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EXECUTIVE REPORT
FANFAR Workshop 1
@ AGRHYMET Regional Center, 17–20 Sept. 2018, Niamey, Niger

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The FANFAR consortium:

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Summary

The FANFAR project (rein**F**orced cooper**A**tion to provide operatio**N**al **F**lood forecasting and **A**lerts in West Af**R**ica), funded by the European Commission (2018–2020), aims to foster reinforced co-operation between key West African and European organisations. The project focuses on developing a system according to West African user needs and priorities, identified through a set of workshops. The first workshop took place at the AGRHYMET Regional Center (2018.09.17–20), in Niamey, Niger. Representatives from hydrological agencies and emergency management agencies on the regional and national level from 17 countries in West Africa contributed substantially to achieve the project goals. In this workshop, the main objective was to co-design the flood forecasting and alert system in West Africa by: 1) clarifying user objectives, needs, and preferences, 2) receiving feedback on the currently available FANFAR forecast and alert system prototypes, and 3) on acknowledging which stakeholders should be involved. Therefore, several activities were performed. To identify which objectives are important for the participants for developing a flood forecasting and alert system; several exercises were performed and allowed us to prioritize the following objectives by order of preference: High accuracy of data and information outputs, Timely dissemination of flood alerts, High Reliability, Clear definition of alert thresholds, and Reliable access to data & information outputs. The activities performed to understand the matching between expectations and the current development status of the FANFAR prototype systems for the flood forecast production (Hydrology-TEP) and visualization portal, allowed to focus on identifying possible system options (how the system should be configured to meet the objectives) through key questions or drivers: 1) the easiest-to-use system, 2) the most attractive system for West-Africa, and 3) the most robust system; i.e. that works in all West Africa. To conclude, an exercise was developed to identify key stakeholders to be involved in the continued development process of the system. A social science framework was used to identify stakeholders that would desire to continue their involvement in co-design activities and those that may be interested in participating in future co-design activities. The results obtained are very promising and allow us to look forward to continuing the co-design process and improve the FANFAR system in the next workshops.

1. Introduction

FANFAR (rein**F**orced cooper**A**tion to provide operatio**N**al **F**lood forecasting and **A**lerts in West Af**R**ica) is a project funded by the European Commission (2018–2020) with the overall aim to provide a short-term streamflow forecasting and alert pilot system for West Africa, through reinforced cooperation between key West African and European organisations (http://fanfar.eu/). A key focus of the project is to develop the system according to West African user needs and priorities, identified through a set of workshops. The first workshop took place at the AGRHYMET Regional Center (2018.09.17–20), in Niamey, Niger, and the main results are herein reported.

Representatives from hydrological agencies and emergency management agencies on the regional and national level from 17 countries in West Africa contributed substantially to achieve the project goals. These participants came from Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinee, Guinee Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Chad, Togo, and Senegal. The FANFAR Workshop 1 welcomed 47 participants from 21 countries, including the consortium members from Europe.

The aim of this first workshop was to co-design the flood forecasting and alert system in West Africa by clarifying user objectives, needs, and preferences, and to receive feedback on the currently available FANFAR forecast and alert system prototypes, and on stakeholders that should be involved. Therefore, several activities were performed to:

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- identify which objectives are important for the participants for developing an operational flood forecasting and alert system (i.e. what the system should achieve); results are highlighted in **Section 2**;
- understand the matching between expectations and the current development status of the FANFAR prototype systems for the flood forecast production (Hydrology-TEP) and visualization portal (http://fanfar.eu/), and focus on identifying possible system options (how the system should be configured to meet the objectives); see **Section 3**;
- identify key stakeholders to be involved in the continued development of the system; results are highlighted in **Section 4**.

