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

INTERMEDIATE EVALUATION REPORT ON NSL OPERATION

Deliverable D6.2

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Responsible partner: .....UO
Author(s): .....Caroline van Bers (UO), Caroline Lumosi (UO), Ksenia Koroleva (EIPCM), Mathias Becker (EIPCM), Jasminko Novak (EIPCM), Marco Micotti (POLIMI), Andrea Castelletti (POLIMI) Alfred Owuor Opere (ACCESS), Dinis Juizo (UEM), Imasiku Nyambe (UNZA), Ethel Namafe (UNZA),

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Contributors to review	*Revision content*	*Date*
Marco Micotti	Section 4 and 6.2 (part)	13/02/19
Ksenia Koroleva	Section 6.2 and Section 5	15/02/19
Mathias Becker	Section 3, 5 and 6	20/02/19
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Ethel Namafe	Section 6.1	27/02/19
Dinis Juizo	Section 6.1	27/02/19
Alfred Owuor Opere	Section 6.1 and 6.2	27/02/19
Caroline Lumosi	Section 6.1	27/02/19
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EXECUTIVE SUMMARY

This deliverable 6.2, *Intermediate evaluation report on NSL operation*, is described in the DAFNE project's Description of Activities as follows: '*Report describing the NSL implementation and an intermediate evaluation of its operation, including possible changes and modifications'.* It is part of Task 6.1 of the work package, *Synthesis and Pathways to Impact.*

The report presents the implementation to date and status of the Negotiation Simulation Labs (NSL) including face to face meetings and NSL tools: collaborative document area, the Geoportal and the multi-perspective visual analysis tool. It then provides a review of the NSL operation based on stakeholder feedback in meetings and interviews, as well as partner observations and analysis.

The deliverable is structured as follows.

- Section 1 introduces to the overall NSL purpose and approach;
- Section 2 presents a summary of the first NSL face-to-face meetings in Zambezi and Omo-Turkana basins;
- Section 3 presents the structure and use, thus far, of the collaborative document area
- Section 4 describes the DAFNE Geoportal prototype that has been developed and its use and integration in NSL;
- Section 5 presents the functions of the multi-perspective visual analysis tools and current status;
- Section 6 provides a review of NSL operation with respect to those elements of the NSL listed above (in sections 2-5);
- Section 7 summarises the outcomes of the review of the NSL operation.

Overall, the NSL has been implemented according to plan. The project partners have endeavoured to be responsive to questions raised and suggestions made by both stakeholders and other partners, and where possible, adjustments have been or are being made. The details of these adjustments are also presented in this report.

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Abbreviations

CA: Consortium Agreement
GA: Grant Agreement
DoA: Description of Action (Annex I of the Grant Agreement)
GAs: General Assembly
MB: Management Board
PAB: Project Advisory Board
WP: Workpackage
QM: Quality Management
CS: Case Study
EC: European Commission
PO: Project Officer
PR: Project Review
DM: Deliverable Manager
DDP: Deliverable Development Plan
RP: Reporting Period

Partner Abbreviations

ACCESS	African Collaborative Center for Earth System Science
ATEC	ATEC-3D Limited
EIPCM	European Institute for Participatory Media
ETH	Swiss Federal Institute of Technology
IWMI	International Water Management Institute
ICRE8	International Center for Research on the Environment and the Economy
KU Leuven	Katholieke Universiteit Leuven
POLIMI	Politecnico di Milano
UEM	Eduardo Mondlane University
UNZA	University of Zambia
UO	Osnabrück University
UNIABDN	University of Aberdeen
WLRC	Water and Land Resource Centre

1 INTRODUCTION

The purpose of deliverable 6.2, Intermediate evaluation report on the operation of the Negotiation Simulation Lab is to describe the implementation of the Negotiation Simulation Lab (NSL) and provide an intermediate review of its operation to date including modifications and changes. It is part of Task 6.1 of the work package, Synthesis and Pathways to Impact.

1.1 BACKGROUND OF THE NEGOTIATION SIMULATION LAB

The Negotiation Simulation Lab supports the analysis of trade-offs of a range of management and development options identified in the pathways to sustainable resource use in the Water-Energy-Food Nexus (undertaken in Work Package 5) and identifies potential solutions for sustainable resource use. The NSL as a whole has been developed in consultation with partners and stakeholders with the intention of providing an open and 'safe' space to explore and reflect on these pathways. It is the project's platform for consultation among the partners and stakeholders. The NSL uses a multi-perspective knowledge visualization tool to support this consultation and analysis of pathways, and the geo-information portal (WP 7) which integrates and shares all data collected in the DAFNE project further extends this. Finally, the NSL uses an online collaborative document area that allows both partners and stakeholders to annotate indicators, solution pathways, or benchmark values, as well as to try out the NSL tools (geoportal, multi-perspective visual analysis tool) for their analysis of the WEF nexus modelling and simulation. During the project, and especially in the final NSL meeting in Year 4, these tools are intended to support understanding and exchange among stakeholders.

Twelve DAFNE partners have been involved in the NSL's development and implementation: UO (lead), ETHZ, POLIMI, ICRE8, KU LEUVEN, UABDN, IWMI, WLRC, ACCESS, UNZA, UEM and EIPCM. DAFNE partners UO and EIPCM have had the primary responsibility for implementing the NSL. In addition to leading the WP, UO has primary responsibility for the actor analysis and the organization of the face-to-face meetings, while EIPCM is leading the development of the online shared document area and the multi-perspective visual analysis tool. It also provides a significant contribution to the facilitation of stakeholder interaction in face-to-face meetings. The development of the Geoportal is the responsibility of POLIMI (in WP7) and they work closely with EIPCM on its integration in the NSL. The partners in the case study regions, UNZA and UEM in the Zambezi and WLRC and ACCESS in the Omo-Turkana, have been key to the process of identifying the stakeholders and selecting them for involvement in the NSL and the project as a whole. They also support programme development, host the meetings with stakeholders and play a key role in facilitating the events that take place in the basins. In addition, they play a pivotal role in ensuring information flow and validating knowledge with the stakeholders. ETHZ as project coordinator follows the whole process of NSL development and implementation closely and attends all NSL meetings together with all of the above mentioned partners. Other partners, KU LEUVEN, IMWI and ICRE8 contribute resource materials such as maps, data and advice and participate in one or more NSLs with an active role in interaction with the stakeholders.

This report is structured to first provide an overview of the approach to the NSL development and implementation (Section 1). This is followed by several sections summarizing the implementation status of the various components of the NSL including the face-to-face meetings (Section 2), the online shared document area (Section 3), the integration of the NSL with the Geoportal (Section 4) and the multi-perspective visual analysis tool (Section 5). A review of the implementation to date of these various components is then provided in Section 6 followed by a summary of conclusions of the evaluation (Section 7).

1.2 APPROACH TO DEVELOPMENT OF NSL

DAFNE's Negotiation Simulation Lab is intended to facilitate interaction among stakeholders for the discussion of water, energy and food issues, the actions to address these issues, associated indicators, and the pathways to sustainable resource use. Supported by project partners, the ultimate

objective of the NSL is to *simulate* negotiations in a safe environment so that stakeholders have the opportunity to develop and substantiate their arguments. It prepares them for real negotiations on the basis of indicators underpinned with scientific data on impacts within water-energy-food nexus collected and compiled in the project. It also provides a better understanding of the arguments used by stakeholders in other sectors. Through interaction among stakeholders, the intention is to develop win-win solutions for sustainable resource use and to prevent negative impacts by identifying mitigating actions. More specifically, the NSL seeks to:

- **compare and contrast** the impact of natural resource management practices in the river basins;
- **visualize, explore, and understand** multiple perspectives in the river basins and new solution pathways; and
- provide **a 'safe place'** to jointly discuss potential solutions, enabling the building of trust and social learning

This is accomplished in the NSL by providing opportunities for stakeholder interaction through face-to-face meetings and online interaction that allow stakeholders to explore pathways, indicators and scenarios that form the basis of the decision analytic framework. Specifically:

- **Face-to-face stakeholder meetings** for both case studies serve to simulate negotiations between stakeholders by providing them with insight about solution pathways, indicators, and benchmark values for acceptable solutions. These meetings also provide a forum for presenting intermediate results and the use of the DAFNE tools for analysis and visualisation of path-ways and their trade-offs (geo-portal and multi-perspective visual analysis tool). The introduction and use of these DAFNE tools in the stakeholder meetings is also a form of capacity building for data-driven, analytical approaches to the analysis of W-E-F nexus issues and solution pathways. Last, but not least, the face-to-face meetings are crucial for facilitating engagement and trust between the stakeholders and the DAFNE project partners, as well as among the stakeholders themselves.
- **Online interaction** takes place in the form of a protected area of the website dedicated to two-way interaction of partners and stakeholders. Intermediate results can be shared with stakeholders (e.g. indicators, solution pathways and benchmark values. Access to the NSL tools (geoportal, multi-perspective visual analysis tool) for use in the analysis of the WEF nexus modelling and simulation, is also provided in this area following the implementation of the different prototypes according to the implementation plan.

The main benefits to the stakeholders of participating in the NSL is to:

- gain a better understanding of the DAFNE project in terms of process and products, and the nexus approach to integrate sectors in order to identify trade-offs and to generate more sustainable solutions to resource management issues;
- learn about/ gain insights into intersectoral aspects of resource management through the negotiation process;
- gain experience and a better understanding of the value of visualisation tools for identify trade-offs between solutions;
- have the opportunity to use the products of DAFNE including the decision analytic framework, the NSL itself, and the online Geoportal further developed and extended in WP7.

An important step in stakeholder involvement in the NSL was the mapping or analysis of actors. This was led by UO in close collaboration with the case study leaders who played a key role in identifying the stakeholders. The selection was based on a range of criteria to reflect the knowledge needed for addressing the Nexus. The implementation plan of the NSL is summarised in the next subsection.

1.3 SUMMARY OF THE IMPLEMENTATION PLAN

The implementation plan described in D6.1 reflected the outcomes of the iterative and stakeholder-driven approach in DAFNE, which served two main purposes. On the one hand, it described the process by which the input for the Decision Analytic Framework is collected during stakeholder

meetings. On the other hand, it outlined several tools that were to be developed to visualize the results of the DAF model, and to allow users to explore the trade-offs, make comparisons and formulate perspectives. Figure 1 gives an overview of the elements of the NSL foreseen in D6.1 supporting the continuous stakeholder involvement in DAFNE with three tools: the collaborative document area, the multi-perspective visual analysis tool and DAFNE Geoportal (Figure 1).

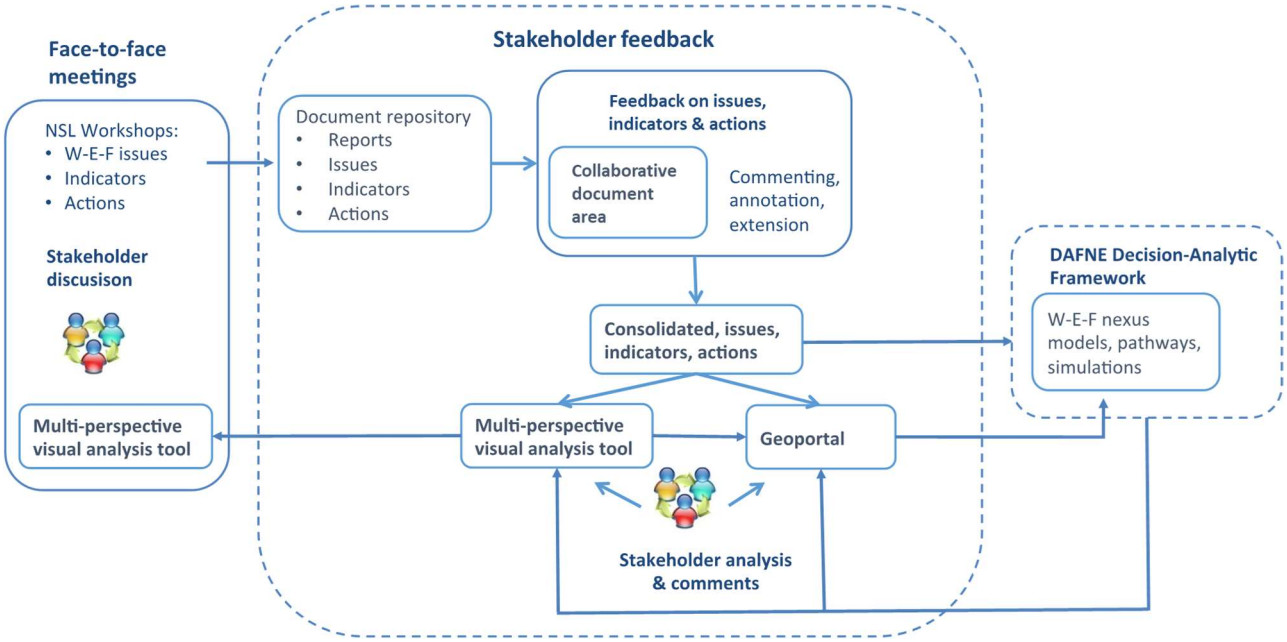


Figure 1 – Stakeholder interaction through face-to-face NSL workshops and online platform (adapted from D6.1)

Beginning with the face-to-face meetings in the NSL workshops, the results of the stakeholder discussion and the identified W-E-F issues, indicators and actions (for a given basin) have been provided in the form of reports and structured documents in the **collaborative document area** on the DAFNE website. This area allows for an exchange of views regarding the building blocks for and key elements of the decision analytic framework among involved stakeholders and partners. These have been inspected by the stakeholders, verified, corrected, extended and/or commented upon. The results of this online stakeholder feedback have then consolidated and the resulting consolidated issues, indicators and actions fed into the DAFNE decision analytic framework. They have also been used as input into the DAFNE **Geoportal,** which stores, integrates, and shares all data collected in the DAFNE project. It allows for access to and in-depth analysis of, for example, scenarios, drivers, model simulation outcomes, pathways, and indicators based on available data. The consolidated issues, indicators and actions have also been made accessible to the stakeholders in a geo-based visualization. Finally, the **multi-perspective visual analysis tool** is targeted to all stakeholders, regardless of their level of expertise, to be used both in face-to-face meetings and for own analysis. Drawing on data from the DAF model and the Geoportal, it allows an at-a-glance understanding of the impact of solution pathways on selected indicators from different sectoral perspectives, thereby allowing for an easy analysis of the trade-offs between water, energy, and food (and/or other related sectors). It supports an informed assessment of the impact of solution pathways for the WEF sectors and provides continuous support for stakeholders to discuss solutions online and in face-to-face meetings.

Section 2 describes the status of NSL face-to-face meetings while sections 3 to 5 describe the implementation of the three tools that have been developed and released according to the technical implementation plan presented in D6.1.

2 FIRST NSL MEETINGS IN ZAMBEZI AND OMO-TURKANA

2.1 IMPLEMENTATION OF FACE-TO-FACE NSL MEETINGS

The purpose of the DAFNE Negotiation Simulation Lab (NSL) meetings is to bring together stakeholders in the two case study basins, the Zambezi and the Omo-Turkana basins, to discuss emerging issues and actions/solutions that promote sustainable resource use in the Water-Energy-Food (WEF) Nexus. In both case study regions, the initial NSL was preceded by a stakeholder workshop in which participants from the respective basins had the opportunity to learn more about the project, to integrated river basin management, the WEF Nexus and each other.

Originally, two face-to-face NSL meetings were planned for the Zambezi and Omo-Turkana basins in first and last year of the project. After the first NSL in the Zambezi it was decided a third meeting in the third year of the project would take place since stakeholders preferred this over online interactions which are of course less personal but also more unreliable particularly in countries or regions with low bandwidth.

The first NSL meeting in the two regions was intended to build trust and identify issues, actions and indicators as a foundation for the eventual development of pathways to development. The second face-to-face meeting in year three (July 2019) has been added in response to stakeholder feedback. The final and most important face-to-face meeting takes place, four months before the end of the project. In this meeting, the completed pathways will be assessed by stakeholder and the potential solutions in the context of the WEF Nexus priorities of the basins will be identified.

The approach in the first NSL for both case studies was to use participatory mapping to jointly examine the current situation (issues) in the basins as a whole and in specific sub-basins and to identify actions, planned or hypothetical, that will or can contribute to sustainable resource use. This was followed by a session on the value of visualization and how it can be used for trade-off analysis and the stakeholder engagement process in the project. Subsequently, the Geoportal tool was also presented and discussed, in particular issues of clarity concerning the hosting, application and use of the Geoportal once it is completed presents the scheme for the NSL simulation and visualization process that was presented to stakeholders (Figure 2).

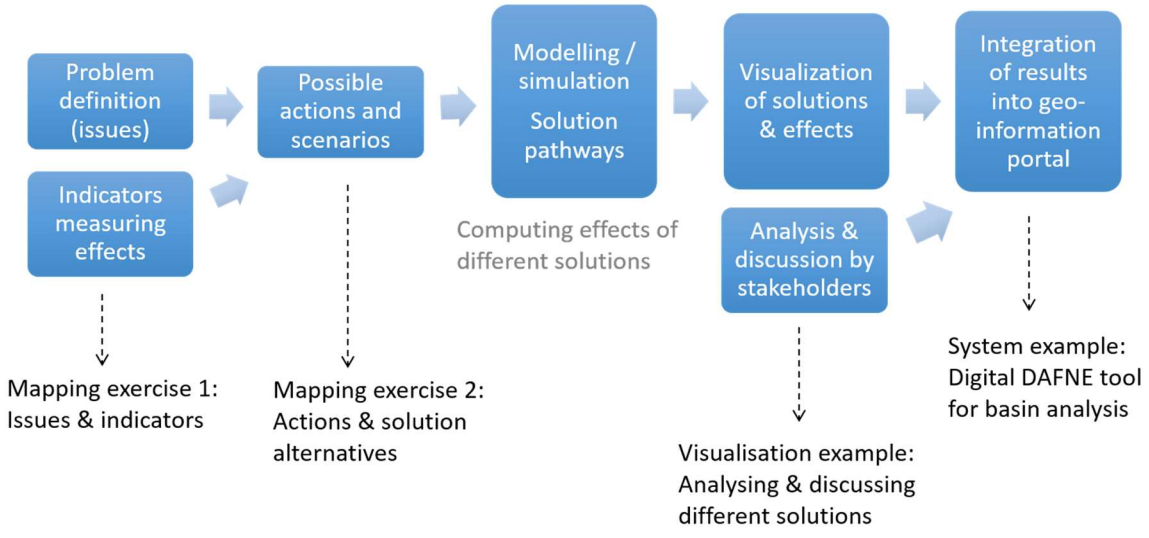


Figure 2 – Process of simulation and visualization of solution pathways presented to stakeholders in NSL

The final session of the NSL meeting provided an opportunity for feedback on the DAFNE approach to engaging stakeholders and an evaluation of the learning impact of the meeting, both of which contributed to the evaluation presented in this report. The meeting was then wrapped up with a review of next steps in the NSL and project as a whole. These outcomes are summarized in the next section.

