1980s have been prepared for Rikha Samba (Lama et al., manuscript) and Yala glaciers. Geodetic glacier mass balance has been estimated for Yala Glacier for 2000-2012 (Joshi et al., manuscript), and a larger analysis in cooperation with T. Bolch from University of Zürich is in progress.** **Studies of snow line variation is supposedly ongoing, but no relevant documents have been produced except from the general MODIS snow cover mapping (Tang et al., 2013).** **Unmaned aerial vehicles have been successfully used for repeated 3D mapping of the debris-covered Lirung Glacier (Immerzeel et al., 2014). This a promising tool for studying ablation and dynamics of debris-covered fronts and crevasse zones. This is not a specified activity within output 3.2 (or any others), but it fits well within the scope of CMP Project.**

COMPONENT 4

Result	Indicator	Review assessment
Component 4: Strengthening of ICIMOD as regional knowledge hub for sharing and disseminating cryosphere related data and information		
Outcome 4: Strengthened and acknowledged ICIMOD as a Regional Cryosphere Knowledge Hub for storage, analysis, sharing and disseminating knowledge for relevant operational services and research in the HKH region and internationally.	Cryosphere Knowledge Hub by 2014, with web-based system and bulletin board services fully operational.	**Achieved, but other RMC partners do not seem to be much involved so far.** **The Cryosphere Knowledge Hub:** **http://www.icimod.org/cryosphere** **The web-based knowledge hub contains cryopheric news bulletins, ICIMOD publications and events, and a near real-time (if working!) "station watch" for the meteorological stations in Langtang and Hidden Valleys. There are also links to the GeoPortal, where the glacier inventory and drainage catchments can be viewed, and to the Regional Database System where the inventory and snow cover maps from different times can be downloaded. The web-page has a nice, clear layout and is easy to navigate.** **As a "knowledge hub" for all RMC partners, the web page is very ICIMOD-focused, and there is little introductory material for readers with limited background knowledge. This could be improved in the future and possibly linked with some of the existing training material (Comp. 5) and the Mountain GeoPortal (http://geoportal.icimod.org/) such that people can find online tutorials and topical overviews.** **The goal must be that other RMC partners also share information and data on the Knowledge Hub. This can only be achieved by sustained efforts from both ICIMOD itself and its RMC partners.**
Output 4.1: Operational system at ICIMOD for the Cryosphere Knowledge Hub in accordance with the regionally and internationally agreed standards. **Activity 4.1:** Review data sharing policy in the region and develop appropriate framework (with 2 sub-activities)	Policy on knowledge and data exchange on cryosphere 2014.	**Achieved.** **Workshops on knowledge and data sharing policy were organized in 2012 and 2014 as part of a larger conferences. These were well attended by the RCM partners, and progress was made towards sharing data more openly. ICIMOD presented their data policy and how data sharing can be facilitated through the Knowledge Hub.**
	Frequency of data exchange among different partners substantially increased by 2014.	**Not achieved.** **So far, it seems that only ICIMOD-based data sets (mainly glacier and snow maps) have been published in the database (http://rds.icimod.org). More open data exchange requires an effort from both ICIMOD itself and it's RMC institutions.**
	Partners feedback confirm the quality of data and knowledge products in regionally accessible form by 2015.	**Data exchange can also be an external quality control, so feedback forms from the RMC partners will be useful.**
Output 4.2: A web-based interactive mapping and visualization system established and internationally recognized. **Activity 4.2:** Development of a web-based interactive dissemination and visualization system (with 1 sub-activity)	Internationally recognized web-based interactive mapping and visualization system established by 2012.	**Achieved.** **The Mountain GeoPortal is a web-based GIS that provides a very efficient visualization of geospatial data such as the glacier inventory:** **http://apps.geoportal.icimod.org/hkhglacier/** **As more data get added, this will become a very central part of the Knowledge Hub.**
Output 4.3: Regular bulletin board services established and in use by relevant regional and international subscribers. **Activity 4.3:** Regular bulletin board services (with 2 sub-activities)	80% partners expressed satisfaction on Quarterly e-bulletin board services for snow and annual bulletin for glacier data from 2012.	**Achieved.** **Quarterly e-bulletins are published on the Knowledge Hub. They give a nice overview of cryosphere related news, events and publications within the ICIMOD community. More items from other HKH regions will hopefully come, but requires active participation from RMC partners.**
Output 4.4: Regional/ international knowledge sharing platform and procedures organized through workshops and conferences. **Activity 4.4:** Organize platform and events for regional knowledge sharing (with 2 sub-activities)	Regional knowledge sharing forum established with international participation by 2013.	**Achieved.** **A workshop "Glacier, Snow Melt and Runoff in the Himalayas" was organized in February 2012. Two international conferences on "the Cryosphere of the Hindu Kush Himalayas: State of the Knowledge" have been organized by ICIMOD in Kathmandu in May 2012 and 2014. These have seen increasing participation; from 96 in 2012 to 144 in 2014, of which about 20% were from RMC partners.** **ICIMOD and the International Glaciology Society in will host a large symposium (several hundred participants?) on "Glaciology in High-Mountain Asia" in March 2015.**