2. Objectives for an operational flood forecasting and alert system

The first task was to identify and rank the objectives that stakeholders consider important with respect to developing an operational flood forecasting and alert system. The term "objectives" here refers to what the system should achieve. Objectives are the framework used to compare different system options in the next phase. A system option can achieve the objectives very well or less well, thus the objectives are required to measure the performance of each system option. To gather the required information, four different stages were introduced (see Figure 1) to: 1) explain Multi-Criteria Decision Analysis; 2) perform problem structuring, objectives elicitation and ranking activities; 3) discuss the previous results in a plenary session; and, 4) allow for further co-development and work by the project team.

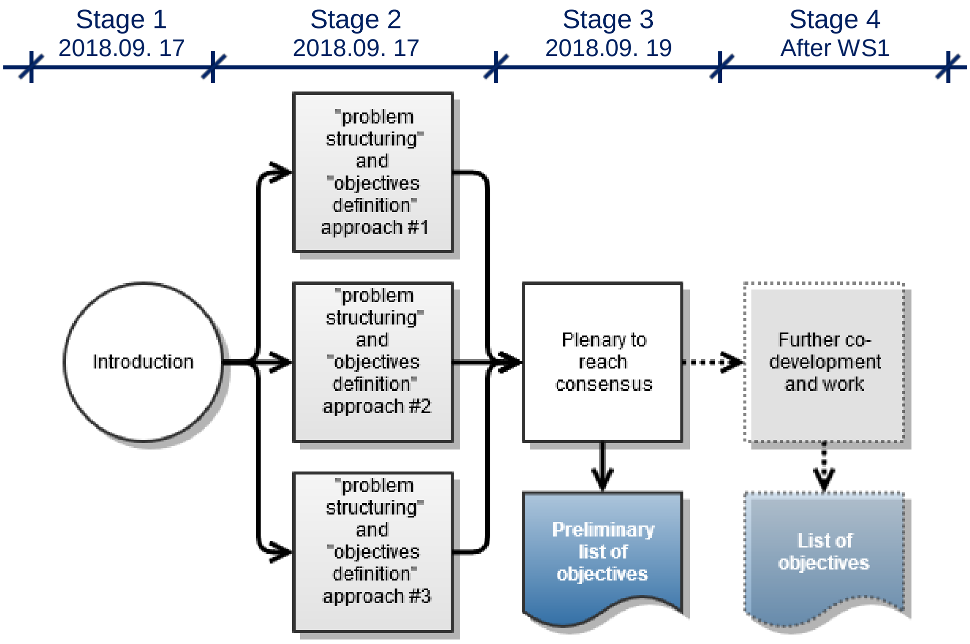

Figure 1. Flowchart of the problem structuring and definition of objectives process.

The output of stage 3 was a preliminary list of objectives identified and prioritized by the workshop participants. The selected objectives are highlighted below in order of importance (Figure 2). These will be further revised and used to guide the system development process.

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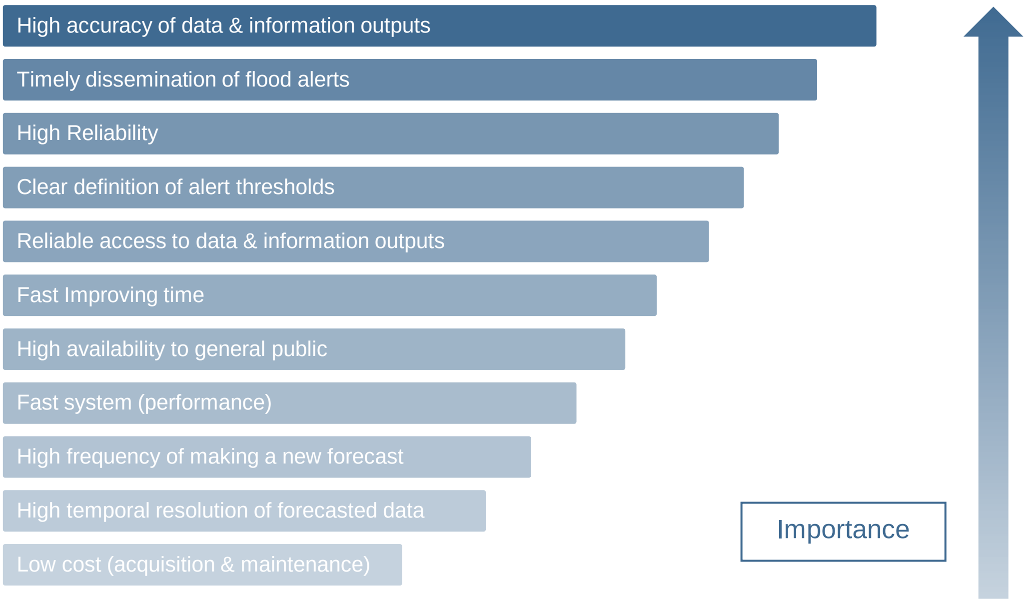