2.2 SUMMARY OF RESULTS OF ZAMBEZI BASIN AND OMO-TURKANA BASIN NSLS

The first NSL for the **Zambezi Basin** took place in Lusaka, Zambia on September 11 and 12, 2017 and was hosted by DAFNE partner, University of Zambia with support from DAFNE Partner, UEM. Participants included 14 representatives of the three WEF sectors from Mozambique, Zambia, Zimbabwe and Botswana (the latter two representing basin-wide organisations). The first NSL meeting for the **Omo-Turkana Basins** took place on Feb. 15 and 16, 2018 in Addis Ababa, Ethiopia and was hosted by DAFNE partner, Water and Land Resource Centre and supported by DAFNE Partner Access. The event brought together 15 stakeholders representing the Omo basin in Ethiopia and five representing the Turkana basin in Kenya.

2.2.1 Summary of Zambezi Basin NSL Results

The first NSL for the Zambezi Basin in September 2017 included a number of outcomes which are briefly summarized in this section. The participants undertook a mapping exercise in three groups with the use of three large catchments maps for the Zambezi basin as a whole and the Luia and Lunsemfwe basins. Stakeholders were assigned to the group representing the respective (sub)basin with which they are most familiar. All three groups identified the issues concerning resource management issues in terms of agricultural activities and hydropower generation, as well as impacts on urban settlements the environment. The results of each of the three groups were then presented in the plenary. In a second phase of the mapping exercise the participants in their respective groups, identified the currently implemented, planned and potential future actions that [can] address the issues they identified in the first stage of the exercise. They provided a full description of the actions planned including what has to be done, who the responsible decision maker is, when the action is planned, where it is being planned for and the phase of implementation. The results were subsequently presented to the plenary.

Some of the general issues identified that are common in the Zambezi basin in general include:

- inconsistent and inadequate or lack of access to data
- inadequate considerations of the WEF in planning
- environmental integrity and significant losses of biodiversity (not much left in the study areas)
- lack of coordination in planning hydropower
- increasing deforestation due to clearance of land for farming (related to Foreign Direct Investments)
- Access to irrigation water and resulting competition with hydropower

On the second day's (September 12) the value of visualization and how it can be used in the stakeholder engagement process in the project was presented by EIPCM and discussed among the participants. Subsequently, the Geoportal Tool was also presented by POLIMI. The subsequent discussion centred on specific issues of clarity concerning the hosting, application and use of the geoportal once it is completed.

During the wrap up of the meeting, it was suggested that for ongoing participation in future meetings, small gatherings of representatives could meet with DAFNE partners once per year in face-to-face meetings, which are considered more meaningful, resourceful and productive. Locally, meetings within catchments could be held more often, say twice per year. Overall, online meetings were encouraged as they are less costly but are less reliable because of connectivity issues and lack of personal interaction. In addition, emphasis was placed on the need to make available and collect data as that it the only sure way that the model and geoportal tools to be developed will be of value if this data can be accessed. There appeared to be general agreement with the suggestion that ZAMCOM may be the most appropriate organisation to host the completed DAFNE Geoportal.

Finally, a presentation on *Nexus Approaches in the Southern African Development Community (SADC) Region* was given by the SADC representative, Kenneth Msibi. Dr. Msibi provided a summary of similar nexus studies completed and currently being conducted in the SADC Region and demonstrated the linkage with DAFNE.

2.2.2 Summary of Omo-Turkana Basin NSL Results

Two general stakeholder meetings in Kenya for Turkana basin stakeholders and in Ethiopia for Omo basin stakeholders preceded the NSL in the Omo-Turkana basins that was held in mid-February 2018. These meetings were held back-to-back with the first NSL as there was the need to catch up after the replacement of the Ethiopian partner by WLRC in the summer of 2017.

On February 15th and 16th, 2018, 20 stakeholders from both the Turkana basin and the Omo basin met together in the NSL to explore in more detail the issues and good practices as well as the potential solutions for addressing resource management challenges in the WEF Nexus. The programme was virtually identical to that of the Zambezi basin NSL. Basin maps were provided for locating this information. Two groups focused on the Omo basin and a third group representing the Turkana worked on the Turkana basin map.

Some of the general issues identified that are common to the Omo and Turkana basins include:

- inadequate sound, scientific data;
- reduced water quality of Omo river (due to erosion, sediment movement and siltation as well as increased waste from urban centres) and in Lake Turkana due to irrigation in the basin;
- changes in and movement away from pastoralist lifestyle due to land use and environmental changes and increasing population;
- deforestation and land degradation due to increasing population pressure and competition for land.

Subsequently the same three groups addressed actions and solutions and prepared descriptions of these.

3 THE COLLABORATIVE DOCUMENT AREA

As described already in D6.1, the collaborative document area had been anticipated ahead of plan in order to support online stakeholder involvement as early as possible. A collaborative document area addressing these planned functionalities had already been implemented and integrated into the DAFNE Website for easy access (one-stop shopping) for the Zambezi case study by February 2018. Subsequently, it was extended after the release of D6.1 also for the Omo-Turkana case study with similar functionalities. Therefore, the following paragraphs provide an overview of the implemented solution. For further details, please refer to D6.1 *NSL Technical Implementation Plan*.

The collaborative document area integrated in the DAFNE website provides lightweight possibilities for stakeholders to easily access and give their feedback to and supplement the results of the NSL face-to-face workshops, specifically the WEF issues, indicators and actions identified by them. Through this tool the issues, indicators and actions are provided in the form of structured documents for inspection and verification, as well as if required for correction, extension and/or commenting by the stakeholders.

The stakeholder document area can be accessed via https://dafne-project.eu/negotiation-simulation-lab/ (access is protected with a password provided to the stakeholders). The start page provides a menu for the issues, indicators and actions grouped by sector that links to separate tables, the NSL report as well as instructions to the stakeholders on to how to amend or provide their comments on the information listed in these tables (Figure 3).

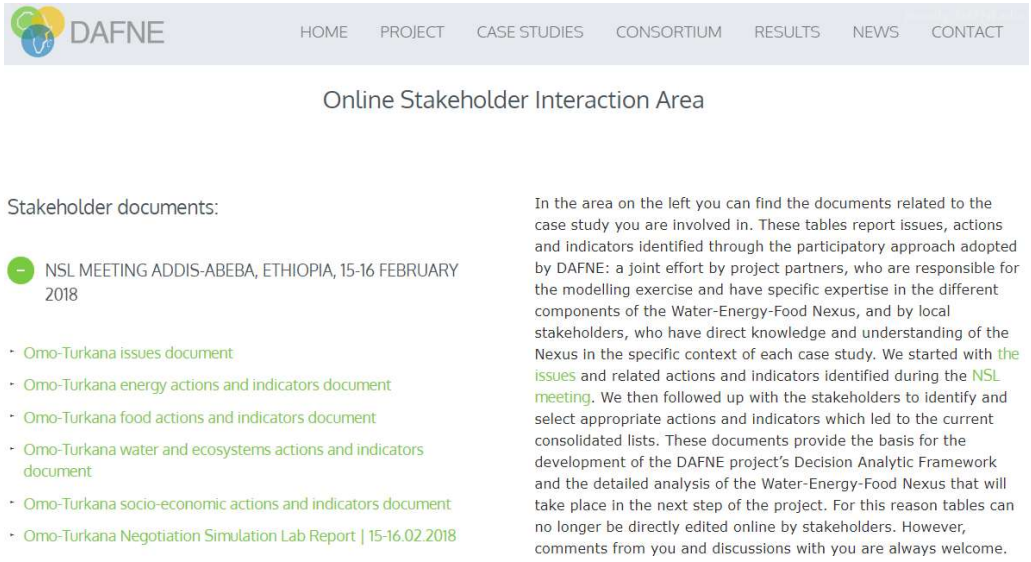


Figure 3 – Screenshot of the start page of the online interaction area of the Omo-Turkana case study

One important requirement for the collaborative document area is accessibility without complex authentication processes, while ensuring protected access to DAFNE stakeholders involved in the process, as well as a simple means of identifying (or marking) individual contributions. The documents can be accessed for viewing by simply clicking on them, or they can be commented on and supplemented by the stakeholders through different various document editing functionalities (Figure 4). This has been achieved by integrating the Google docs and Google sheets API in a way that allows the stakeholders to directly provide comments on the individual elements in the document without having to log into an extra online service (e.g. without logging in with a Google Email address).

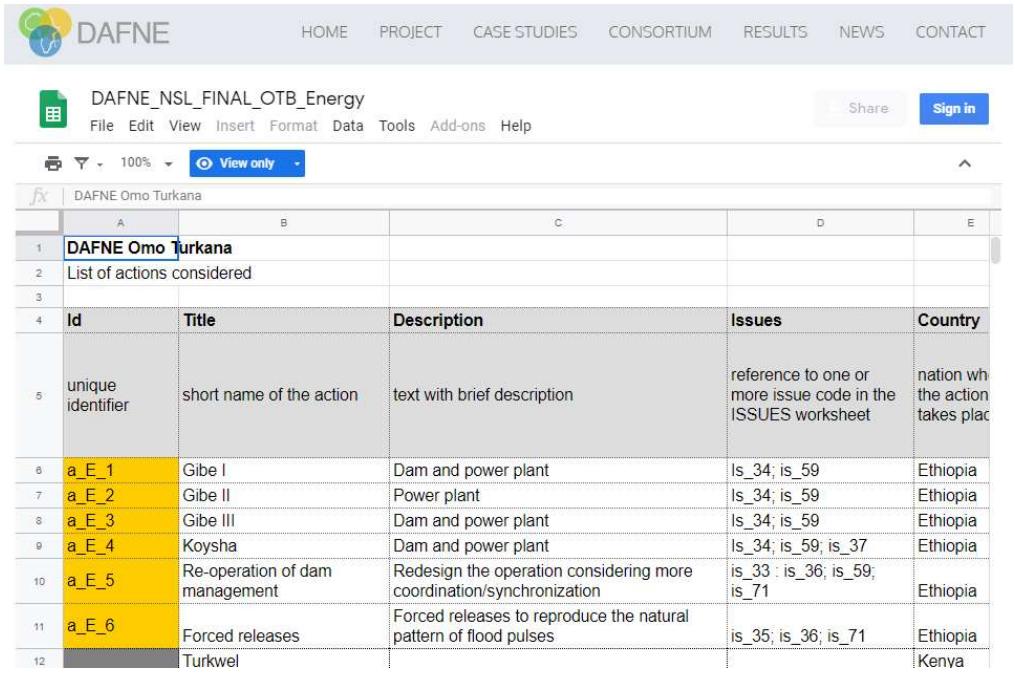
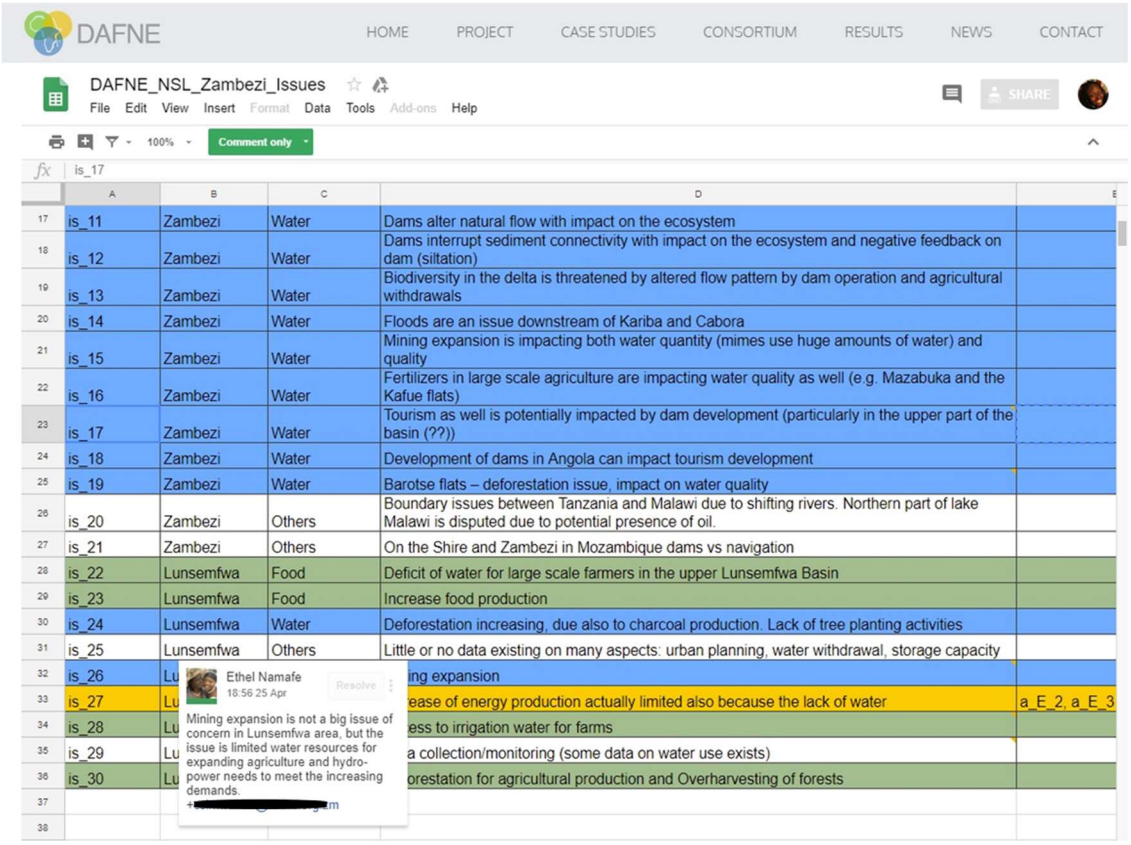


Figure 4 – Sample screenshot of an actions-indicators table of the Omo-Turkana case study

To associate their input with a personal identity the stakeholders can simply manually prefix their comments with their name (or initials) (Figure 5). If they want to have more sophisticated control of

document editing and have their inputs automatically associated with their names, they can log in with their Google account. Either way, the documents can be reviewed and feedback or extended input can be provided. In this way, all stakeholders can easily perform a collaborative review the project's working documents concerning their respective W-E-F-Nexus issues and the identified actions and indicators, and provide their feedback and additional input.



is_11	Zambezi	Water	Dams alter natural flow with impact on the ecosystem	
is_12	Zambezi	Water	Dams interrupt sediment connectivity with impact on the ecosystem and negative feedback on dam (siltation)	
is_13	Zambezi	Water	Biodiversity in the delta is threatened by altered flow pattern by dam operation and agricultural withdrawals	
is_14	Zambezi	Water	Floods are an issue downstream of Kariba and Cabora	
is_15	Zambezi	Water	Mining expansion is impacting both water quantity (mimes use huge amounts of water) and quality	
is_16	Zambezi	Water	Fertilizers in large scale agriculture are impacting water quality as well (e.g. Mazabuka and the Kafue flats)	
is_17	Zambezi	Water	Tourism as well is potentially impacted by dam development (particularly in the upper part of the basin (??))	
is_18	Zambezi	Water	Development of dams in Angola can impact tourism development	
is_19	Zambezi	Water	Barotse flats – deforestation issue, impact on water quality	
is_20	Zambezi	Others	Boundary issues between Tanzania and Malawi due to shifting rivers. Northern part of lake Malawi is disputed due to potential presence of oil.	
is_21	Zambezi	Others	On the Shire and Zambezi in Mozambique dams vs navigation	
is_22	Lunsemfwa	Food	Deficit of water for large scale farmers in the upper Lunsemfwa Basin	
is_23	Lunsemfwa	Food	Increase food production	
is_24	Lunsemfwa	Water	Deforestation increasing, due also to charcoal production. Lack of tree planting activities	
is_25	Lunsemfwa	Others	Little or no data existing on many aspects: urban planning, water withdrawal, storage capacity	
is_26	Lu		ing expansion	
is_27	Lu		ease of energy production actually limited also because the lack of water	a_E_2, a_E_3
is_28	Lu		ess to irrigation water for farms	
is_29	Lu		a collection/monitoring (some data on water use exists)	
is_30	Lu		orestation for agricultural production and Overharvesting of forests	

Figure 5 – "Access to NSL output" and "Feedback" Functionalities

The results of this stakeholder feedback have then been reviewed and changes have been made resulting in a revised set of issues, indicators and actions that are made available as inputs to DAFNE decision analytic framework (DAF) and integrated WEF model. These issues, indicators and actions tables integrating stakeholder feedback have then been updated in the collaborative document area and communicated to the stakeholders.

4 DAFNE GEOPORTAL DEVELOPMENT STATUS AND INTEGRATION WITH NSL

DAFNE Geoportal Prototype (DGP), led by project partner POLIMI, is one of the online tools intended to support NSL activities. A first alpha version for the Zambezi case study (DGP-Zambezi) was made available for testing to all partners involved in the project. The DGP for the Omo-Turkana (DGP Omo-Turkana) was initially presented to Omo-Turkana stakeholders during the NSL held in Addis Ababa in February 2018. The two portals are now available at the following URLs and credentials will be provided to DAFNE Stakeholders prior the next NSL face-to-face meeting:

- DGP Zambezi: http://xake.elet.polimi.it:8081/drupal/dafne
- DGP Omo-Turkana: http://xake.elet.polimi.it:8081/drupal/omo-turkana

In this section the most recent updates to the DGP concerning content and technological updates are provided.