COMPONENT 5

Result	Indicator	Review assessment
Component 5: Capacity building		
Outcome 5: Enhanced institutional capacity and competence of national partners in Nepal and the HKH region for sustained glaciological monitoring, glacio-hydrological modelling and scenario development and remote sensing of the cryosphere.	ICIMOD and supported Nepali partners operational according to intended outcomes.	**Mostly achieved, still ongoing.** **The training courses in glaciological monitoring (by ICIMOD) and the MSc program in glaciology (by KU) have been well received among Nepalese and RMC partners. However, local institutions are not yet capable of running large-scale monitoring programs on their own.**
Output 5.1: Participants in training courses are applying their new and improved knowledge in their daily work to improve the ability of their institutions to carry out sustainable glaciological and glacio-hydrological programmes. **Activity 5.1:** Training courses (with 3 sub-activities)	Increased number of trainees applying new knowledge in their daily work by 2014.	**Mostly achieved, still ongoing.** **Practical training courses (see list in Annex VII) have been held for each Component 1-3. They have been very well attended with participation from KU, TU, HDM, WECS and many RMC partners. The courses contain a good mix of lectures, tutorials and practical activities in the field. Participants are generally very satisfied, but DHM expressed that practice in field planning and equipment maintenance is needed in order for them to operate similar monitoring programs on their own.**
Output 5.2: Participants in study tours are utilising their improved competence and knowledge in their daily work. **Activity 5.2:** Study tours to well-established glacier mass balance monitoring schemes (with 2 sub-activities)	Participants in study tours from partner institutions apply the new experiences in their daily work.	**Achieved.** **Study tours for ICIMOD professionals and national CMP partners have been organized to well-known glacier monitoring programs in Urumqi, China (2012) and Norway (2013). Although such trips are no doubt useful, they come at a relatively high cost compared to what similar amounts can be used for on more local capacity building.**
Output 5.3: MSc course in glaciology developed and incorporated in the study plan and curricula of KU. **Activity 5.3:** Support for MSc course in glaciology at Kathmandu University (with 1 sub-activity)	MSc course incorporated in the KU general curricula.	**Achieved.** **A MSc program in Glaciology was started at KU in 2011, with 4 new students enrolled each year, all from Nepal or other RMC countries. The student places are highly competitive, and full scholarships are granted. Students were motivated and satisfied with the program.** **ICIMOD and TU has been involved in some guest lecturing, but there does not seem to be much synergy between the MSc at KU and relevant studies within meteorology and hydrology at TU. Also, it is difficult for TU students to get accepted for the MSc at KU because they require a 4-year bachelor, whereas TU have a 3-year bachelor.**
Output 5.4: The graduates from the MSc course have found relevant employment in operational services in the HKH region or continued to pursue PhDs. **Activity 5.4:** Scholarships for MSc (with 1 sub-activity)	At least 10 out of 16 graduates from the MSc course are employed by relevant RMC partners or pursuing PhDs by 2015.	**Achieved.** **The first batches of 4 students graduated in 2013 and 2014, and most have them found relevant jobs at insitutions like DHM and ICIMOD. A few current students are on contract with their home institution to pursue a MSc at KU and then come back to work for them (one example from India and one from Pakistan). Several students wish to pursue an international PhD after completing their MSc.**
Output 5.5: Participants in personnel exchange schemes and on-the-job training are utilising their improved competence and knowledge in their daily work. **Activity 5.5:** Short-term personnel exchange and on-the-job training at ICIMOD and other relevant institutions (with 2 sub-activities)	At least 80% of participants using improved knowledge in daily work.	**Not achieved.** **Personnel exchange seem to have happened only to a limited extend. Judging from feedback of DHM staff and TU students/staff, this would be very useful for both sides. They have been missing interaction/contact with ICIMOD outside formalized training courses, fieldwork and workshops. This would also smoothen the planned transfer of the monitoring programs from ICIMOD to DHM (or the universities) in near future.**
Output 5.6: The Nepali partner institutions WECS and DHM are fully operational in relation to the stated outcomes of the Project. **Activity 5.6:** Capacity building of Nepali partners (with 1 sub-activity)	Nepali partner institutes participate in all the activities of the project and plan to continue similar activities beyond 2015.	**Partly achieved, still ongoing.** **DHM staff told that the training courses and shared field activities had been very useful, but that they do not yet have sufficient resources or experience to manage a full-scale monitoring program on their own. Responsibilities need to be transferred gradually, and sufficient funding must be allocated. WECS has participated in a few of the trainings, but are mainly interested in the more aggregated results.**
Output 5.7: ICIMOD has improved its competence and capacities for sustained planning, management and monitoring **Activity 5.7:** Capacity building of ICIMOD (with 1 sub-activity)	Relevant ICIMOD facilities achieved intended output on indicative factors as in Component 4.	**Achieved.** **ICIMOD has expanded its activities and hired several new staff related to the Project, particularly scientists. The increased capacity gives new possibilities, but could in worst case lead to a decreased need for engaging local expertise from the universities and DHM in the work.**

