DAFNE

A **D**ecision-**A**nalytic **F**ramework to explore the water-energy-food **NE**xus in complex and transboundary water resources systems of fast growing developing countries

REPORT ON RISK MITIGATION MEASURES

Deliverable D1.3

February 2018

EU H2020 Project Grant No. 690268

Programme Call: Water-5-2014/2015
Project Number:......................690260
Project Title:............................DAFNE

Work-Package:........................WP1
Deliverable #: D1.3
Deliverable Type: ....Document
Contractual Date of Delivery: 28 February 2018
Actual Date of Delivery: ....28 February 2018
Title of Document: ....Report on Risk Mitigation Measures
Responsible partner:..............ETHZ
Author(s): ....Paolo Burlando, Andrea Castelletti

Availability: ....This report is public.

Document revisions		
Contributors to review	*Revision content*	*Date*
Paolo Burlando	First draft	23.02.2018
Andrea Castelletti	Reviewed	26.02.2018
Jonathan Lautze, Matthew McCartney	Suggestion for improvements	27.02.2018
Scott Sinclair	Editorial revision	28.02.2018
Zeray Yihdego	Comment and text suggestion	28.02.2018
Paolo Burlando	Approval and production of final pdf version for upload	28.02.2018

Table of Contents

List of Tables

Abbreviations

CS:	Case Study
DoA:	Description of Action
GA:	Grant Agreement
GAs:	General Assembly
MB:	Management Board
OTB	Omo-Turkana Basin
PI	Principal Investigator
PMP:	Project Management Plan
RP:	Reporting Period
WP:	Work Package
ZRB	Zambezi River Basin
WEF	Water-Energy-Food
TRMM	Tropical Rainfall Measuring Mission (3B42 product)
MERRA	The Modern-Era Retrospective analysis for Research and Applications dataset
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
TAMSAT	**T**ropical **A**pplications of **M**eteorology using **SAT**ellite data and ground-based observations
MoU	Memorandum of Understanding
NDA	Non Disclosure Agreement
NSL	Negotiation Simulation Laboratory
PC	Project Co-ordinator
ZAMCOM	Zambesi Watercourse Commission
SADC	Southern Africa Development Community

1. INTRODUCTION

This document reports about the risks encountered in the first 18 months of operation of the DAFNE project and on measures that were implemented to minimise the impact of such risks on the successful completion of the project.

It refers both to the risks identified in section 1.3.5 of Annex I of the Description of Action (DoA) and those risks that emerged after the beginning of the project and that could not be identified in the Grant Agreement (GA) negotiation phase.

In a project of this size, duration, and complexity, risk management and contingency planning is important to ensure that the project strategy, operations, outcomes, and budget remain on track. According to the Project Management Plan (PMP), the Management Board is in charge of defining the risks and of detecting risks. Risks were identified throughout the first year by means of internal periodic reporting and measures were envisaged to mitigate the impact of such risks. WP leaders presented an assessment of progress, and risks to progress at the periodic PI meetings and proposed various contingency plans where it was necessary to address any specific identified risks. Here below a summary of the specific risks and their mitigation covered in the risk management process.

2. RISK #1: HYDROMETEROLOGICAL DATA

This section contains a discussion of the measures implemented (or to be implemented) for dealing with Risk #1 and 2 listed in section 1.3.5 of Annex I, Part A of the GA (Table 1).

Accessing historical data was attempted so far only for the Zambezi river basin case study because the beginning of activities in the Omo-Turkana basin case study was delayed due to the late inclusion in the project of the Ethiopian partner WLRC[1]. The inclusion of the Ethiopian partner represents already a ***mitigation measure*** of a ***risk*** -the lack of an Ethiopian partner- that emerged during the Grant Agreement negotiation phase, when the Ethiopian partner, which was part of the proposal submission, could not be validated by the EC and had to be excluded from the project.

Obtaining data proved to be challenging because of several factors. The first and most important is the limited collaboration received from the stakeholders (institutions, agencies, etc.) who collect and hold data. The second but still significant factor concerns the existence, consistency, and extent of the available data, which are often limited, due to the factors intrinsic to the developing nature of the targeted countries and regional organizations responsible for transboundary basin management, and often could hardly be assessed, due to the longer than anticipated process of developing trust, willingness and collaboration from the side of the stakeholders.

The process of data access and acquisition was organised under the coordinating activities of WP2 and under the advice of the local academic partners for the ZRB that are part of the DAFNE team. The coordinator and the local academic partner co-signed official letters and sent them to the agencies and/or institutions that were identified as data holder and potential suppliers. The response was, and still is, slow, considering that accessibility to data and data themselves from agencies and institutions are not yet available at the level expected on the basis of the knowledge available at the time of the proposal submission and of the negotiation of the GA.