4.1 CONTENT UPDATES

As described in Deliverable 2.1 "*Baseline Scenario"*, the following new datasets have been made available in the DGP.

Spatial data

A number of general datasets for the Omo-Turkana case study, reflecting the same content already listed for DGP-Zambezi in the Deliverable 7.2 report:

- a map with essential information on the project case study: administrative boundaries, roads, cities, basin and sub-basins, rivers, water bodies, wetlands, protected areas;
- the extent and percentage of areas equipped for irrigation, according to FAO AquaStat[1];
- the annual average rainfall distribution in the basin (New et al, 2000);
- a digital elevation model of the basin (STRM 90m DEM v4.1[2]);
- a set of maps related to the Global Surface Water dataset, reporting transition, seasonality, recurrence, occurrence, extent and changes of areas covered by water over the period 1984-2015 (Pekel et al., 2016);
- markers for each component of the strategic model prototype implemented in the DAF, at the current stage of development.

Time series

The main focus of the DAFNE Geoportal is to support NSL analysis, providing insights on detailed and spatially distributed simulation results. While, at the moment, these kind of results are not yet available, also a subset of the historically recorded data will be considered as reference. Starting from the Table 43 and 65 of Deliverable D2.1, reporting comprehensive lists of the Geo- and time se-ries data collected and stored in the project repository for the Baseline scenario definition, the follow-ing datasets have been selected to test visualization tools available in the DGP and implement suita-ble interfaces for data import:

- Water availability: Station flow data
- Agriculture, Livestock and Fisheries:
  - Georeferenced irrigation schemes and their characteristics (area under irrigation, water source, produced crops), as points and polygons (irrigation perimeters);
  - Water requirement for crop and livestock production per subbasin (in cubic hectometres per year)
- Environment:
  - Continuous time series of lake levels (for Lakes Turkana, Malawi, Kariba and Cahora Bassa, high temporal resolution since the 1990's) (Schwatke et al., 2015)
  - Accumulated data on fish species richness and fish habitat requirements
- Demography:
  - Night Light map
  - Population per sub-basin

Issues, Indicators and Actions

The consolidated lists of issues, actions and indicators have been derived from the two NSL meetings using a participatory approach to support interaction among partners and DAFNE stakeholders. At the present stage of implementation, the DGPs for the two case studies have been populated with the available information:

- list of Issues, with the link to related actions and indicators.

[1] AQUASTAT is FAO's global water information system, developed by the Land and Water Division. http://www.fao.org/nr/water/aquastat/main/index.stm

[2] NASA Shuttle Radar Topographic Mission DEM, resolution 90m. https://cgiarcsi.community/data/srtm-90m-digital-elevation-database-v4-1/

- actions included in the consolidated versions with each one uploaded as a single page in the Geoportal and, once the DGP is available to stakeholders, will be possible to comment on these pages;
- all the indicators included in the consolidated versions with each indicator uploaded as a single page in the Geoportal and, once the DGP will be made available to Stakeholders, will be possible to comment on these pages.

4.2 TOOL DEVELOPMENT UPDATES

Figure 6 reports, schematically, the components needed to transform data collected and generated to visualizations in the DGP, and the related development stage where:

- "Data" icons represent general data types used by DAFNE, namely: spatial data, time series, indicators, documents;
- "Convert and Import" column encompasses a set of tools needed to acquire data integrating them from a number of heterogeneous sources and converting to formats suitable for visualization in the DGP;
- "Storage" column presents where data are effectively stored;
- "Functionalities" reflects the four sections introduced in the D6.1 Report (WEF map, Issues and Indicators, Action and Pathways, Results) and two more functionalities that are accessible from these sections, extending their content (*Indicators map, Indicator/action info pages*).

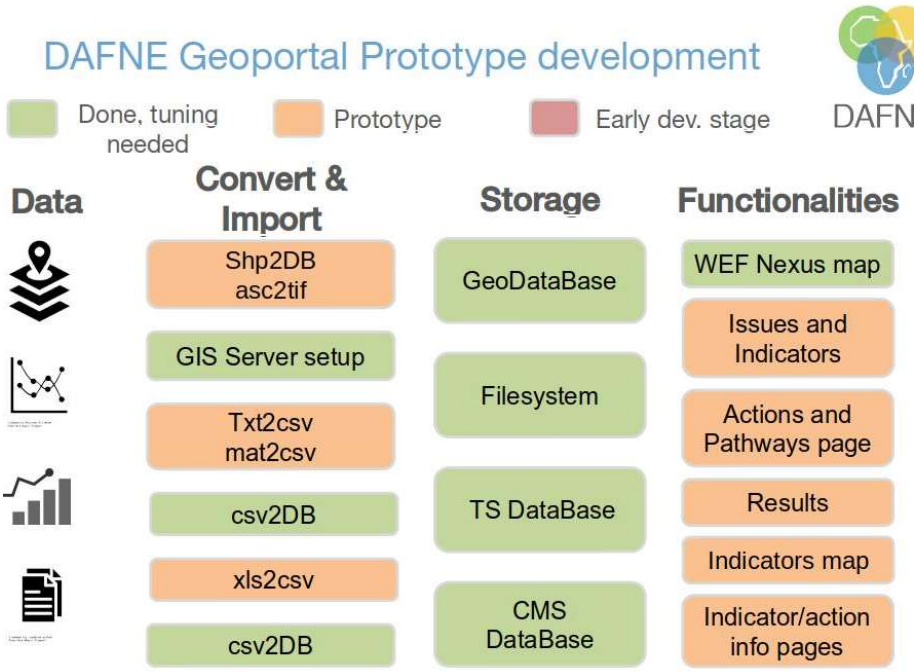


Figure 6 - Geoportal development scheme

Issues and Indicators

Outcomes of the participatory process for actions and indicators identification led to the identification of a number of relevant Issues in the two case-studies. These issues have been linked to many actions and indicators, which are reflecting how each issue can be taken into account in the DAFNE project. Due to the need to explore multiple relations, the hierarchical tree chart originally developed to explore issues and indicators has been extended as follows:

- the hierarchical tree chart offers an interactive navigation among the components of the WEF Nexus and the indicators considered;

- a sub-page has been added to display the list of issues considered, linked to all the related actions and indicators.

Indicators map

Indicators computation will be performed across several spatial and temporal scale and evaluating a number of different pathways: results of this computational process will be provided as time series, either in a tabular form or as set of maps, referred to a specific combination of indicator, time interval, pathway and scenario. The *Results* page already provides an effective way to explore all kind of tabular data, starting from their location in the map of the system. In order to provide an effective way to inspect indicators results also in case of spatially distributed time series, one more tool has been developed, called *Spatial time series analysis*[3], displayed as a sub-page of the *Results* section. For the time being, spatially distributed indicators time series are not yet available: these functionalities has therefore been tested with generic dataset taken from available data. The page, presented in Figure 7, is comprised of two maps, each one controlled by three selectors (respectively for scenario, pathway and indicator selection) and two time sliders, operating on both maps. The two visualizations share the same centre and zoom function, in order to offer a synchronised view and allow visual comparison for all possible combinations of different indicators, pathways and scenarios.

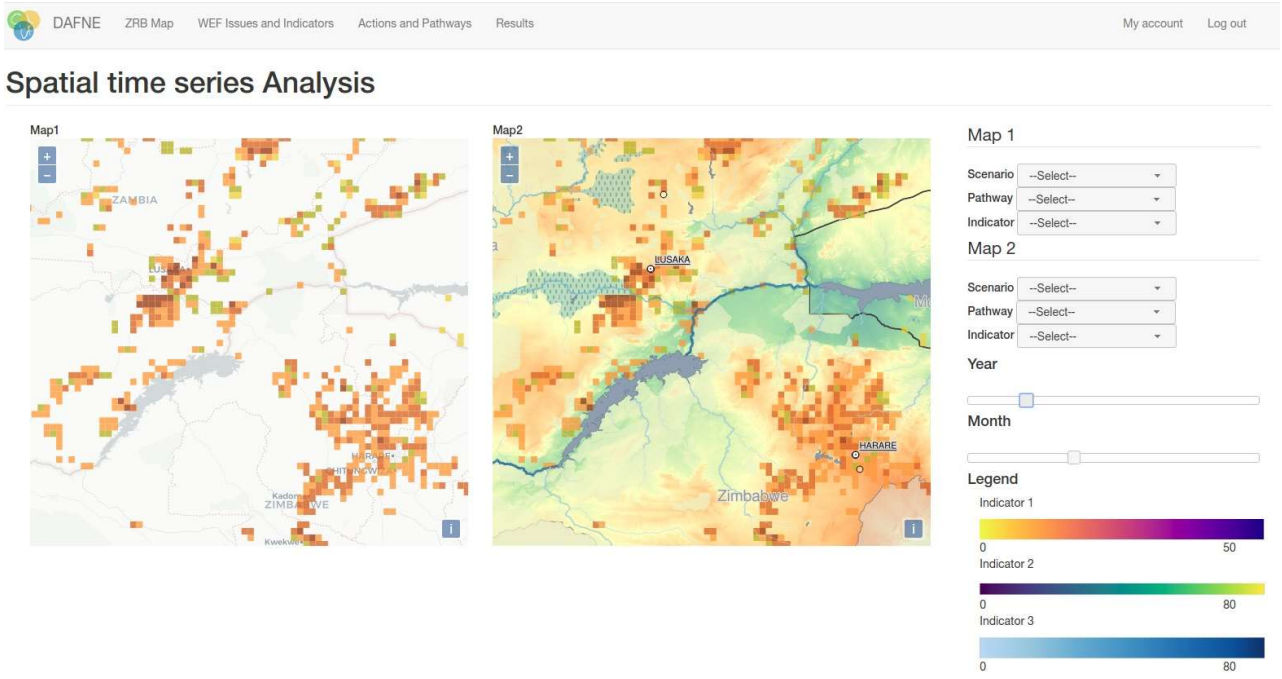


Figure 7 – Spatial time series analysis page

Indicator/action info page

Information included in the actions and indicators tables have been imported into the geoportal, populating a descriptive (info) page for each element. Figure 8 shows the page for the action related to Batoka reservoir and power plant, in the Zambezi River Basin case study: whenever available, a dynamic map showing action location in the system has been added. Figure 9 displays the info page for "Energy production from Hydropower" indicator+: where relevant, the computation formula is represented as a mathematical formulation.

[3] Referred to as *Indicators map*

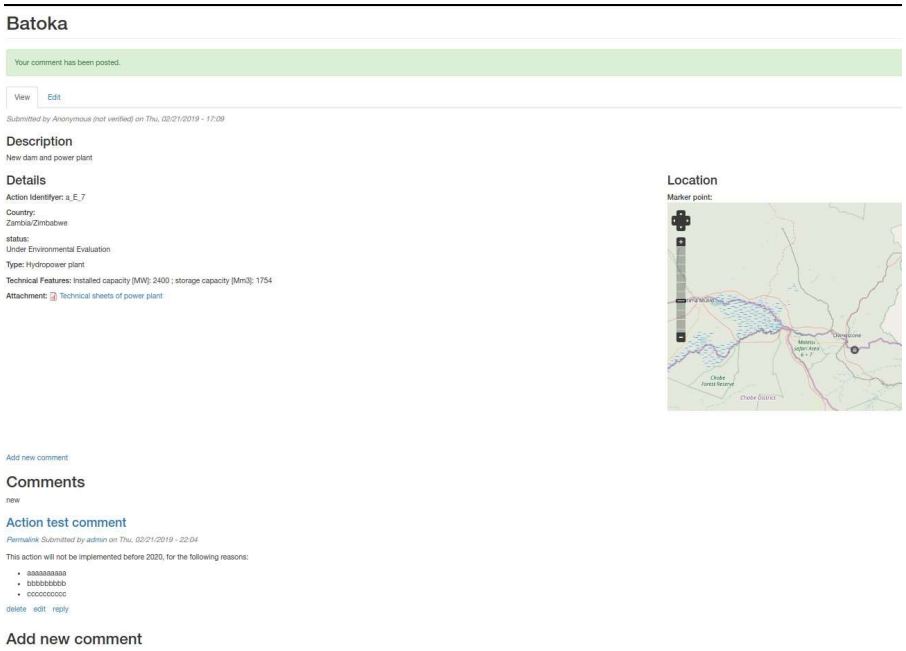


Figure 8 – Action info page - example for Batoka new dam and power plant action

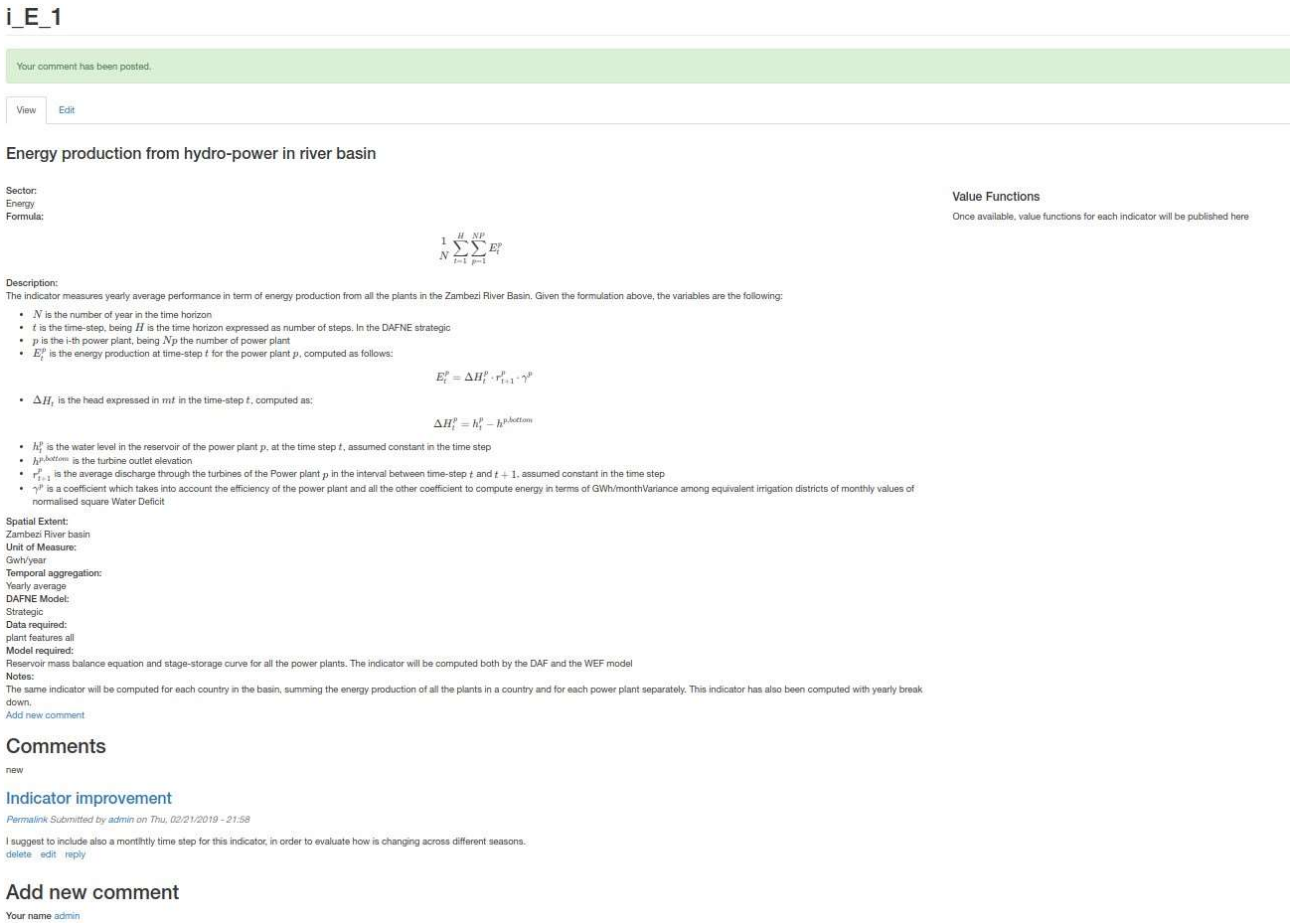


Figure 9 – Indicator info page - example for energy production indicator

5 IMPLEMENTATION OF THE MULTI-PERSPECTIVE VISUAL ANALYSIS TOOL

The main objective of the multi-perspective visual analysis tool (see Figure 10) is to make the main results of the DAF model available to a wide range of stakeholders in a way that allows them to easily explore, analyse and discuss the trade-offs of different WEF nexus solution pathways. The approach we follow in this tool is informed by the theory of "perspective making and perspective taking" (Boland and Tenkasi, 1995) that demonstrates how interaction and cooperation between members of heterogeneous "worlds of knowledge" can be supported. Specifically, the tool allows stakeholders from diverse backgrounds to formulate, visualize and compare their perspectives with respect to various alternative solutions and reflected in indicators representing their real-world impact. It provides both a holistic view of the WEF issues, useful for stakeholders with non-technical backgrounds, as well as detailed information on specific issues for stakeholders with special interests. By supporting both single-sector as well as multiple-sector perspectives the visualization tool allows the stakeholders to identify the interconnections between the different WEF issues, supports communication and decision-making and also supports trust-building and willingness to use such tools for multi-stakeholder WEF analysis.

A perspective can be defined as the set of relevant indicators used by each stakeholder to evaluate impacts of each pathway on their sector of interest. The tool therefore allows the stakeholders to create one or more perspectives, as well as to compare their perspectives to those of others, in order to understand the trade-offs between the effects of different solution pathways on the indicators that each sector considers important. The DAFNE decision-analytic framework (WP5) generates data for the multi-perspective visual analysis tool and the WEF integrated model (WP3) and is imported by the tool administrator whenever new data becomes available. The prototype of the multi-perspective visual analysis tool is available both for the Zambezi and Omo-Turkana basin data provided by WP5 and WP3. For reasons of simplicity of use, a separate instance of the tools is provided for each of the two case studies, which is based on the same concept and with same functionalities but with a different set of data corresponding to the respective case study (i.e. with different indicators and pathways). In the current prototype, the tool is based on the available exemplary data sets from WP5. As new results of the modelling and simulation in WP5 and WP3 become available, the prototype will be updated to include them. For the Zambezi case study, the prototype presented in Figure 10 is based on the exemplary data for demonstration purposes, which includes the impact of 20 pathways (distributed over two classes) on four selected design indicators. For the Omo-Turkana case study, it presents 22 pathways (distributed over four pathway classes) for five design indicators. Once the final data becomes available, it can be easily imported into the tool.