Comments on Draft Report (and responses)

A draft report was submitted to relevant parties on 20th January 2015, and comments were received from the Embassy, ICIMOD and Norad in early February. All factual and editorial corrections have been implemented directly, whereas comments and questions on the content are provided below in *italics*, with in-line responses from the Review Team in normal font.

The Embassy

Submitted by Jan Eriksen:

In general the Embassy finds that you have responded to the ToR.

As you are aware, one of the main challenges for ICIMOD is to secure that their research, findings, experience and knowledge are transferred and utilised by other partners in their member countries. This includes public institutions, private sector and civil society.

To some extent this has been discussed in the report. One also has to take into account that HKH Cryosphere Monitoring Project is a relatively new project. You have recommended an intermediate planning exercise to improve national involvement (p 23). We believe the challenge is also a more structural issue, which needs a comprehensive approach. It is especially important to improve stronger commitment and ownership from government entities. We would therefore recommend a more substantial discussion in the report around this issue, which also could involve non-government stakeholders.

Review Team: We have added the following paragraph to address this (Section 7.2):

"The Team proposes that additional measures to increase the activity level and integration of Project partners are also considered. This could for example be meetings between KU and TU with the aim of coordinating curriculums and research, as well as to bring TU more actively into the project activities. Additional efforts should be directed towards WECS, and possible also other high-level governmental bodies, to attain closer links between the project and planning- and budgeting processes on national level. The Team also proposes that an open workshop on data availability, -use and -needs is organized in the near future. This could be an opportunity to present the project to other governmental or non-governmental stakeholders and possibly also to bring new partners into the project."

This issue is also addressed in Section 7.3 - Summary of recommendations.

Below are some specific comments.

Page 12, 2nd paragraph: Please elaborate on how RMC partners could be actively involved.

Review Team: We have added the following text to address this (Section 3.1.4):

"To facilitate this, ICIMOD needs to approach other institutions about their cryospheric activities and support the generation of web-articles and standardized data for sharing. Once the RMC partners realize the benefits of broader outreach and shared databases, they will probably also be willing to commit resources into the development of the Knowledge Hub. The Team suggests that ICIMOD and the most relevant RMC institutions get together to discuss the needs and wishes for the Knowledge Hub, and to make a coordinated plan for its future development."

Page 13, top paragraph: Could it be sorted out that BSC from TU could qualify for MSc at KU?