After the interaction of the local DAFNE partners did not seem to produce any advancement of the data access procedure above explained, a ***first general measure*** was implemented aiming at ***mitigating the data blockage risk***. The co-ordinator and his deputy travelled in November 2017 to meet personally the directors and responsible management of the main agencies. The purpose of this visit was mainly to explain the benefits that supporting the DAFNE project with data access

[1] The history of the consortium composition leading to the delay in the inception of the Omo-Turkana basin case study is documented in the “History of Changes” of Part B, Annex I of the DoA.

can produce for the institutions. The lack of clarity about the benefits seemed indeed to be one of the blocking obstacles, despite the stakeholders attending two (successful) stakeholder events, in which the benefits were extensively explained. On this occasion the coordinator offered to sign Memorandum of Understanding or Non-Disclosure Agreements with the relevant stakeholders, to provide a form of guarantee that the data would be used properly and for the sole scope of the project, while explicitly mentioning the benefits that stakeholders can obtain in return. This measure was effective in producing an initial momentum but the process of data acquisition is at the moment of writing this deliverable still extremely slow and not conclusive, partly because the preparation and signature of MoUs and NDAs is still on-going, in part because the process of obtaining consistent data from eight riparian countries is intrinsically challenging, let alone considerations about data that may be commercially sensitive (e,g, hydropower).

Table 1 – Expected risks as summarised in section 1.3.5 of Annex I, Part A of the GA.

Risk #	Description of risk	Work package(s) involved	Proposed risk-mitigation measures
1	Accessing historical data for the river basin may prove to be a challenge if data collection does not back far enough, if there are data gaps or if data collection was otherwise incomplete.	2,3	Probability: medium. The use of physical models, and the planned remote sensing surveys, however, allows the calibration and simulation of the hydrologic response even with limited data.
2	Accessing data and information concerning hydropower generation and socio-economic sectors may be difficult if authorities are unwilling to share it with European researchers.	2,3,4,5	Probability: medium The large number of local academic partners and the large number of endorsement letters showing the interest by local stakeholders should help to minimise this risk.
3	Operational risks: information and data not shared effectively within the consortium	2,3,4,5,6	Probability: low. The close cooperation of the responsible persons and the establishment of a Geo-information portal will minimise this risk. Web-conferencing meetings will be held at short intervals (e.g., every 2 weeks) to monitor progress and identify blocking issues as soon as possible.
4	Time/budget risks: delays in producing expected deliverables	All	Probability: low. The high frequency meeting of the Management Board allows identifying delays, assessing impacts and implementing organisations/budget changes
5	Competence risks: personnel involved or recruited not able to fulfil tasks	All	Probability: very low. Continuous monitoring by the WP Leaders and the Management Board, and implementing adjustments within each organisation if necessary.
6	Scientific risks: models do not produce outputs close to available observations	2,3,4	Probability: low. The consortium includes experts on the development of the required models. If necessary existing modelling tools can be adjusted and improved.
7	Impact risks: the proposed solutions do not meet stakeholders requirements	5,6	Probability: low. The involvement of all stakeholders from the very beginning will mitigate this risk.

A second reason concerns the extremely hierarchical structure of the organisations expected to supply data. The ***risk*** of being unable to identify the person who can authorise the access to data and that who can materially provide access is very high. Unfortunately, there is ***no general measure*** that the project can advocate or enforce to counteract this risk. The project will continue to be open with stakeholders about what the project is trying to do and to make every necessary effort to better understand both the situation on the ground and how things really work in the countries of interests, eventually continuing to get high level political buy in.

A third reason that makes data access difficult is the lack of resources that seem to affect the agencies and institutions and that does not allow them to set aside time for the preparation of the data to be delivered to the project. The proposed ***general measure*** to counteract this ***risk*** consists of offering to visit the agencies and institutions and provide manpower from the side of the project to prepare the available data.

Additional ***targeted measures***, which aim at mitigating the ***risk*** of (negative) impact of limited data availability, are described in the following with respect to specific data categories

2.1 HYDROMETEOROLOGICAL DATA

A key component of the DAFNE project is the modelling of the WEF Nexus in response to development pathways through an integrated WEF model. This consists essentially of a hydrological model, which is being expanded through the research developments to account explicitly in the model for the WEF components and to simulate their cause-effect interactions following a given set of actions (i.e. a pathway). The hydrological model component requires forcing data, i.e. hydrometeorological data, other hydrological data, e.g. streamflow data, for calibration and validation, as well as thematic data, e.g. topographic, soil, land cover maps, for parameterisation of the process components.