In line with the perspective making and perspective taking theory, the tool has two main modes: "Create your perspective" mode and "Compare perspective mode". The tool can be used in two main ways illustrated in Figure 10. Normally the stakeholders start to create their perspective(s) first by selecting the indicators they would like to focus on and in the next stage, comparing the perspectives with each other or exploring the perspectives of others (Way 1). However, if the stakeholders want to explore the perspectives of others or they have already created some perspectives, they can go directly to the "Compare perspectives" mode (Way 2). These different views can support two different types of interactions with the tool. "Create perspective mode" can enable sector-specific interactions, whereas the "compare perspectives" allows for multi-stakeholder interactions.

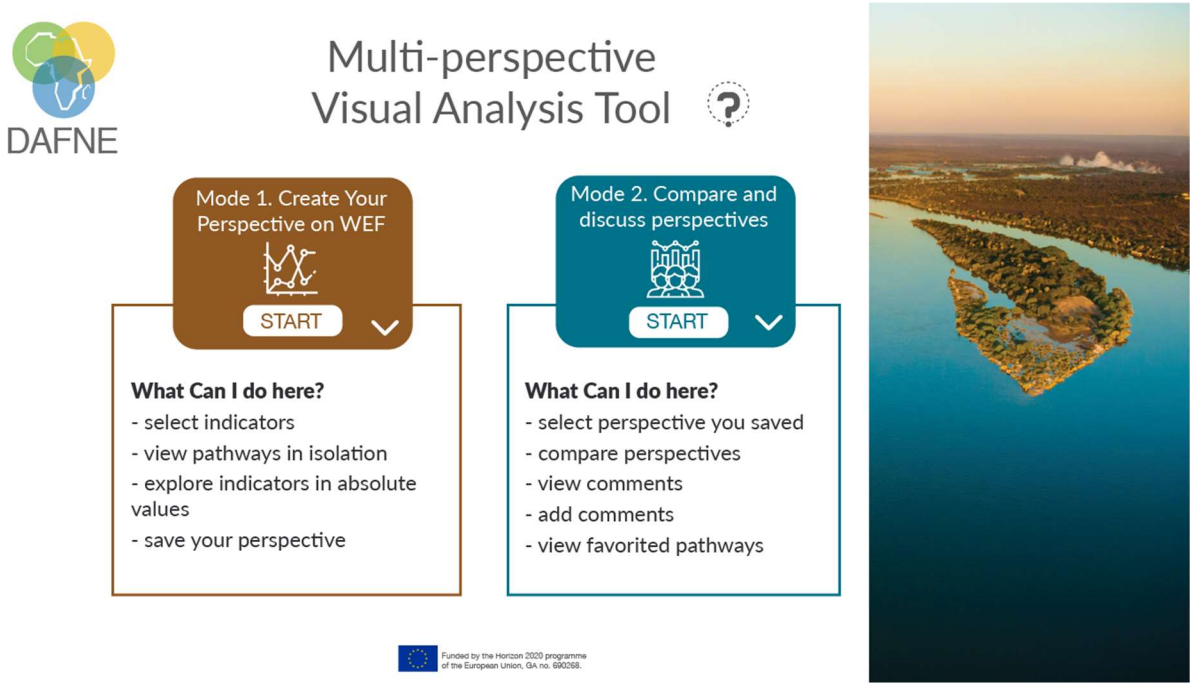


Figure 10 – The start screen of the multi-perspective visual analysis tool

The functionalities included in the first version of the multi-perspective visual analysis tool were implemented in accordance with those reported in deliverable D6.1. The features that have been implemented in the first version of the tool include:

- Import indicators values for best-candidate pathways from DAFNE Geoportal
- Visual display of a set of best candidate pathways provided from the decision-analytic framework
- Define a sector perspective by selecting the indicators pertaining to one sector
- Select and display a sector perspective for comparison
- Select indicators
- Select a multi-sectoral perspective by selecting indicators from different sectors
- Comparison of pathways
- Filtering of pathways (first version that allows to filter out one pathway from pathway class)
- Indication of favourite pathways
- Annotation
- Saving a given view and results of the analysis

Two functionalities, “Setting the thresholds” and “Export”, are being developed now and will be available with the final version of the tool.

In line with the main purpose of the tool, that of enabling the stakeholders to analyse and discuss the trade-offs of different solution pathways, the tool has two primary modes: “Create your Perspective” and “Compare perspectives,” which are accessible from the main menu. There is also one supplementary mode, “View impact of pathways and indicators in absolute values,” which is accessible through the “Create your perspective” mode. These are explained in this section.

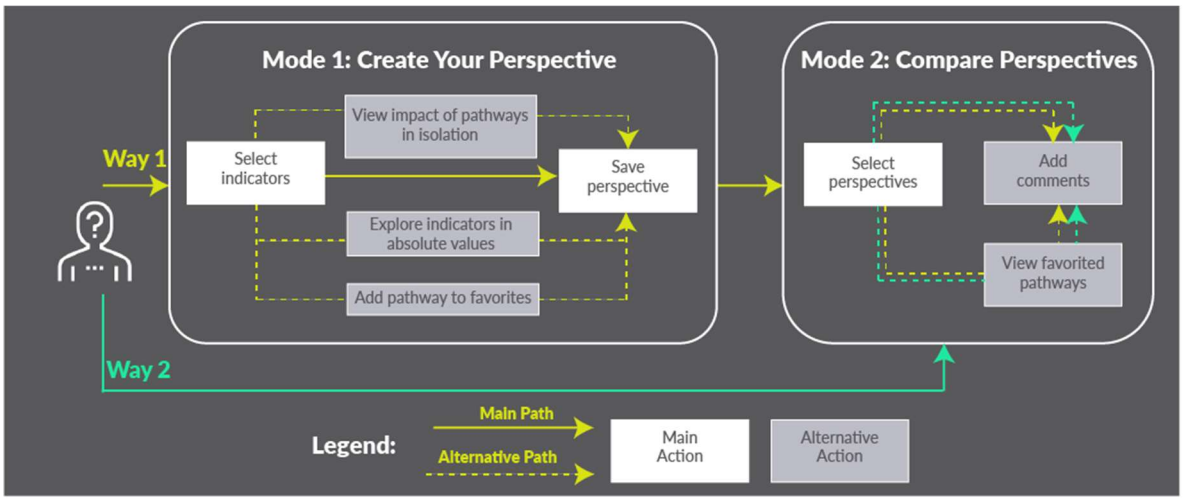


Figure 11 – Two primary ways in which the multi-perspective visual analysis tool can be used

"Create Your Perspective" Mode

In the 'Create Your Perspective' mode (Figure 12), the stakeholders can visually display a set of best candidate pathways provided from the DAF model. They can view the impact of the pathway classes and pathways on the indicators, create and save the perspective and view indicators in absolute and normalized values. A pathway class is a collection of pathways with the same set of structural actions. For example, for the Omo-Turkana case, the four possibilities for the structural actions are: 1) Baseline scenario; 2) Future scenario with Koysha in operation; 3) Future scenario with the two agricultural districts; and 4) Future scenario both with Koysha and the agricultural districts. Each pathway within a pathway class is the implementation of the same set of actions under a different management scenario. For each pathway class, in the Omo-Turkana case study, four or five pathways were selected: the ones which perform the best on the selected indicators and one compromise pathway that performs equally well on all the indicators. In the Zambezi case study, there are two pathway classes each with 10 pathways. Here we present the screenshots from the Omo-Turkana case study. The Zambezi case study is identical and the screenshots are provided in Appendix 3.

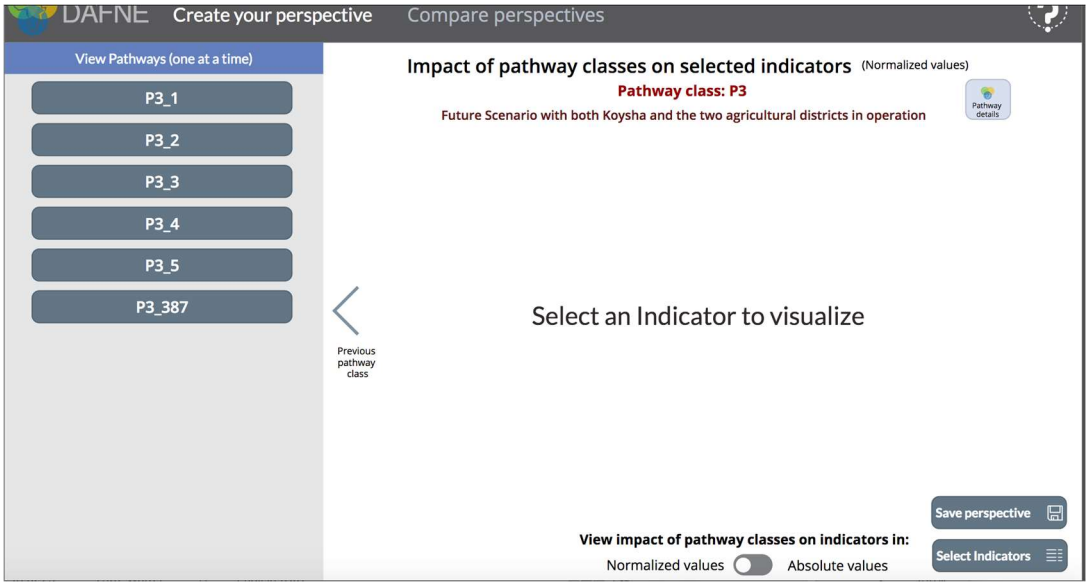


Figure 12 – Start screen of the "Create your perspective" mode

To create a perspective, stakeholders first select the indicators that interest them (Figure 13). Stakeholders can create one or more perspectives of the chosen sector by selecting the indicators for which they want to explore the impact through the “Select Indicators” window. Indicators are grouped by sector, but stakeholders can also choose from the complete list of indicators. They can then click on the indicators to select them. By selecting the indicators, the stakeholders want to focus on, either belonging to one or multiple sectors, they can view either the perspective of one sector or a multi-sector perspective, respectively.

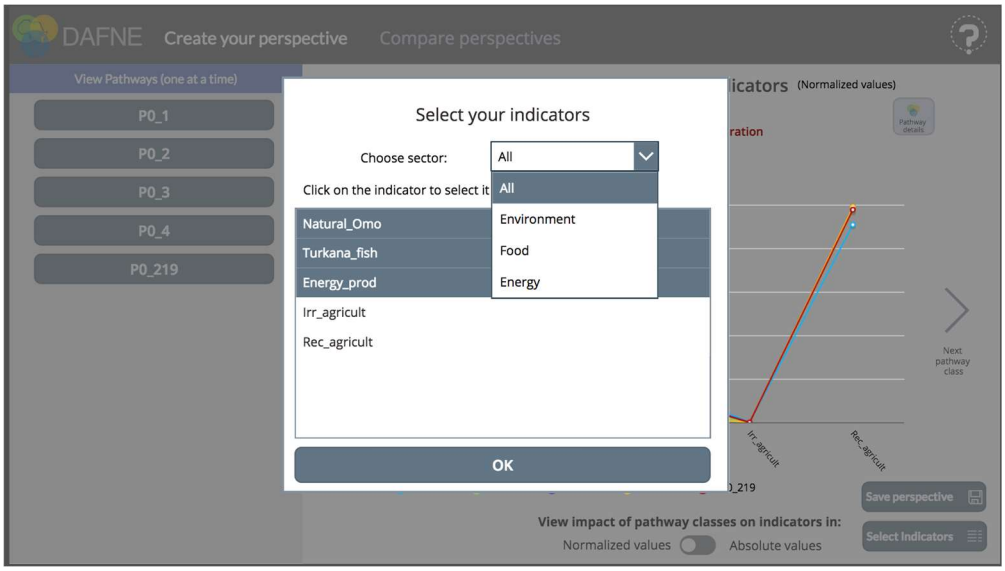


Figure 13 – Step 1 in creating the perspective: selecting the indicators

In the next step, the stakeholders can explore the impact of pathways on the selected indicators (Figure 14). They can click through the pathway classes to see the impact of the structural investments on the selected indicators. Stakeholders can view detailed information (e.g. which exact actions comprise the pathway class) by clicking on the DAFNE icon, which will redirect the user to the Geoportal where the detailed pathway model is contained.

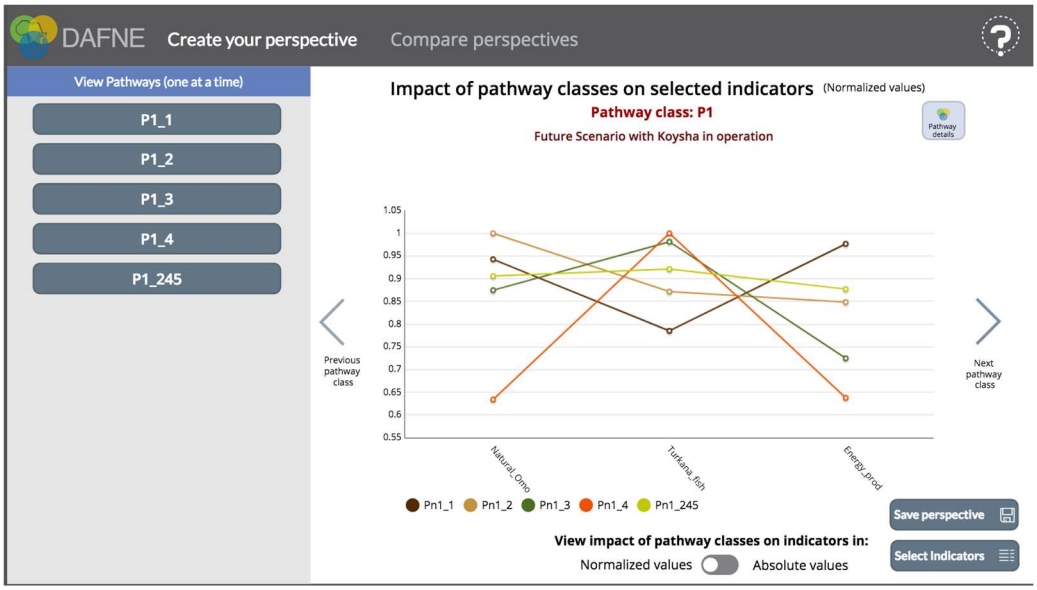


Figure 14: Step 2 in creating the perspective: exploring the pathways

At this stage, some additional options to explore the pathways include: exploring one pathway at a time and exploring the impact of pathways in absolute values. On the right side of the screen the icon called “View Pathways (one at a time)” can be selected to filter out one pathway from the pathway class and explore its impact on the selected indicators. On this screen, stakeholders can also save one of the pathways to ‘favourites’ (Figure 15). By saving a pathway to favourites, stakeholders can later see which pathways were preferred by others.

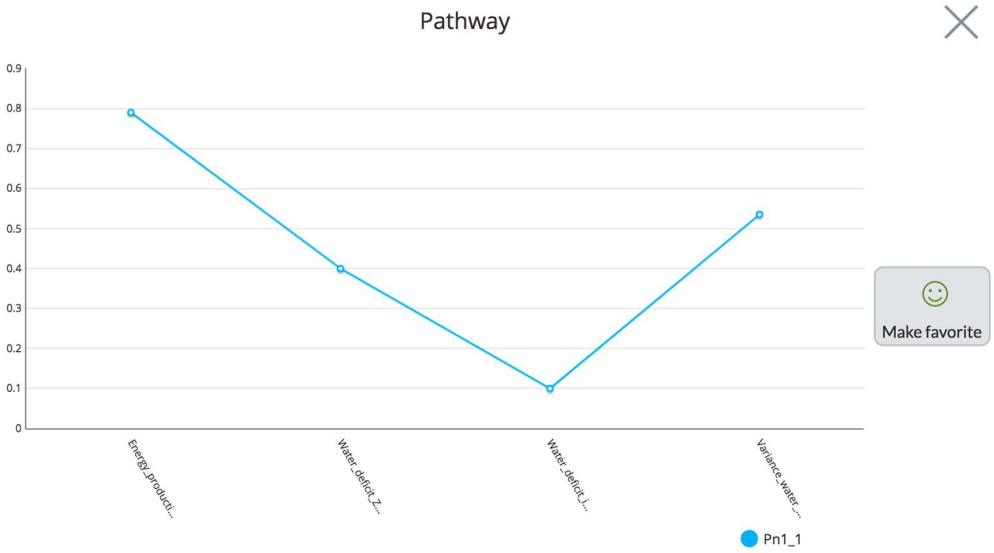


Figure 15: View pathways one at a time (“filtering” functionality) and indicate a favourite pathway (“indication of favourite pathway” functionality)

The indicators which are explored do not always follow the same optimization function. For example, in the Omo-Turkana case study, energy production should be maximized, whereas other indicators such as deviation from flood pulse should be minimized. To ensure comparability and to make the analysis easier, the values of the indicators are normalized on a scale from 0 to 1, where 0 represents the worst possible effect of the pathway on the indicator, and 1 – the best possible effect (across all simulated pathways). The disadvantage of the normalization is, however, that the seemingly small differences in normalized values can correspond with large differences in absolute values.

Therefore, if stakeholders would like to explore the impact of pathway classes on indicators measured in absolute values, this can be done by toggling the option at the bottom of the screen “View impact of pathway classes in absolute values”. In the ‘View impact of pathways on indicators in absolute values’ mode, stakeholders can explore the impact of pathways on the indicators in absolute values Figure 16). As the absolute scale is different for each indicator, stakeholders can only explore the impact of the pathways on one indicator at a time. Stakeholders select an indicator they want to explore from the drop-down list. For each indicator, a short description is provided. The details of how the indicator was calculated can be viewed in the Geoportal by clicking on the DAFNE icon. If stakeholders want to return to explore the impact of pathway classes on indicators in normalized values, this can be done by toggling the option “View impact of pathway classes in normalized values”.