Review Team: It is supposed to be possible if students go through preparatory courses, but TU gave the impression that this has been difficult. We have added some text to clarify:

"The academic requirement of a relevant 4-year BSc degree secures well trained students, but has had the unfortunate consequence that 3-year BSc graduates from TU do not get admitted or need to go through preparatory courses. This problem will gradually disappear as TU has also started with 4-year BSc programs, but until then, it is in the Project's interest that admission for 3-year graduates is made as smooth as possible with clear requirements for additional courses that are agreed upon by both KU and TU."

Page 17, 3rd paragraph (Answer): How could it be facilitated that RMCs to a larger extent utilize ICIMOD and their experience?

Review Team: This question was regarding international work, but concerning ICIMOD, we believe that the best connection point is through the Knowledge Hub and participation in ICIMOD's training activities and workshops. We have added a few suggestions on this in Section 3.1.4 (Knowledge Hub) and Section 7.3 (Summary of recommendations).

Page 18, 3rd Answer: If DHM, WECS and IPPAN express a strong interest for data, how can this room for improvement be facilitated?

Review Team: A natural start would be a meeting to coordinate interests and needs in relation to the CMP Project and other hydrological data. We added the following text:

"The Team suggests that ICIMOD invites the relevant Nepalese institutions to discuss the current state of hydrological data and models, with the aim of developing plans for how the CMP Project and its continuation can best contribute to improved hydrological management in Nepal."

Page 19: 2nd Answer: Will the members pay for possible expansion, or is that supposed to be donor funded? How can a possible expansion be sustainable?

Review Team: We do not have the overview to fully judge this, but we added a paragraph about our general impression:

"A sustainable expansion of ICIMOD should ideally be initiated and funded by the RMC countries, but many of them have limited financial resources, and the two largest of them, China and India, also have an interest to build up strong national research centers such as the Institute of Tibetan Plateau Research (ITP) in China and the Wadia Institute of Himalayan Geology (WIHG) in India. It is therefore likely that ICIMOD will still be dependent on donor funding, especially with regards to coordinated efforts across national borders."

Page 21, bottom paragraph: Why has WECS not been more involved? How could this be rectified?

Review Team: We added the following text about WECS in Section 6 - Sustainability:

"Their responsibility is mainly at the policy level, and hence data and results need to be applicable for management of water and energy resources. This will be more relevant in the continuation of the Project when the monitoring activities develop from a research phase to an operational phase. A close dialogue between WECS, DHM and ICIMOD on data provision and needs should be established. A more active involvement of WECS in the future is crucial

for the political foundation of the Project, and for attaining action that can benefit the Nepalese people and society as a whole."

Page 23, top paragraph: Very important issues which should be elaborated, and good recommendations should be given.

Review Team: This paragraph is just meant to be a brief summary, but we have added some more material on this earlier in the document, partly in response to previous questions. We have also made a list of specific recommendations in the new Section 7.3.

Norad

Submitted by Helle Biseth:

The draft report is comprehensive and answers all the main issues raised in the ToR.

Some issues /questions:

The selection of international partners (ETH, FW, UU and more recently NVE), how is that done?

Review Team: We have added explanations to this in Section 2.3 - Participating institutions:

"The glacio-hydrological research groups at the Swiss Federal Institute of Technology (ETH) and FutureWater/Utrecht University (FW/UU) in the Netherlands were invited to join the Project due to their extensive experience with high-alpine research, particularly in Himalaya."

And in Section 1.2 - Norwegian support to ICIMOD:

"In MTAP-III there is also an assignment of NOK 6 million for a collaboration between ICIMOD and the Norwegian Water Resources and Energy Directorate (NVE) who have agreed on the project Snow Accumulation and Melt Processes in a Himalayan watershed (SnowAMP)."

The project partners receiving funds from the project, do they receive lump sums for implementation of certain components or do they receive funds according to specific budgets? How do they report back to ICIMOD (technical reporting and financial reporting)?

Review Team: Annual allocations of funds are included in the LoAs between ICIMOD and KU and ETH. The use of funds is reported in yearly Financial Project Reports and annexes (incl. audit reports and invoices). Technical progress is reported yearly in separate progress reports. The text in section 2.4 and 2.5 has been amended to address this comment.

Is the CMP only financed by Norway or also by other donors?