To date no hydrometeorological station data or any elaboration thereof were made available to the project. While there is hope that in near future the situation can improve, the ***risk*** of being unable to access hydrometeorological data can (and will) be mitigated by using data sets that are publicly available (this includes some limited historical data through initiatives like the Global Historical Climate Data Network database). This ***measure*** foresees the replacement of traditional hydrometeorological ground observations through estimates obtained from satellite and model reanalysis data (e.g. TRMM, MERRA, CHIRPS, TAMSAT, …). These data were already collected by the relevant partners and are being processed for quality control and used to drive the preliminary simulations of the hydrological response of the ZRB and its sub-basins

2.2 HYDROMETRIC DATA

The raster based integrated WEF model requires to be calibrated and validated at least with respect to streamflow data at selected flow gauging stations throughout the entire river network. Also in this case only few data were delivered to date. The ***measures*** to mitigate the ***risk*** of being unable to access further hydrometric data consist of three elements. First, publicly available global data sets at coarse temporal resolution will be used to assess the performance of the WEF model over mid- to long-term scales assessing the capability of the model to reproduce the interannual variability of the hydrological response when driven by global and satellite based data sets. Second, a few targeted field campaigns will provide at selected sites high frequency flow measurements, which will be used to validate the WEF model at daily and sub-daily temporal scales. Third, the physically explicit nature of the WEF model limits the need of data for calibration, because hydrological processes are simulated by means of equations, the parameterisation of which is based on quantities that are measurable for which reference values can be obtained by targeted field campaigns or by values available in the scientific literature that link thematic characteristics of soil and land with parameters of hydrological model components.

2.3 THEMATIC DATA

The hydrological model requires thematic data such as soil properties and land cover maps. These should depict as much as possible the historical evolution of the ZRB characteristics, in order to constrain the model to provide the right response, especially as driven by land cover changes due to agricultural expansion. While there is a ***risk*** that data in whatever form may not be available directly from the relevant agencies, institution and authorities, there are possible ***measures*** to mitigate the impact of missing thematic data. These consists on using a) publicly available data (e.g. FAO soil maps) b) thematic maps derived from remote sensing imagery (e.g. land cover maps derived from LANDSAT TM, which cover a time span of about 40 years, though characterised by different accuracy). These measures were already implemented and publicly available data were collected and made available in the internal project data repository.

3. RISK #2: HYDROPOWER AND SOCIO-ECONOMIC DATA

Accessing data and information concerning hydropower generation and socio-economic sectors represents a ***risk*** if authorities, institutions, and agencies owning date are unwilling to share it to the project. As in the case of hydrometeorological data there are ***measures*** to partly overcome this risk. These are illustrated in the following sections.

3.1 HYDROPOWER DATA

Dam building and operation is one of the most impacting activities with respect to river reaches downstream, especially because streamflow and sediment transport are significantly altered. Because of this, data about dam characteristics and their operation are key to validate the management policy to be implemented in the reservoir module of the integrated WEF model and in the optimisation model. The major dam operators were invited as key stakeholders to the information workshop held in February 2017 and to the Negotiation Simulation Laboratory in September 2017. ZESCO, one of the major dam operators, was additionally visited by the coordinator and his deputy in November 2017 after having observed that data access was not yet fully agreed.

Despite the many efforts, started already in the early months of the project operation, to access available hydropower data, the ***risk*** of lacking the necessary information to implement properly the modelling effort and to validate it is still high. Unfortunately, there are no ***measures***, which can directly act as replacement of the missing data. ***Measures*** can be, however, identified, which make use of data that can be used as proxy of dam operation. By combining electricity demand data, likely available from national and publicly available statistical data, with target power installed at the dams and flow data (available at large temporal scale from public sources), and with qualitative information obtained by interaction with the hydropower stakeholders in the context of the NSL, we will reconstruct plausible operation policies that will be used as necessary baseline to compare with operation policies defined by the considered development pathways.

3.2 AGRICULTURAL DATA

Irrigated agriculture is also one of the water impacting activities, especially because of its consumptive nature and because of the intimate link with development and food security national policies. Data concerning the irrigated areas, the irrigation techniques used for the different crops, the productivity, and the development of the irrigated surface through time are key for the validation of the modelling assumption and for the simulation results. To date no such data could be accessed.