Finally, in the third step, the stakeholders can save their perspective by clicking on “Save perspective” in order to compare it later in the “Compare perspectives” mode (Figure 17).

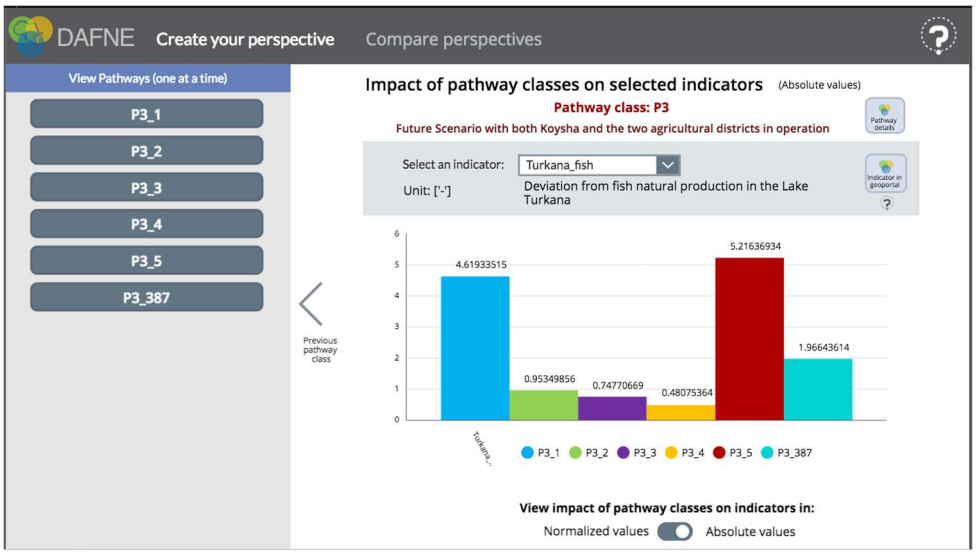


Figure 16: "View impact of pathways on indicators in absolute values" Mode

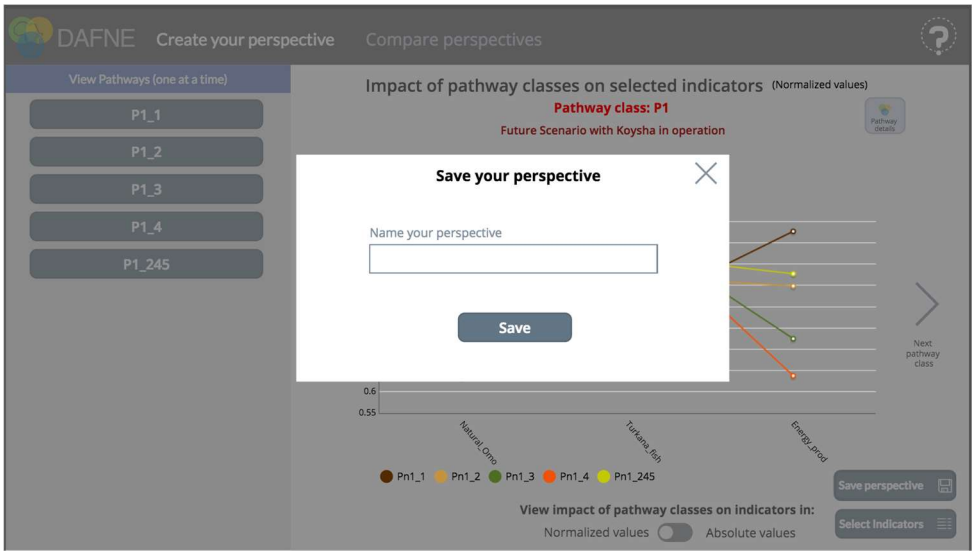


Figure 17: Step 3 in creating the perspective: saving a perspective

"Compare Perspectives" Mode

In the 'Compare Perspectives' mode, stakeholders can compare and annotate perspectives as well as view pathways favoured by all other users. In this mode, stakeholders can choose to retrieve two perspectives saved in the "Create Your Perspective" mode and compare them with each other. They can also retrieve perspectives that other stakeholders have saved. In this way, they can take the perspective of other sector and anticipate the pathways that will be preferred by that sector. Additionally, by selecting two saved perspectives stakeholders can analyse and compare them to each other, thus supporting discussions between stakeholders representing different sectors (Figure 18). Stakeholders can annotate the perspectives by writing comments about them and/or reading the comments provided by others. If needed, the user can also make comments privately so that they are not seen by other users.

In addition, by clicking in this mode on the icon "Favourite pathways" in the middle of the screen, one can see how many times each pathway was favoured by all the users (Figure 19). In this way, one can see which pathways are preferred by other stakeholders.

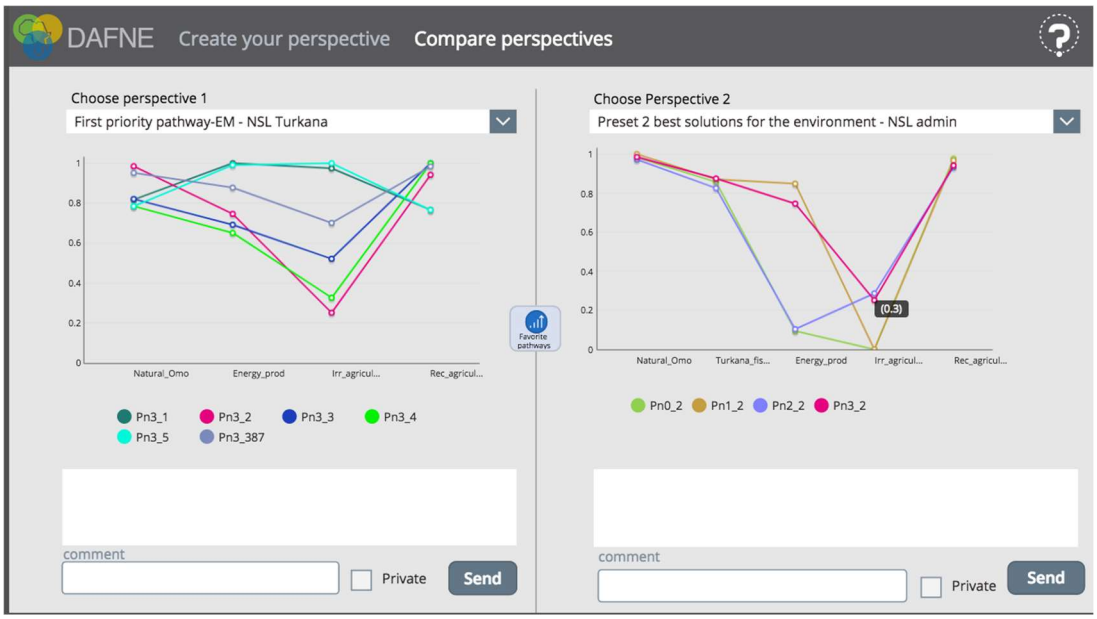


Figure 18 - Compare perspectives" Mode and "Select and display a sector perspective" functionality

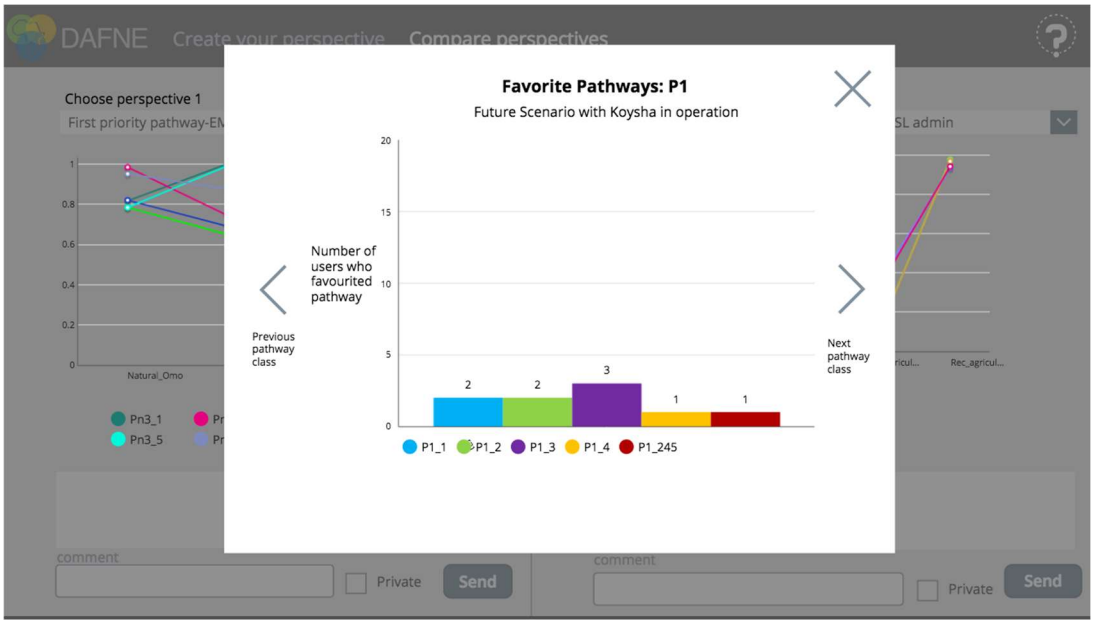


Figure 19 - "View Favourite Pathways" Functionality

6 NSL OPERATION

In this section, the NSL meetings and the NSL tools are reviewed based on both internal evaluations of DAFNE partners and on feedback from stakeholders. Each is described in turn, with an indication of the source of the review, the experiences and challenges observed and the adjustments that were or will be made.

6.1 NSL MEETINGS

The evaluation of NSL meetings is based on a review of feedback from participating stakeholders on the effectiveness of the NSL in promoting the objectives listed in section 2 (describing the purpose and status of the NSL meetings). In this section, three sources provided the material for an evaluation of the face-to-face NSL meetings: pre- and post-meeting stakeholder surveys, the meeting minutes and informal feedback from stakeholders from both case studies. The outcomes are described for each.

The pre-survey was developed with the project partners and especially with the input of the case study leaders. The aim of this survey was to gather information about the stakeholders and the level of understanding of WEF nexus as well their experience in similar simulation workshops. The pre-survey was emailed to stakeholders prior to the workshop and stakeholders were asked to hand in the survey before the beginning of the workshop. Analysis of the survey results also informed the facilitators how to adjust and restructure the NSL meetings in order to meet the expectation of the stakeholders. The post survey was developed to assess learning from the NSL meeting. Stakeholders who attended the NSL meeting were asked to complete the survey at the end of the event. In total, 19 of 20 stakeholders from the Omo-Turkana basins responded to the survey, while 13 of 14 stakeholders responded from the Zambezi basin. The most relevant sections of the pre- and post-surveys can be found in the Appendix 1.

6.1.1 Evaluation of interactions in the NSL for understanding W-E-F nexus in the basins

In this section, the results of the post-survey results in comparison with the expectations of the stakeholders gathered in the pre-survey are presented. The results show the extent to which the interactions in the NSL meeting helped stakeholders to gain a deeper understanding of WEF nexus interaction in the basin.

In the Zambezi basin, 70% of the stakeholders reported that the NSL met their expectations in terms of providing them with the following:

a) In-depth knowledge of the interrelatedness of WEF nexus issues through interactions with stakeholders and the practical exercises
b) Tools to support a better understanding of the interactions in the basin
c) A safe space for interaction and developing a shared understanding of WEF nexus issues in the basin
d) Making complex issues easier to understand through the interactions and tools used in the NSL.

Although 75% of the stakeholders reported having some knowledge of water management issues in the basin, many lacked a clear understanding of how the water-energy-food issues in the basin are interrelated. Through the NSL process, stakeholders reported that they developed a clearer under-standing of the interrelatedness of the WEF and environmental issues in the basin. Of the stakeholders responding, 80% reported that the WEF nexus approach to examining basin issues was a new approach for them and 90% were particularly excited to participate actively in the interactive sessions and to visualise the WEF nexus issues through the maps and interactive sessions. Most (90%) of the stakeholder acknowledged that interaction on real tangible aspects such as mapping the issues on geographic maps provided them with a deeper understanding of WEF nexus and their interconnectedness within the sub-basins and the regional basin.

Stakeholders of Omo-Turkana basins had similar responses to those of the Zambezi basin. The political, socio-economic and environmental context was of course different and the Zambezi basin case study had the benefit of having a pre-existing stakeholder interaction platform and structure through ZAMCOM (Zambezi watercourse commission), which the Omo-Turkana basins do not have. Hence the NSL was not only unique for the Omo-Turkana stakeholders but for most of them (90%), the NSL was the first platform in which stakeholders from both Ethiopia and Kenya were brought together to interact and exchange on the Omo-Turkana basins. This was also evident by the subsequent modification of the basin name from Omo-Gibe to Omo-Turkana to include the two ba-sins as entities of one hydrological system. Prior to the NSL meetings, stakeholders representing the Omo basin had understanding of issues that was focused on the Omo-Gibe River basin, and the same applied for stakeholders representing the Turkana basin. Through the NSL meetings, stake-holders were able to expound their understanding of issues in the basin beyond just the national boundaries. The NSL meetings and interactive sessions facilitated a space for the stakeholders from either side of the basin to not only understand the other basin better but to question the assumptions they held about the other basin. The meeting provided a platform for stakeholders to understand and address questions and issues from other stakeholders as well as to provide

facts about and evidence of developments in the basins. This raised awareness of the basins and the interactions taking place within them.

We can argue that the NSL meetings were a social learning platform for the stakeholders to question assumptions, critically deliberate on the assumptions and perspectives, and work towards developing a new way of thinking about and framing of the Omo-Turkana basins. For example, at the beginning of the meeting, stakeholders from Ethiopia only referred to Omo-Gibe basin, while stakeholders from Turkana used the term, Turkana basin. After discussions the term Omo-Turkana basins was adopted by all stakeholders to refer to the hydrological basin that originates in the Omo River in Ethiopia and drains into Lake Turkana in Kenya. Furthermore, the term down-stream country was initially framed from a political perspective inferring power dominance by the upstream region. This brought some discussion on the use of the term. However, after deliberations on the term and a clear under-standing of its implications, the stakeholders agreed to look at the basin as a hydrological unit and thus refer to upstream and downstream areas from a hydrological point of view referring to drainage rather than political aspects and boundaries.

Overall, 90% of the NSL stakeholders from the Omo-Turkana basins reported that the NSL meeting provided them with the opportunity to understand WEF nexus issues better. By considering the perspectives of other actors in the basin (at country level across sectors, at regional level between the two states) they were able to broaden their view of the issues in the Omo-Turkana basins.

6.1.2 Structure/ design of the NSL interactions

A set of questions in the post-meeting survey addressed the structure and design of the NSL meetings. In the Zambezi basin case, 90% of the NSL participants who completed the post-meeting survey found that the structure of the NSL meetings provided the opportunity for them to interact and engage deeply on WEF nexus issues and space for sharing knowledge and exchanging of experiences. In addition, 90% participants found that the organization of the NSL sessions allowed them to freely interact and express their views within the sessions. This was because the sessions were organized in a way to give participants the sense of a safe space for those who may have conflicting or competing perspectives to openly share their views. The facilitators and sessions chairs ensured that the open discussions were held in confidence. The approach was used as a trial for future NSL meetings where negotiation will play a more central role. Despite the conflicting views and sometimes competing interests expressed by 70% of the stakeholders, all of the stakeholders who completed the survey reported sharing the same vision of sustainable management of the Zambezi basin. Though the approaches towards achieving this vision varied, but most stakeholders had a general understanding of the need to sustainably manage the basin resources by integrating sectors and developing a system approach/thinking to the issues in the basin and by incorporating the voice of all key actors.

The NSL meeting in the Omo basin was structured in such a way as to first provide an opportunity for the basin actors (Omo and Turkana) to get to know each other and work together to agree on is-sues within the basins from their own perspectives. This was done by holding separate but parallel sessions for the Omo stakeholders and the Turkana stakeholders. Later the two groups came together in a joint session to discuss outcomes of their separate sessions and to provide an opportunity for the other stakeholders to question and respond to issues arising. This was done as most of the stakeholders had never interacted before on basin matters and it was thus considered important that stakeholders first get to know each other.

Most stakeholders (85%) reported that the design of the interactive sessions in the NSL allowed them to take part actively in the discussions during the individual basin sessions as well as the joint sessions. Three-quarters of the stakeholders reported that while they may have held different perspectives on the issues, the initial separation of the two basins in separate interactive sessions allowed them to express their views on these issues openly. By first developing a rapport and building trust among themselves, the process was made easier especially where discussions could take place in the local language. Designing the sessions to encourage familiarity and build trust was key in facilitating effective interactive sessions during the NSL meeting.

6.1.3 Opportunities for further interaction, learning and network-building

A set of questions in the survey addressed the opportunities for further interaction, learning and networking. In the case of the Zambezi, 70% of participants reported that the NSL meeting supported the identification and the formation of alliances with other participants who had similar or complementary interests. This demonstrates that the NSL meeting supported the identification of synergies and helped strengthen the development of further collaborations. In addition, through the NSL sessions, stakeholders were able to identify any limitations in their technical capacity to understand and model the scenarios. This, as expected, highlighted the need for further training on understanding model building and interpretations of models. This aspect was discussed at several instances and was thus seen as the next step for taking up the on-going developments of the DAFNE project as core subject of know-how transfer and capacity building activities already foreseen in the DoA.

For the Omo-Turkana basins, the NSL provided the opportunity for stakeholder to understand the importance of seeing the basin as a whole system, but most importantly, it helped the stakeholders identify the key actors from both countries, which can in turn facilitate future interaction. In particular, stakeholders (80%) were keen to: a) organise field visits at either the regional level or through their own organisations in order to have a better understanding of the issues on the ground in both basins; b) coordinate data collection in the basins between the two states; and, c) develop a coordination body for the two basins (like the Zambezi Watercourse Commission). Moreover, while many stakeholders had initially expressed scepticism in the ability to integrate WEF nexus issues in the basin, the NSL process resulted in at least 65% of stakeholders reporting a change their views based on their interactions with other stakeholders (from other sectors and/or the other basin/country). on their interactions with other stakeholders (from other sectors and/or the other basin/country).