Review Team: All direct funding comes from Norway, but some associated activities are supported by others such as additional student admission to the KU MSc program (USAID) and specific research projects of the main European partners (ETH and FW/UU). This is mentioned where relevant, and the text in Section 2 has been updated to:

"The contract had a financial frame of NOK 35 million over five years, which covers the full funding of the project"

The review report often refers to the "next phase", which period is meant then – from 2013 until…..? After 2015? after 2017?

Review Team: We have added an explanation to this commonly used term in Section 2.1 - Project background and development:

"The CMP continuation after this review and until the end of the MTAP-III funding in 2017 is referred to as "the next phase of the Project"."

The KU Master students, a country and gender breakdown of these could be provided if possible.

Review Team: We have added a table with a breakdown of student admissions with regards to gender, home country and funding (Table 3).

In Chapter 7, the recommendations should be spelled out more clearly

Review Team: We have added a list with summarized recommendations at the end of the report as Section 7.3 - Summary of recommendations. We have also tried to be more specific in our suggestions elsewhere in the report.

ICIMOD

Submitted by Farid Ahmad:

General remarks:

We are suggesting to include the following paragraphs in the parts of the report wherever they are appropriate:

With the signing of the new agreement, the rights and obligations of the CMP agreement has been transferred to the new agreement.

The CMP Project Completion (Final) report submitted has been approved by the donor. With this, the CMP activities now will be implemented under the framework of the new agreement.

This will also help to address some of the suggestions made in the report e.g. posting of the budget.

Review Team: This is now reflected in Section 2.1 - Project background and development.

Comments:

Page 9, para 5, line7: It is ok to say that Yala is relatively easily accessible. The purpose of selecting this glacier is also to conduct trainings and demonstration. It cannot be said that access to Rikha Samba is relatively easy.

Review Team: We agree and have changed all relevant text accordingly.

Page 11 last 3 lines: The Technical University of Dresden should be mentioned beside University of Zurich. They provided significant support for that work and had 2 experts at ICIMOD for about 5 week.

Review Team: We were not aware of this, but have updated the text accordingly.

Page 18, First para: Comment:- After signing of December 2013 agreement by ICIMOD and MFA/Norway for continuing the CMP programme, ICIMOD is getting formally involved in extending Cryosphere monitoring work in other parts of RMCs including Bhutan. Regarding ICIMOD collaboration with NVE, snow monitoring part of CMP is being conducted in Nepal.

Review Team: That was our impression too, but the text was unfortunately not clear. We have modified and expanded the text to point out the different nature of these two projects:

"In next phase of the CMP Project, ICIMOD is getting formally involved in extending cryospheric monitoring activities to other parts of the HKH region, including Bhutan where an agreement has been signed with DHMS. Separately, ICIMOD and NVE have initiated a snow monitoring project in Nepal that builds on the observational network in Langtang Valley and the snow modeling experience of NVE. This will fill a missing link between ICIMOD/CMP and the Norwegian cryospheric community, and the cooperation could be further enhanced by involving other relevant institutions such as the University of Oslo (general cryospheric research) and Statkraft (snow monitoring for hydropower purposes)".

Page 19, Comment to the 2nd para about first A of first Q: Bhutan NVE Project was an independent initiative. As stated above, ICIMOD has already signed a letter of agreement with DHMS/Bhutan and initiated CMP-Bhutan following the experience of Nepal.

Review Team: See the response to your previous comment. Since the Bhutan/NVE projects are now described in more detail there, we decided to not mention them here anymore.

Page 21, Comment to the last para: Correction required as: ICIMOD has involved DHM in all field related activities and also capacity building activities. DHM/Nepal has expressed its willingness to take over the responsibility of CMP glacier monitoring programme in cooperation with KU starting from 2017, but the modality like funding and dedication need to be worked out.

Review Team: The relevant text about DHM's involvement has been modified to:

"Until now they have mainly participated in field-related activities and capacity building … They have expressed willingness to take over the responsibility of CMP glacier monitoring programme in cooperation with KU starting from 2017, but the modality like funding and dedication need to be worked out."

Page vi, 3rd para, line 4: International partners are actually those beyond the 8 RMC countries of ICIMOD, not regional member countries .

Review Team: Agreed. All relevant text has been updated to make this distinction clear.