The foreseen ***measures*** to counteract the ***risk*** of data unavailability consist of (a) analysing land cover maps available from satellite imagery (see also §2.3) and blending this information with (possibly available) statistical data of the production at national level, in order to identify plausible size of the relative extent of each crop as well as of the productivity level by comparing these estimates with the productivity theoretically achievable under ideal conditions; (b) computing the actual evapotranspiration (ET) from hydrological modelling for each crop[2] (c) estimating ET from drone surveys and/or satellite products, in order to determine the water demand and its variability across the simulated years. The estimate of (b) is subject to the ***risk*** discussed in §2 with respect to the validation of the hydrological model, but ***measures*** discussed there also apply here. Estimates indicated in (c) are subject to the risk of unsuccessful field campaigns and limited predictive power of satellite products. All these measures will help, in the absence of directly available historical data and/or estimates, to define the baseline scenario of irrigation water demand, which will be the basis for the identification of development pathways together with the stakeholders throughout the NSL.

3.3 SOCIO-ECONOMIC DATA

The dependence of socio-economic development from water availability and from the WEF nexus is discussed in the deliverable D4.1. The ***risk*** of inaccessibility of data owned by the relevant agencies, institutions, and authorities, which are not public, had to be faced during the preparation of that deliverable. The only possible ***measure*** against the consequence of the lack of access to data was the use of publicly accessible data for each sector of the economic activities (primary, secondary, tertiary and households). The same ***measure*** applies to governance data, i.e. legislation body, regulations, in the case non-public data will not be made accessible by the stakeholders.

4. RISK #3: OPERATIONAL RISKS

The DoA identified as operational risk that of lack of effective information and data sharing within the consortium. The probability of occurrence of this risk was estimated as low. Indeed, a close communication among the partners, the periodic exchange at the monthly PI meetings – not foreseen in the project management plan, but established as additional management measure to improve the exchange of information across the consortium – and the use of an internal repository for data and documentation proved to be effective ***measures*** to mitigate potential ***risks*** related to lack of information exchange within the consortium. A specific measure was recently implemented, after discussion and agreement among the PIs, in order to improve the quality control of the deliverable production. The time allocated in the procedure described in the PMP was slightly expanded to allow more time for controlling and for implementing changes that may emerge as necessary to improve the quality of the deliverable. More specifically, the time of the deliverable production process was extended to 55 days. The additional 10 days with respect to the original production process time are allocated to the quality check and to the project coordinator decision. Moreover, the quality check, originally done only by the WP leader, will be carried out by another quality manager, designated from time to time by the PC.

5. RISK #4: TIME AND BUDGET RISKS

The ***risk*** related to time and budget management – e.g. with respect to completing work within stipulated deadlines, delays in producing expected deliverables – was and will continue to be counteracted by means of the implemented management ***measures*** discussed in the PMP. In particular, among these, the internal periodic reporting with a six-month pace is used to verify the advancement of work and the corresponding use of resources. These reports allow WP leaders to identify deviations from the agreed project schedule (GANTT) and, thus, call the MB to act and implement specific countermeasures. In addition to the controlling measures foreseen in the PMP, the GAs in Leuven identified the opportunity of monthly PI e-meetings as additional measure to reduce the probability of untimely identification of delays, and to intensify the assessment of potential impacts of such delays, as well as to offer regular opportunities to discuss the implementation of organisation and budget changes.

---

[2] See, e.g., FAO publication 56 «Crop Water Requirements, 1998

6. RISK #5: COMPETENCE RISKS

The DoA identified as "competence risks" those related to the involvement and/or recruitment of personnel that is not able to fulfil the assigned tasks. The probability level of incurring in such risk was estimated as low at the beginning of the project. Based on the composition and operation of the consortium, this ***risk*** can be confirmed to be low. The ***measures*** that allow to counteract this risk consists of the measures already foreseen in the PMP (i.e. MB meeting, WP progress monitoring through WP leaders, milestone achievement controls, etc.) and of the recently implemented extension of the time allocated for the deliverable production process.

7. RISK #6: SCIENTIFIC RISK

The scientific risk listed in the DoA concerns the inability of the modelling framework and of the project approach to deliver the expected results. One component of this ***risk*** is strongly influenced by other risks – i.e. data related risk – and ***measures*** identified to mitigate those risks are considered to be effective also with respect to this component of the scientific risk.

An additional component of the scientific ***risk*** is related to the choice of the appropriate model approaches (i.e. the integrated WEF model and the optimisation of the selected pathways) and to the correct implementation of the designed interaction with the stakeholders (i.e. the development pathway identification and definition through the NSL). For this risk there is no a priori ***measure*** that can be identified and formalised, as the risk concerns research developments that are intrinsically uncertain when innovation is involved. The consortium, however, includes experts that are knowledgeable about consolidated literature modelling approaches that represent a back-up solution, should the innovation fail to deliver the expected results. This ensures the minimisation of the impact due to this type of scientific risk and warrants an adequate level of achievements that is still in line with the promised results.