6.1.4 Addressing challenges in the NSL Meetings

While for both case studies, the NSL provided an opportunity for the development of a better understanding of WEF nexus issues among stakeholders, some challenges were reported. While stakeholders were keen to mention the issues within their basins, some of those mentioned were beyond the scope of the DAFNE project (such initiating on-the-ground activities to address and reduce resource-use conflicts in the basin, as well as instigating policy reforms by initiating and steering regional dialogue in the basin). While it is hoped that these may be secondary effects of the project, these perspectives on the part of several stakeholders point to the importance of managing expectations at regular interludes in the project. Secondly, in some cases language was a barrier to effective and engaging interactions. Since English was the common language of interaction, several stakeholders (especially Portuguese-speaking) were at somewhat of a disadvantage. A solution would be simultaneous translation or running separate meetings in the sub-regions in the language of choice (e.g. Amharic or Portuguese). Unfortunately, the resources in the project are insufficient to make this possible. Nonetheless, a solution is being sought for subsequent meetings such as identification of stakeholder conversant with English or translating key slides into Portuguese.

It was also noted that we are not guaranteed that the same individuals will attend each of the NSL meetings. Occasionally another representative or a replacement will participate. This has the potential to slow down the engagement process, and while we cannot control this factor, we aim at ensuring that stakeholders selected to attend the meeting have a good knowledge of WEF nexus issues or have work experience in the basin.

Finally, the institutional capacity needed to take up the outcomes of the WEF nexus integration is often lacking and an acknowledgement of the importance of uptake and how the project aims to contribute to it through capacity development is something that requires regular reinforcement in the meetings and in other communications with stakeholders. The project acknowledges the vital importance of being able to work with the DAF and will support the capacity of selected stakehold-

ers to do this. Capacity building will be further facilitated by dissemination materials and approaches including the documentation of the DAF and of the Geoportal as well as the curriculum of the summer school and the MOOC. Links to other related capacity development programmes will be shared through the MOOC and the DAFNE website. Opportunities to strengthen the capacity building action beyond what indicated in the DoA (summer school and MOOC) are being explored by aiming at a coordinated effort with other projects and/or initiatives on-going in the ZRB.

6.2 NSL TOOLS

In this section, the three NSL tools are reviewed including the collaborative document area used for assessing issues, actions and indicators, the integration of the Geoportal Prototype in the NSL and the Multi-Perspective Visual Analysis Tool. Each is addressed separately based on testing and feed-back from both project partners and stakeholders.

6.2.1 Feedback on issues, actions and indicators in collaborative document area

Following the participatory approach described in D6.1, several interactions among partners and stakeholders have been carried in order to progressively refine and consolidate the list of issues, actions and indicators considered, starting with the inputs collected during the NSL meetings. While the general approach was used in both case studies, different strategies have been implemented to collect the second round of feedback from stakeholders. In the Zambezi case, actions and indicators tables were published in the Collaborative Document Area of the Online Stakeholder Area of the DAFNE Website and stakeholders were invited to provide feedback and comments directly on the online version of the table. DAFNE partners were also involved to facilitate this process or to directly collect feedback from some stakeholders. These used the Collaborative Document Area to access the documents and browse through the various tables and information, but they preferred to communicate their comments and changes directly to case study reference partners or to other partners. Table 1 provides some examples of feedback collected for the Zambezi case study.

Table 1 – Examples of feedback on actions/indicators lists collected for Zambezi case study

Sector	Description	Example
Energy	New action or indicator proposal	Kabompo Gorge new dam and power plant
Food	Change related to specific information describing an action or an indicator	Action related to "*IWR irrigation development project in Lusitu*": changed Location and Status from "planned" to "*Setting Up*"
Water-Ecosystem	Indicator split or aggregation	Indicator *Artificial flood releases from dams to ensure "environmental flows" by mimicking natural floods but also to empty reservoirs before the start of the rainy season* was splitted into indicators *Magnitude of flooding* and *Timing of Flooding*

In order to improve the involvement of Stakeholders in this process, for the Omo-Turkana case study two local facilitators (one for the Omo SHs and another for the Turkana stakeholders) were recruited through the DAFNE case study reference partners. Feedback on actions and indicators lists were directly added in the tables by these facilitators on the basis of their direct interaction with a number of relevant stakeholders. For both the Omo and Turkana this process involved 16 stakeholders.

Interviews were guided with the following questions:

- Relevance: *Are the actions/indicators proposed relevant with respect to your competence/knowledge of the specific sector? Are they relevant in order to understand how will be the future development in your system?*
- Completeness: *According to your knowledge, is the list of actions/indicators complete? If not, which action/indicator could be also considered? Are you or your institution available to pro-vide data and information to complete relevant information missing in this table?*
- Comments: *Do you have any comment or feedback on specific actions or indicators to im-prove the description?*

No new actions and indicators were proposed as results of the interviews: many of the actions and indicators extracted from the NSL meeting notes were confirmed by most of the SHs, while others were marked as not relevant. Several comments were provided to highlight the relevance of some action/indicator or to suggest alternative formulation of specific indicators. Table 2 reports some examples representative of the feedback collected for Omo-Turkana Basins.

The consolidated version of actions and indicators lists have been finalised by DAFNE Partners. Based on this feedback and the feasibility in terms of available data and modelling tools, actions and indicators suitable to be considered in the project were identified. A small set of these indicators, capturing the main components of the Water-Energy-Food (WEF) Nexus, was also selected for use as design indicators in the Decision Analytic Framework (DAF) for the design of efficient pathways (see also Deliverable D5.1 Report). No further prioritization was performed in order to preserve the multi-sectorial and participatory approach of the project.

Table 2 – Examples of feedback on actions/indicators lists collected for Omo-Turkana case study

Sector	Description	Example
Energy	Feedback on indicators for-mulation	Indicator: *Lifespan of the dam*: Relevant for all SHs who gave feedback. Feedback: • *There has been serious land degradation problem in the project area that has been inducing siltation in the reservoir.* • *MoALR can provide the required data*
Food	Removal proposal for specific indicator	Action: *Promote catch culture* Feedback: • N*ot relevant: The lake offers natural breeding ground and therefore, creating artificial will interfere with breeding patterns* • *Relevant: Should be considered. This will help to improve the fish species.*
Water-Ecosystem	Removal proposal for specific action	Action: *Sediment transport across dams by diversion of turbid waters or flushing of sediment* Feedback: • Not r*relevant: Better to control soil erosion at catch-ment level.* • *Relevant: quantify the sediment using different mod-els such as SWAT, RUSLE etc*
Water-Ecosystem	Indicator formulation and in-terpretation suggestion	Indicator *Salinity* Relevant feedback: • *Critical: required for irrigation development* • *Reducing salinity important towards improving or maintaining water quality for effective use by all people and animals too.*

6.2.2 Feedback on the Geoportal Prototype

The DAFNE Geoportal Prototype has been presented to stakeholders during the two NSL meetings, tested by partners since July 2018, and discussed in a number of project meetings including most recently the 2018 DAFNE General Assembly where a development update was provided. Useful feedback has been gathered on all these occasions. Table 3 summarises this feedback, proposes a schematic classification, provides an explanation of the actions undertaken in order to orient DGP development and indicates the present status of development of each action.

6.2.3 Evaluation of the Multi-Perspective Visual Analysis Tool

A preliminary evaluation of the first prototype of the multi-perspective visual analysis tool was done in February 2019 with the stakeholders from the Omo-Turkana basin. In total, nine interviews were conducted with stakeholders from various sectors, such as energy, agriculture, environment, food, socio-economic and tourism. The stakeholders were familiar with the DAFNE project as they took part in last year's NSL meeting. The interviews were conducted in person in Addis Ababa. The inter-views took 45 minutes. After a brief introduction to the purpose of the session and a reminder of what has been done since the last NSL, the evaluation was performed. In an interactive session, the stakeholders were asked to perform tasks in the multi-perspective visual analysis tool similar to those they would be doing when using the tool on their own. The interviewer asked questions after every interaction (the questions can be found in Appendix 2). The multi-perspective tool presented to the stakeholders used the preliminary data that was available from WP 5. The goal of obtaining this intermediate feedback from the stakeholders was to verify that the prototype developed fits their needs and to identify any issues for further improvement. The stakeholders were interviewed mainly at their work premises or in neutral premises. All interviews were carried out by a representative of EIPCM.

As a starting point, the stakeholders were asked about their interests in the project and specific objectives for the basin. As expected, the **objectives of the stakeholders** are very different: food security, food productivity, maintaining the livelihood and cultural heritage of communities in the Omo basin, sustainable land management, preserving the environment and forest, promoting investment which complies with environmental requirements, avoidance of floods, good agricultural projects, no conflicts within and between the countries, etc. This served to create the context reminding them of issues that had been discussed in the NSL. In this regard, the stakeholders view the **DAFNE project** in general and the **multi-perspective visual analysis** tool in particular, as potentially fulfilling a variety of goals, such as: optimizing food and water supply; obtaining scientific data to make decisions in the nexus; facilitating negotiations between the policy makers, negotiating with the government including the ministries, identifying sustainable alternatives for investment, supporting infrastructure planning, promoting good relations with Kenya; and, finally, exploring the effects on culture. The stakeholders are especially interested in the multi-sectoral aspect of the project covering long-term considerations and enabling multi-dimensional analyses exploring the interaction between the various indicators.

Overall, the tool presented to the stakeholders received a positive response. The stakeholders were eagerly exploring the results with the available functionalities of the tool. One stakeholder explained: "*I am fascinated by this tool. It is very interactive. I am very interested in it and also to learn how to use it and interpret all the pathways*". They said that the tool is **very useful** for exploring trade-offs, making decisions based on evidence, considering the perspectives of other sectors and using it during negotiations. The **interaction** with the tool was also perceived to be quite easy, as one stake-holder mentioned: "*Overall one can see the trade-offs clearly, easy to save perspectives, quite good interaction with the tool*". The stakeholders could easily explore all of the functionalities of the tool such as: selecting indicators, saving perspectives, viewing the indicators in isolation, saving a path-way to favourites, retrieving and comparing perspectives, and writing comments. The stakeholders were especially interested in the fact that the tool was available online. However, because not all the areas of the country are equipped with (adequate) internet access, they asked if the tool would be available offline too. An export function could be very useful in this regard.

Table 3 – Feedback received during testing stage of the Geoportal Prototype

Feedback	Source and Typology	Action	Status
Include dynamic legend on the system map.	Partners' feedback. Interfaces improvement.	Creating a set of collapsible blocks to include information on layers presented on the map.	Partially done
Include data source in the spatial data description.	Partners' feedback. Interfaces improvement	Adding a source link or description among Legend information.	Done
Improve description of pathways.	Partners' feedback. Major change: refactoring of an existing page.	Adding a more intuitive way to select pathways and inspect the set of actions included. Providing a stronger integration/connection of these pages with the Multi-Perspective Visual Analysis Tool.	Under development
Involve Stakeholders into action/indicators identification and description.	SHs feedback, expressed during NSL meetings4. Content improvement.	Issues, actions and indicators have been identified involving SHs and including their contributions whenever available. Tables reporting information related to these elements have been fully integrated in the DGP, creating one page for each action and indicator	Done
Enable Geoportal users (SHs and Partners) to insert comment on Geoportal contents.	SHs feedback during NSL meeting. Major change: new functionality.	Activating a comment area for action and indicator info pages, where registered users, could express their comment or provide additional information (see bottom part of Figure 8 and Figure 9.	Done, to be tested when the DGP will be shared with SHs.
Publish issues list, with the possibility to explore related actions and indicators	Partners' feedback. Major change: new page.	Creating a new sub-page of the Issues and indicators section, including an interactive table with column filter and links to actions and indicators page.	Done
Include the possibility to explore spatially distributed data changing over time.	Partners' feedback. Major change: new page.	Creating a new sub-page of the Results section, including two synced dynamic map and an extended control panel to explore different combination of pathways, scenarios and spatial indicators across different periods (see Figure 7)	Under development

[4] See also Section 4.2 of the D6.1

6.2.4 Evaluation of the Multi-Perspective Visual Analysis Tool

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Overall, the tool presented to the stakeholders received a positive response. The stakeholders were eagerly exploring the results with the available functionalities of the tool. One stakeholder explained: "*I am fascinated by this tool. It is very interactive. I am very interested in it and also to learn how to use it and interpret all the pathways*". They said that the tool is **very useful** for exploring trade-offs, making decisions based on evidence, considering the perspectives of other sectors and using it during negotiations. The **interaction** with the tool was also perceived to be quite easy, as one stake-holder mentioned: "*Overall one can see the trade-offs clearly, easy to save perspectives, quite good interaction with the tool*". The stakeholders could easily explore all of the functionalities of the tool such as: selecting indicators, saving perspectives, viewing the indicators in isolation, saving a path-way to favourites, retrieving and comparing perspectives, and writing comments. The stakeholders were especially interested in the fact that the tool was available online. However, because not all the areas of the country are equipped with (adequate) internet access, they asked if the tool would be available offline too. An export function could be very useful in this regard.

The **Perspective-making** ability of the tool was evaluated through interaction with the "Create your perspective" mode described in detail in Section 5. This mode was perceived as useful and easy to use, as one of the stakeholders mentioned: "Create your perspective mode is very useful, providing rich and comprehensive information with various options, and it can be used as a negotiation tool by the stakeholders". In this mode, the stakeholders selected the indicators they were interested in, viewed the pathways in isolation, and saved their perspective. All these tasks were carried out with ease by at least 80% of the stakeholders, the other 20% needed a bit of additional

guidance in using the tool. An example of the result of the perspective-making process is presented in Figure 20 with a stakeholder from a socio-economic sector who was interested in three indicators: energy production, minimization of water deficit for the irrigation agriculture, and the minimization of the negative impact on the Turkana fisheries. From this perspective, the stakeholder could clearly identify the trade-off between the irrigation agriculture and the impact on fisheries: a high usage of water for irrigation agriculture upstream will cause a shortage of water downstream, thus negatively affecting the Turkana Lake's fishing opportunities. In this mode, some stakeholders wanted to explore more indicators (which will be the case once the data becomes available) as well as were wondering about the possibility to 'make a perspective' for such interdisciplinary sectors as tourism and possibly include integrated indicators (value-added indicators) to convince the stakeholders from various sectors.

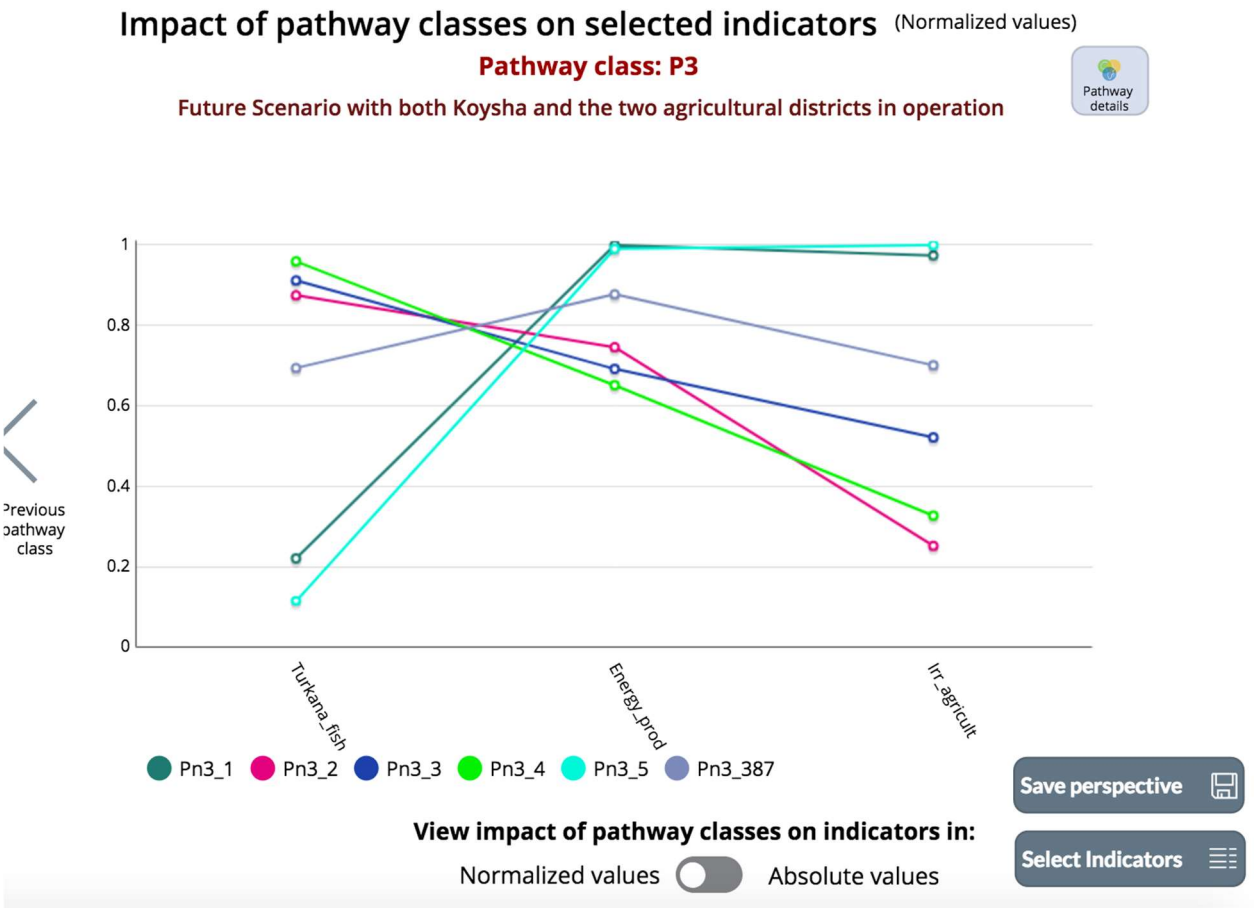

Figure 20 – Example of the result of perspective making with a stakeholder during the interview

The **Perspective-taking** ability of the tool was evaluated through the interaction with the mode "Compare perspectives" described in detail in section 5. As with the perspective-making mode, the perspective-taking mode of the tool was perceived as useful and easy to use. As one stakeholder commented: *"Comparison mode is also very helpful, good visualization, can compare easily, to make trade-offs, and to have evidence for negotiation".* The possibility to consider the impact on other sectors and comparing one's own to the perspective of others was regarded as especially **useful** to the stakeholders. All of the stakeholders could understand and use the functionalities of this mode of the tool such as: retrieving their perspective, making comparisons, identifying their preferred pathways, as well as providing feedback. An example of the perspective-taking process is presented in Figure 21: the stakeholder from the socio-economic sector retrieves the perspective from the previous paragraph and compares it to the perspective of the tourism and culture sector. The focus of the tourism and culture is slightly different: the stakeholder from this sector was interested in the impact of the pathways on indicators relating to minimization of the deviation from the

natural condition in the Omo delta, as well as minimization of the deviation from the flood pulse for recession agriculture. One can see that the two perspectives do show some differences and the Pn3_2 which can satisfy the tourism sector, would not satisfy socio-economic stakeholders as it yields a negative impact on the irrigation agriculture. However, the pathway Pn3_387 could satisfy both of these sectors. As such, by putting the perspectives of the two sectors side by side, a trade-off analysis process for a cooperative selection of pathways can be supported.