Figure 2. List of objectives proposed from FANFAR Workshop 1.

3. Options to improve the FANFAR prototype systems

The FANFAR prototype systems, Hydrology-TEP and visualisation portal (http://fanfar.eu/), were presented in detail to the participants (2018.09.18). This was followed by practical sessions. Hereby, the participants were asked to provide structured feedback regarding different aspects of the currently available system prototypes (Figure 3).

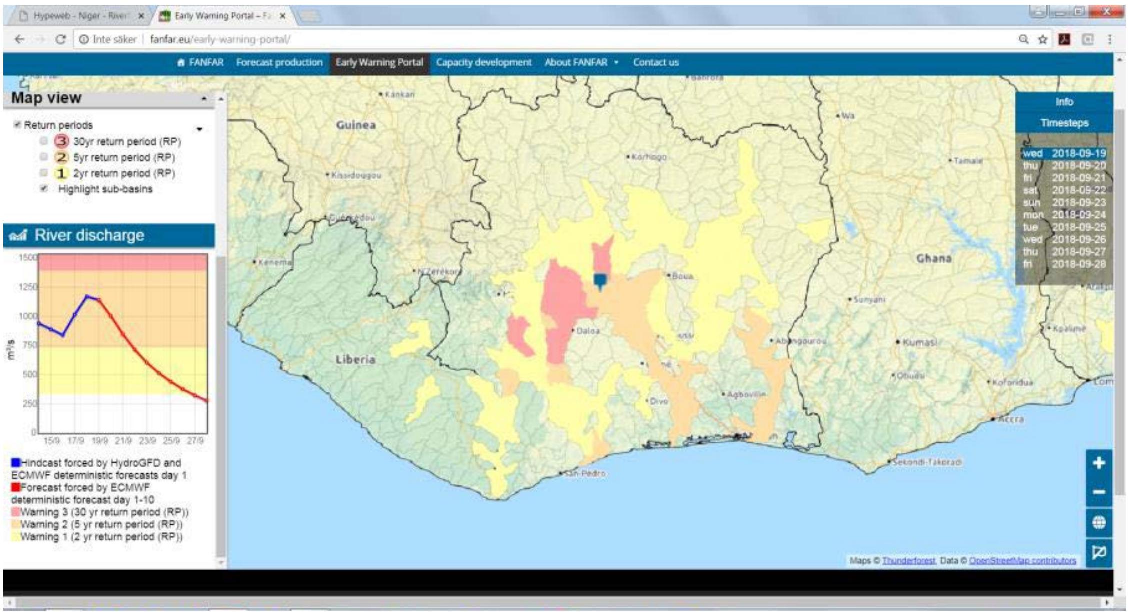

Figure 3. Exercise featured in the FANFAR prototype visualization system.

Further structured brainstorming activities in small groups were conducted to stimulate creativity and widen the perspective towards different "system options" (2018.09.19). Several questions (Q), or strategies, were made to promote the creation of different "system options" (Tables 1 and 2).