8. RISK #7: IMPACT RISKS

The impact risks identified in the DoA concern the failure to meet the stakeholders' expectation through the selected development pathways. In this respect there is no need to define specific ***measure*** to counteract this ***risk***, because the project is implicitly designed to mitigate it, as stakeholders were involved from the very beginning of the project and are expected to actively contribute to the design of the development pathways. Should the risk emerge as more important than estimated, the project will consider to invest additional resources in face-to-face meeting with the stakeholders, in order to increase interaction, generate more trust and ultimately achieve the goal of meeting the expectations of the stakeholders.

9. OTHER RISKS

The first eighteen months of the project did not suggest any specific additional risks beyond those identified in the DoA.

There is, however, potential for residual ***risk*** related to the low level of cooperation of the stakeholders, which can manifest either by their poor interest in participating to the NSL or by the low level of interaction throughout the NSL development. In both cases, the consequences of this risk propagate to the identification and definition of the development pathways. To mitigate this risk, the project will consider, on the one hand, resorting to published documents that illustrate the development plans of government, agencies and institutions (such as ZAMCOM, which gathers together the governmental representatives of the eight riparian states of the ZRB, or SADC, which is active in promoting integrated approach to water resources planning and management) and, on the other hand, promoting initiatives aimed at providing incentives (returns) for participation, such as increasing the capacity building programme, budget and resources permitting.

10. RISKS AND MEASURES FOR THE OMO-TURKANA BASIN

At the time of compilation of this deliverable the project activities about the Omo-Turkana basin case study just started. Two stakeholder workshops took place in February 2018 in Nairobi with the Kenyan stakeholders and in Addis Ababa with the Ethiopian stakeholders. These were followed by the first face-to-face NSL in Addis Ababa with the participation of stakeholders from both riparian countries (see, for details, D6.1 due on month 18, 28th February 2018).

Because of the high interest from both sides, Ethiopia and Kenya, on cooperating towards the identification and negotiation of sustainable policies, we do not anticipate data related and operational risks that are significantly different from those emerged for the ZRB case study. The most significant risk seems also in this case to be related to the limited availability of data. With respect to hydrometeorological data this is mainly due, as in the case of the ZRB, to the coarse density of the measuring networks, the modest temporal resolution of measurements, their accuracy and, more in general, the typical problems of data in developing countries. The measures to counteract this risk are equivalent to those foreseen for the ZRB case study. Also with respect to socio-economic and governance data, the situation seems to be comparable with that of the ZRB. However, an additional risk may be represented by lack of available data when these are regarded by some institutions as sensitive in relation to questions of national interest. The latter type of risk is obviously difficult to handle even considering the adoption of the highest level of confidentiality in handling such data.

However, because of the particularly sensitive nature of the case study – strong upstream-downstream competition about water use, both within each country and at the transboundary level, and highly media-politicised nature of the issues around the projects located in the Omo River – one can expect that the ***risk*** associated with the limited collaboration of stakeholders is somehow higher than in the case of the ZRB. To date, there is no proof that this will happen, as both the Ethiopian and the Kenyan authorities and stakeholders responded positively to the invitation to participate and contributed to the NSL[3], as well as to support the project. ***Measures*** to mitigate the impact of such circumstance will have to be targeted in consideration of the specific situation that will eventually occur. However, we are confident that the scientific nature of the project and the methodological framework at its basis are intrinsically a measure to mitigate this risk. The project is, in fact, designed (i) to stick to scientific exploration of the issues and objective consideration of the issues based on scientific evidence; (ii) to offer policies, institutional and collaborative management options and development pathways in the form of trade-offs; (iii) to facilitate good and honest discussion among the stakeholders thereby making them part of the solution.

11. CONCLUDING REMARKS

The nature of the DAFNE project focusing on developing countries embeds risks related to the inherent complexity of the investigated questions and of the target study areas. Risk management and contingency planning as explained in the previous sections is important to ensure that the project strategy, operations, outcomes, and budget remain on track. While the present deliverables outlines the major risks and the relevant mitigation measures, the Management Board, supported by monthly e-meetings of the PIs and by periodic reporting under the advice of the WP leaders, carries the responsibility of addressing risks detected during the project operation and proposing and implementing contingency plans to mitigate them, thus preventing potential deviations from the DoA, or, when this is impossible, adopting correction measures, which aim to ensure the achievement of the project goals.

[3] See also DAFNE D6.1, due on 28.02.2018

DAFNE