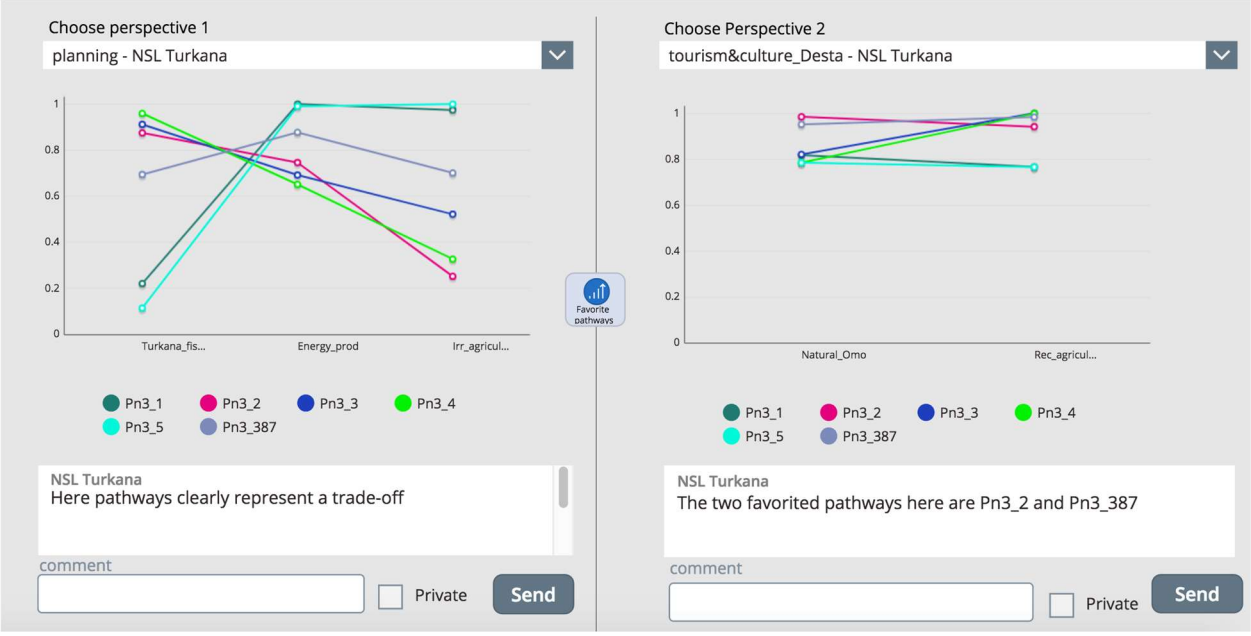

Figure 21 – Example of perspective taking with a stakeholder during the interview

A few aspects were also observed that suggest potential for further improvement. These can be divided into those that relate to the usability of the tool and those related to the general understanding of the results of the DAF model. The former can be addressed in WP6 when improving the tool for the final version. The latter will be addressed in close cooperation with WP5 to make sure that enough background is provided for participants. This can, on one hand, be achieved within the context setting for the participants, i.e. with a proper introduction to the DAFNE decision-analytic framework that is normally done in the NSL workshops. For the individual use of the tool outside of the NSL workshops, the type of additional explanatory meta-data that could be provided from the DAF model to be included in the visual analysis tool should be considered, in order to aid stakeholders in interpreting the results of the model (when an explicit introduction is not possible).

The stakeholders when interacting with the multi-perspective visual analysis tool uncovered a few minor usability issues. First, the stakeholders expected a bit more interaction with the pathways, by clicking on them and selecting them, or clicking on their labels. The ability to select one pathway should be explored in the next versions of the tool, and right now is supported by the extra menu that allows the exploration of the pathway in isolation. Second, when selecting the indicators, the stakeholders were a bit confused when the indicator is selected and when not, and suggested the use of a check box so that the interaction is clearer. Third, some stakeholders could not find the menu to switch between the create and compare perspectives modes, and this might be because the tool is slightly larger than the size of the screen that was used for the evaluation. An easy solution for this is to adjust the size of the tool to fit a screen. These issues require minor adjustments in the interaction design of the prototype and can be tackled in the next version of the tool.

What concerns understanding the results of the model, it was observed that some stakeholders could grasp the results of the model easily, while others required some more guidance into the interpretation of the results. Those stakeholders who required more explanations are the ones with

less technical backgrounds who do not deal with a large amount of numbers in their daily work and are not familiar with the technicalities of WEF nexus modelling. Specific points scattered around understanding the concept of a pathway and the meaning behind it. As such, the stakeholders desired more details about the pathways and some simple description as to the actions that comprise it. They asked: "*How can the model be translated into action? What should the stakeholders do?*". Access to the detailed information about the pathways and the indicators was already foreseen: this can be viewed in the Geoportal with a direct link from the multi-perspective visual analysis tool; however, the stakeholder feedback suggests that it would be advantageous to include some of this more detailed information already in the multi-perspective visual analysis tool itself. Another point was around understanding the impact on the indicators in absolute and normalized values. Overall, normalized values allowed for an easier way of understanding, but normalization in some cases can be misleading (e.g. in a case where a 0.8 normalized value corresponds to a very low absolute term). Finally, the stakeholders suggested that it would be helpful if there could be an overall simplification of the underlying model so it could be grasped without the detailed knowledge of the DAF model. One of the stakeholders mentioned: "*There should be a way to simplify it, add more details in the simplified language so that it is understood by many… someone very high level looking at these results will not be interested in the details*". On the other end of the spectrum, some stakeholders actually required much more information than was presented in the tool. For example, they asked about spatial information in addition to the graphs, which is contained in the Geoportal and linked to directly from the multi-perspective visual analysis tool. This confirms the concept of providing a close linking between the two tools for different purposes of analysis and different types of stakeholders (e.g. technical vs. non-technical).

There are several possible ways of addressing the issues outlined above. First, in the final version of the tool a short video tutorial will be available that explains how the results of the underlying DAF model can be possibly interpreted and how they are reflected in the tool. Additionally, there could be online and possibly offline training sessions offered for the stakeholders. All of the interviewed stakeholders expressed a wish to have training on how to use the DAFNE tools in general. Second, another idea could be to add another mode showing the impact of the pathways on a higher level, e.g. by displaying the aggregated impact on the sectors, or on the specific aggregated indicators. This however is subject to the ability of the DAF model and its elements developed in WP3 and WP5 to account for such aggregation, which is non-trivial and may not be readily possible. One of such options was explored with the participants: to include the potential impact of pathways on sustainable development goals set out by the UN (SDG indicators). The interviewees were presented with a mock up displayed in Figure 22, which shows an example of how the potential impact of the pathway could be shown on the SDG indicators (i.e. which ones could be influenced positively and which ones negatively).

The stakeholders expressed a high level of interest in including the SDG indicators into the multi-perspective tool. For some of them, the SDGs give the high-level multi-perspective view by displaying the combined impact of various indicators. Others already use SDGs in their work, for example when planning infrastructural investments, so this additional information about the impact on SDGs would be especially important to them. Some of the most interesting SDGs were those relating to cultural and human aspects (such as no poverty, food security, etc.), as well as those that allow achievement of a sustainable ecosystem (e.g. poverty or gender balance) as well as partnerships between the sectors and the countries (Ethiopia/Kenya). Integrating the SDGs into the tool, however, would require a reliable framework of how the indicators explored in the DAF model map to the SDGs, and more critically, a model for assessing (calculating) their specific impact (or at least a negative or positive influence). The viability of this option would have to be investigated with the partners from the modelling and simulation part of the work in the DAFNE project. It is also worth noting that currently such a feature is not available in existing work and that the panel discussion from a recent Resource Nexus Policy & Cluster Workshop at the European Commission[5] identified a number of challenges related to developing such a feature in a reliable way. They pointed to the

[5] http://dafne-project.eu/2018/12/11/resource-nexus-policy-cluster-workshop-27th-november-brussels/

need for further research projects specifically addressing this issue. Accordingly, due to the complexity of the underlying challenge, this might rather be an objective to consider in a dedicated follow-up project.

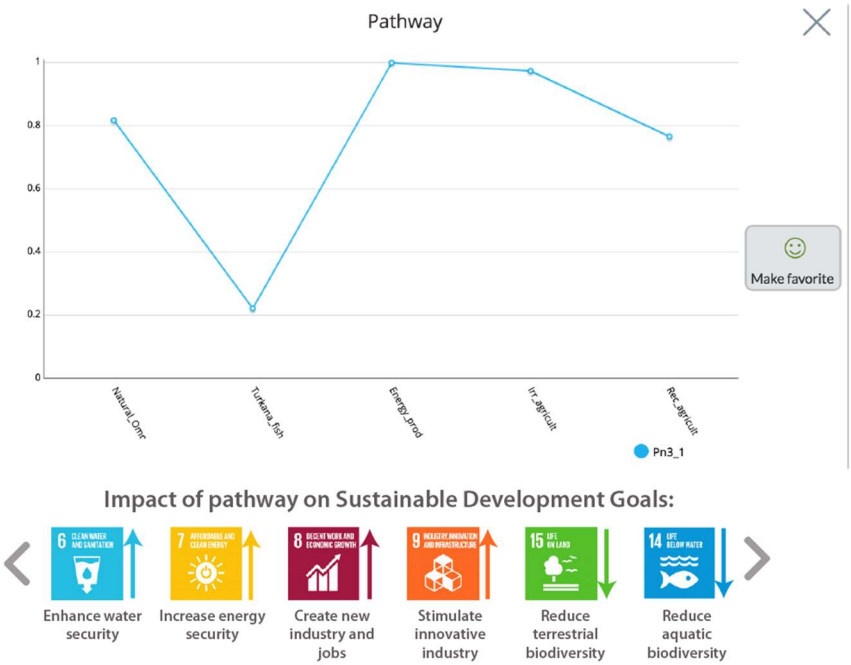

Figure 22 – Mock-up that illustrates the possibility of including the impact of pathways on SDG indicators

Overall, according to the results presented above, the intermediate evaluation of the multi-perspective visual analysis tool confirmed its usability and the suitability of its conceptual design, allowing stakeholders to analyze create and compare perspectives on the WEF issues of the DAF model results in order to analyze trade-offs of different solution pathways. The results suggest that the multi-perspective visual analysis tool corresponds well to the stakeholder's needs and satisfies their expectations on its usefulness and ease of use. The obtained feedback also helped to identify several minor issues to be corrected and possible areas for further improvement.

7 CONCLUSIONS

This report provides a detailed summary of the status of the Negotiation Simulation Lab to date in terms of its scope and implementation, followed by a review of its functioning assessed by a variety of means but relying extensively on the feedback of the stakeholders involved in the DAFNE project. The review was based on a variety of sources depending on the aspect of the NSL under consideration, but it can generally be stated that the review depended on a thorough assessment by partners and with feedback specifically elicited from the DAFNE stakeholders.

The review of the NSL meetings with stakeholders suggested that most stakeholders felt that they had a better understanding of WEF nexus issues and that they had broadened their view of basin is-sues by understanding the perspectives of those stakeholders representing other sectors in the basin. Most stakeholders also felt that the interactive sessions allowed them to take part actively in the discussions. Designing the sessions to encourage familiarity and build trust facilitated effective inter-activity. In the Zambezi case, more than two-thirds of participants reported that meeting supported the identification and the formation of alliances with other participants with similar or complementary interests. In the case of the Omo-Turkana it was an opportunity for stakeholders to identify the key actors who are active in both countries, which can in turn facilitate future interaction.

Several challenges were also identified including, for example, some expectations that DAFNE will al-so address issues that extend beyond the scope of the project, such as instigating policy re-forms and resolving resource conflicts. While it is hoped that the work and legacy of DAFNE will eventually make a contribution to necessary changes, for the project itself, this emphasized the need to man-age expectations when working with stakeholders and stress the importance of the project's contribution to capacity development.

Regarding NSL tools, the Collaborative Document Area has been provided as a means for stake-holders to access DAFNE documents and browsing through and commenting on the various tables and other results. However, stakeholders prefer to provide feedback directly to case study partners or other partners responsible for specific project components. Therefore, in the case of validate the actions and indicators, personal interviews were undertaken and proved an effective means of elic-iting feedback. The final lists of actions and indicators are now available in the Collaborative Docu-ment Area.

The DAFNE Geoportal Prototype was presented to stakeholders during the two NSL meetings and has been tested by partners since July 2018, discussed in a number of project meetings and a de-velopment update has been provided during the 2018 DAFNE General Assembly. Based on feed-back provided, actions are being undertaken, such as including a dynamic legend for the system map, including data sources in the spatial data description, and improving pathways descriptions.

Finally, the evaluation of the multi-perspective visual analysis tool by stakeholders has confirmed its usability and the suitability of its conceptual design. Users can use it to analyse and compare perspectives on WEF issues in order to analyse trade-offs of different solution pathways. In addi-tion, several minor issues for correction and areas for potential improvement were identified.

Overall, the NSL has been implemented according to plan and has been well-received by the stake-holders, as the results of the performed review of the intermediate operation have shown. The pro-ject partners have endeavoured to be responsive to questions raised and suggestions made by both stakeholders and other partners. As this report demonstrates adjustments have been or are being made where they are considered appropriate and feasible.

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APPENDIX 1 – PRE- AND POST-MEETING SURVEYS

Pre-meeting survey for the NSL

Please indicate with an 'X' if you '**strongly agree'**, '**Partly agree', 'Do not know', 'Partly disagree'**or '**Strongly disagree'** with the following statements:

With reference to the basin	**Strongly agree**	**Partly agree**	**Do not know**	**Partly disagree**	**Strongly disagree**
a) One of the competing claims is between water for livelihoods vs. water for irrigation					
b) There are high levels of competition for water resources among different sectors such as irrigation, agriculture, hydropower production, mining etc					
c) My concern is that integration of sectors (Water-Energy-Food) would not be of benefit to my sector					
d) Irrigated areas have a larger impact on water quality/quantity and use than hydropower projects					
e) There is limited institutional capacity to implement integration of sectors in the basins					
f) I am interested to see and hear about other's concerns on the integration of sector (Water-Energy-Food)					
g) My understanding of the aim of integrating sectors (Water-Energy-Food) within this basin is to reach a situation of sustainable management for present and future generations of all riparian communities					
h) There is a lack of coordination among key stakeholders for management of the water-energy-food nexus					
i) I have limited understanding of the interlinkages between agriculture, water and energy due to limited data/information/assessment tools					
j) I am pessimistic about the integration of sectors Water-Energy-Food in this basin					
k) The drive to support the integration of sectors comes more from externally than internally (within the country)					

Post-meeting Survey: Evaluation of learning in the NSL

Please indicate with an 'X' if you '**strongly agree'**, '**partly agree**, **partly disagree'**, '**strongly disagree**' with the following statements:

	Strongly agree	**Partly agree**	**Partly disagree**	**Strongly disagree**
a) The interactive sessions provided the opportunity to engage with other stakeholders in WEF nexus issues				
b) The interactive sessions enabled the sharing of knowledge, and exchanging of experiences				
c) I felt I was able to express my view/ perspective during the interactive sessions				
d) I held different views/perspectives to some other participants but I was able to express them in the interactive sessions				
e) I initially had different perspectives on W-E-F sector integration but developed a shared understanding with other stakeholders through the interaction				
f) I seem to share the same vision as most stakeholders on sustainable management of the river basin				
g) I felt everybody had the same opportunity to influence the direction of discussion in the interactive sessions				
h) I felt the NSL helped me to understand other perspectives on WEF issues and take them into consideration in future planning				
i) I was able to form alliances with participants who have similar or complementary views				
j) Interacting with other participants who shared different views from me allowed me to stop and consider their views and perspectives				
k) I actively took part in influencing outcomes during the interactive sessions				
l) I now have a clear understanding of how the integration of sectors would benefit my sector				
m) The NSL helped me to develop a shared understanding of WEF nexus issues by considering other participants' views on different WEF nexus issues				
n) My views and concerns on WEF nexus integration have since changed while interacting with participants in the NSL				
o) I was initially pessimistic about W-E-F nexus integration in the basin but I am now more optimistic of the potential and benefits				

APPENDIX 2 – QUESTIONS TO THE STAKEHOLDERS DURING EVALUATION OF THE MULTI-PERSPECTIVE VISUAL ANALYSIS TOOL

The questions asked of the stakeholders were split into the four sections: introduction, feedback about the perspective making mode of the tool, feedback about perspective taking mode, feedback about the possible extension of the tool with the display of the SDG indicators.

- **General questions** -
  - What is your interest in the DAFNE project?
  - What would you like to have as an outcome of the project (of using this tool)?
- **Perspective making part of the tool -**
  - What do you find useful in this part of the tool?
  - What information is missing that would allow you to choose the pathways that are interesting for you?
  - Was the interaction with this part of the tool easy to understand?
- **Perspective taking part of the tool** -
  - What is useful in this part of the tool?
  - Was the interaction easy to understand?
  - Which one is more important to you as a purpose of this tool: to understand your own per-spec-tive and the perspective of your sector; or together with the stakeholders from other sectors to select pathways that interest you both?
- **Relating to SDG indicators –**
  - What benefits would the display of the potential impact of pathway on SDG indicators have?

APPENDIX 3 – SCREENSHOTS OF THE MULTI-PERSPECTIVE VISUAL ANALYSIS TOOL OF THE ZAMBEZI CASE STUDY

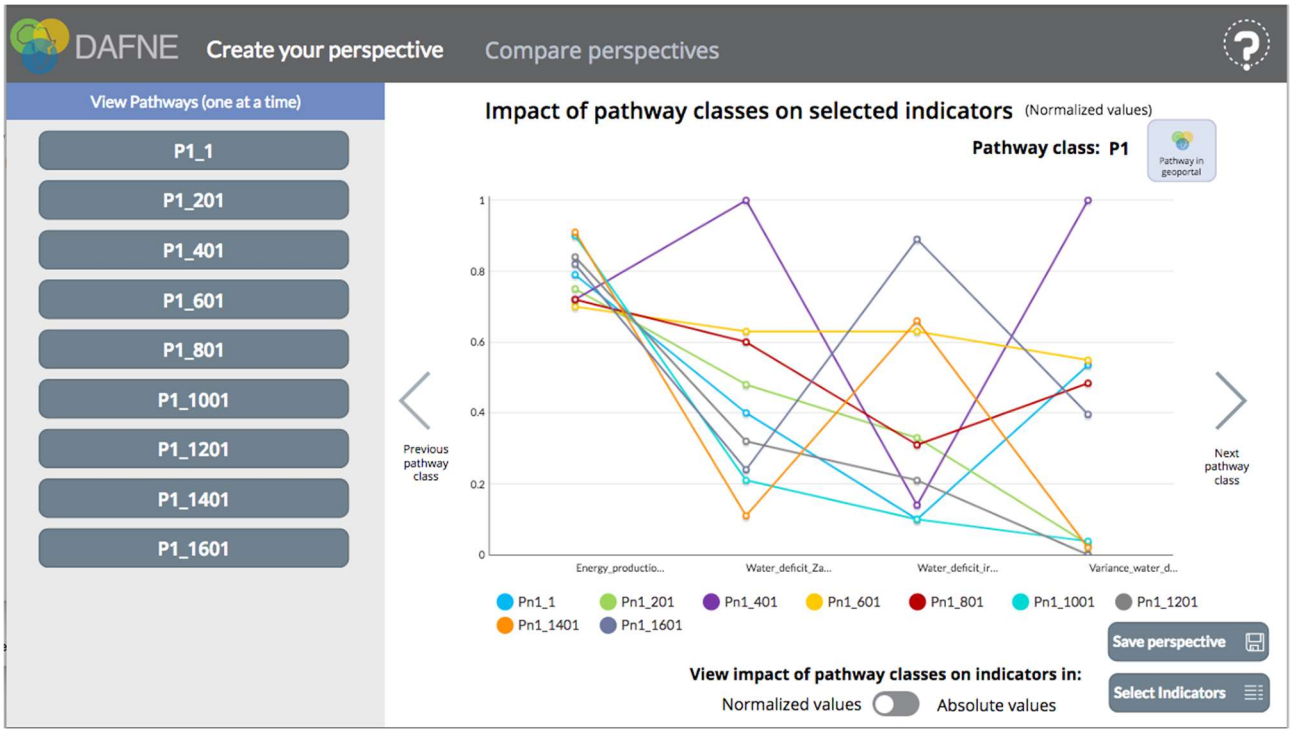

Figure 23 – Mode "Create your perspective", functionality "Visual display of a set of best candidate pathways" and functionality "Save your perspective" in the Zambezi case study

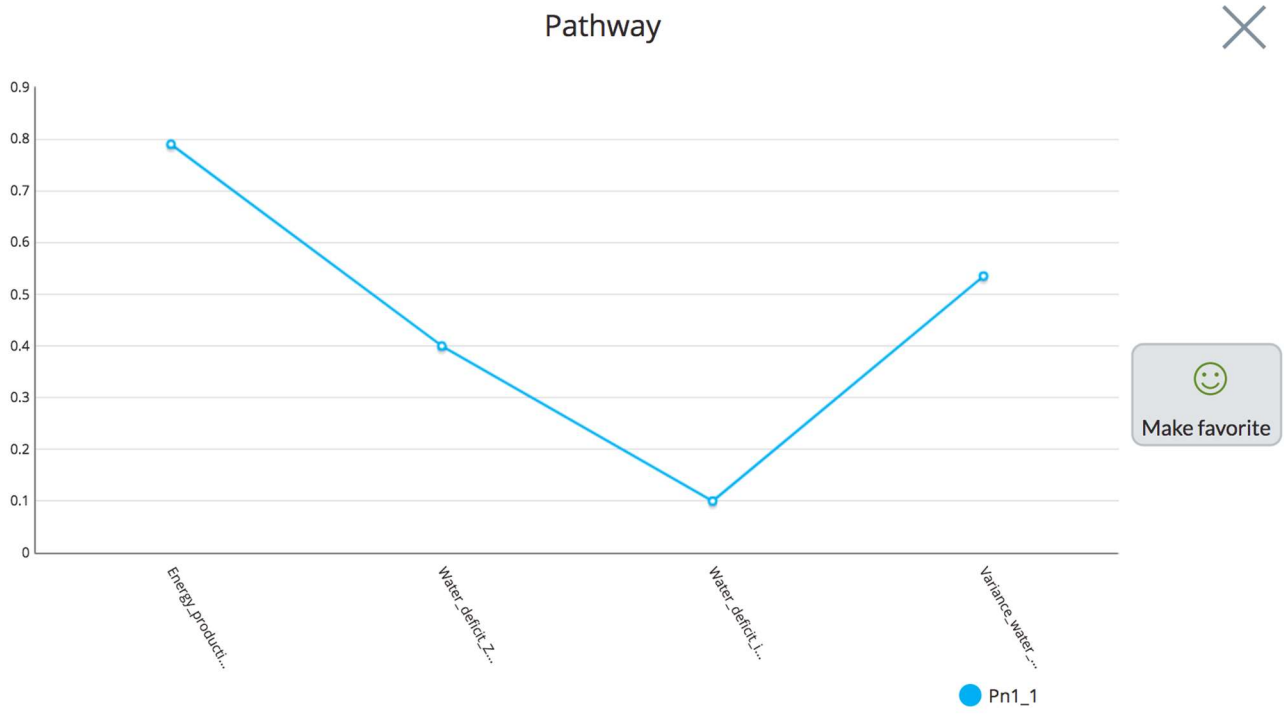

Figure 24 – View pathways one at a time (functionality "filtering") and indicate a favourite pathway (functionality "indication of favourite pathway") in the Zambezi case study

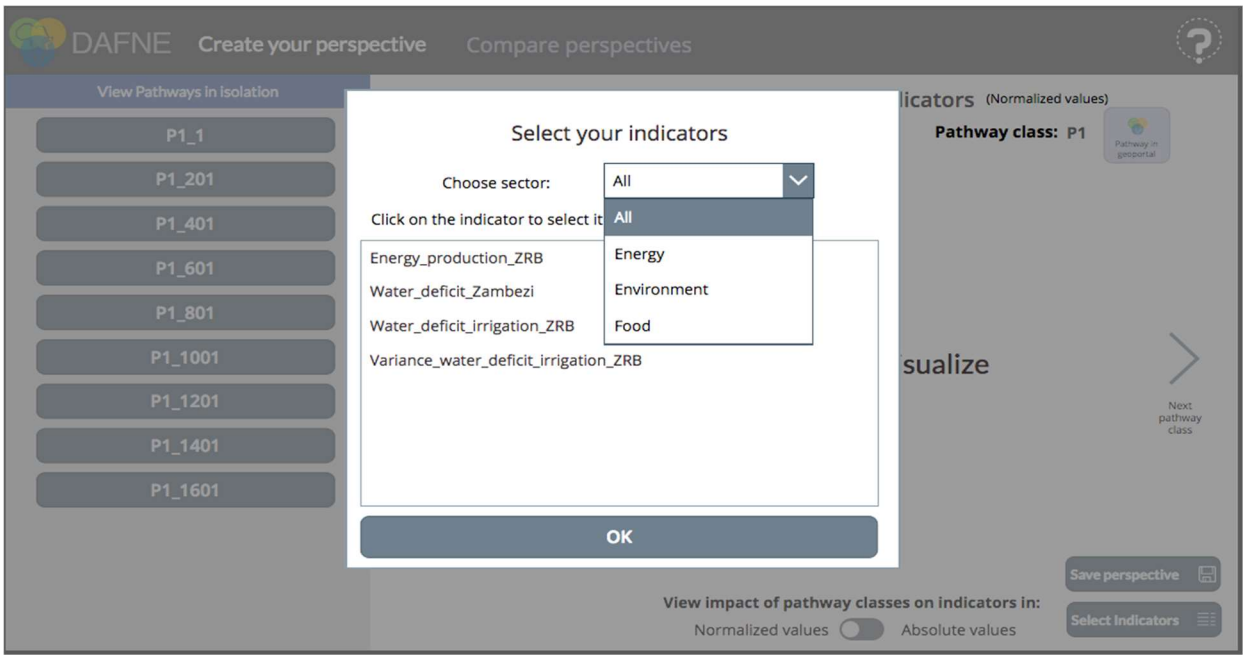

Figure 25 – Functionality “Define Sector Perspective” and “Manual selection of indicators” in the Zambezi case study

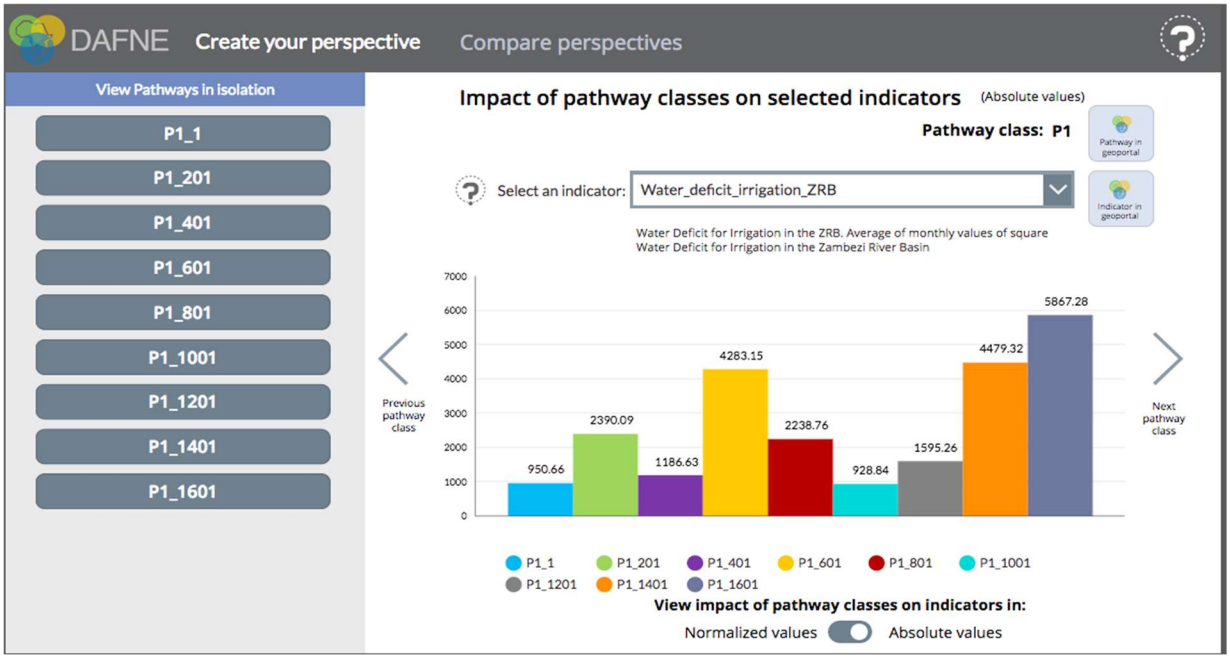

Figure 26 – Mode “View impact of pathways on indicators in absolute values” in the Zambezi case study

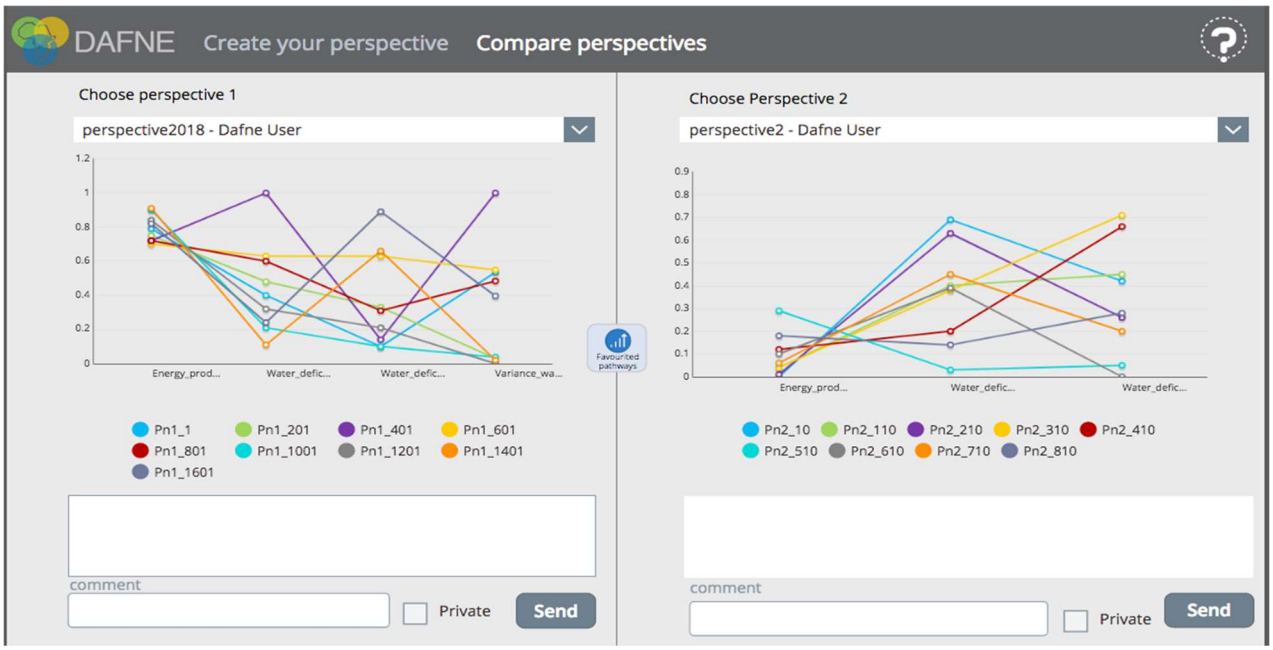

Figure 27 – Mode “Compare perspectives” and functionality “Select and display a sector perspective” in the Zambezi case study

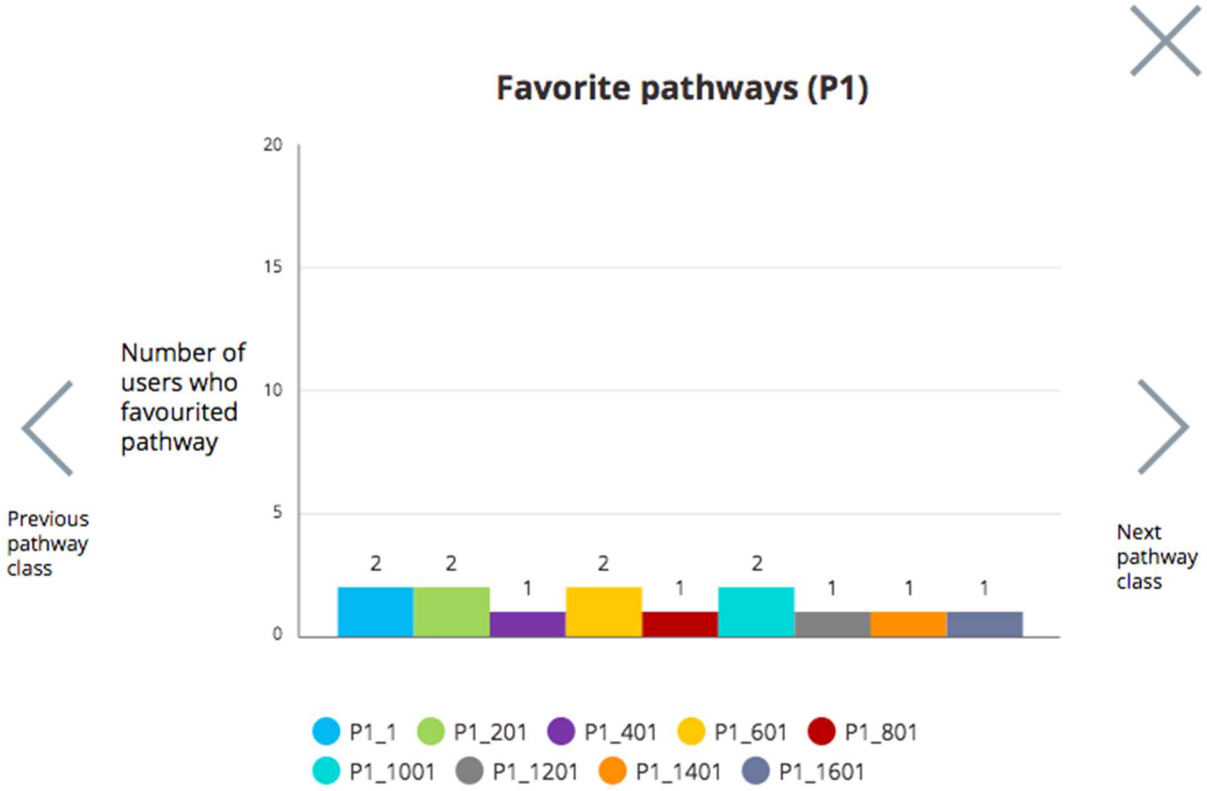

Figure 28 - Functionality “View Favourite Pathways” in the Zambezi case study