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Table 1: Main results for the **Visualization portal** at www.fanfar.eu:

Question	Forecasted variables	Observed variables	Model performance / accuracy	Reference thresholds to assess flood risk	Data download	Distribution channels	Flood risk notification system
Q1: what is the easiest-to-use system?	Streamflow, water level, precipitation, & evaporation	Water level from in-situ measurements and satellites	Display performance metric (e.g. NSE) for forecasts (with colored levels)	Selected historical years, and return periods based on simulations	Tabular data for selected station in Excel format, and charts and graphs	WhatsApp, Radio, TV, and traditional word of mouth	Automatic notification directly to national and regional agencies as well as to their stakeholders
Q2: what is the most attractive system for West-Africa?	Streamflow, water level, precipitation, evaporation, soil moisture storage, and water quality variables	In-situ water level and streamflow, water level from satellites, and precipitation	Display performance metric (e.g. NSE) for forecasts (with colored levels), Blank out areas where forecasting performance is too low	Return periods based on observations (only for gauged locations)	Tabular data for selected station in Excel format, map of displayed variable(s), in PNG and shapefile formats, and charts and graphs	Website with interactive features, SMS, e-mail, WhatsApp, radio, TV, and traditional word of mouth	Automatic notification to national and regional agencies. Controlled distribution to downstream stakeholders using (i) existing distribution channels or (ii) the FANFAR distribution channels
Q3: what is the most robust system; i.e. that works in all West Africa?	Streamflow, water level, & precipitation	The same as Q2	The same as Q2	Selected historical years, user-defined thresholds, and return periods based on simulations and observations	The same as Q2	The same as Q2	The same as Q2

Table 2: Main results for the **Hydrology-TEP** forecast production system:

Questions	Observational data sources	Meteorological input data	Hydrological models	Output information	Distribution options (of outputs)	Degree of automatization
Q1: what is the easiest-to-use system?	Satellite water level data	HydroGFD2.0 from SMHI	Only Niger-HYPE	Water level categorized by return period	SMS notification in flood risk situations	Only automatic processing of data
Q2: what is the most attractive system for West-Africa?	All types: satellite water level data, local water level and streamflow observations, and rating curve parameters, etc.	Several sources. Historic: HydroGFD-West Africa from AGRHYMET and HydroGFD from SMHI. Forecast: ECMWF determinstic, GFS, and ECMWF-ensemble forecasts.	Niger-HYPE, World-Wide HYPE, and other regional/national models	All available variables: e.g. streamflow, streamflow categorized by return period, water level, water level categorized by return period, precipitation, evaporation, soil moisture etc.	SMS and e-mail with forecast summary and link to the complete information in the online system	Automatic processing followed by manual control before data is distributed
Q3: what is the most robust system; i.e. that works in all West Africa?	Satellite water level data	HydroGFD2.0 from SMHI	Niger-HYPE and World-Wide HYPE, or only World-Wide HYPE	Same as Q2	Same as Q2	Same as Q2

The language used and the support systems were also discussed, suggesting a need for having a multi-lingual system (English, French, Portuguese, and Arabic) and providing support through e.g. forum, e-mail, and an online Knowledge Base.

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4. Stakeholders analysis

A stakeholder analysis was carried out (2018.09.20), in order to identify key organisations that would be important to include in the continued development of the FANFAR system

A systematic questionnaire survey was completed by 31 workshop participants. They listed a total of 249 stakeholders, which we first merged if they were very similar, and for which we then calculated summary statistics. This data cleaning process resulted in 68 stakeholder types, which we further analysed. We grouped and filtered these according to their information profile (hydro-innovation stakeholders versus downstream stakeholders, Figure 4), decisional level, sector they belong to, and their perceived main interest. We then analysed, the "importance" of considering their interests in the FANFAR co-design process, their "influence" (power) on a sustainable uptake of the system, and how strongly "affected" every stakeholder would be by a well-functioning (or not well-functioning) forecast and flood alert system.

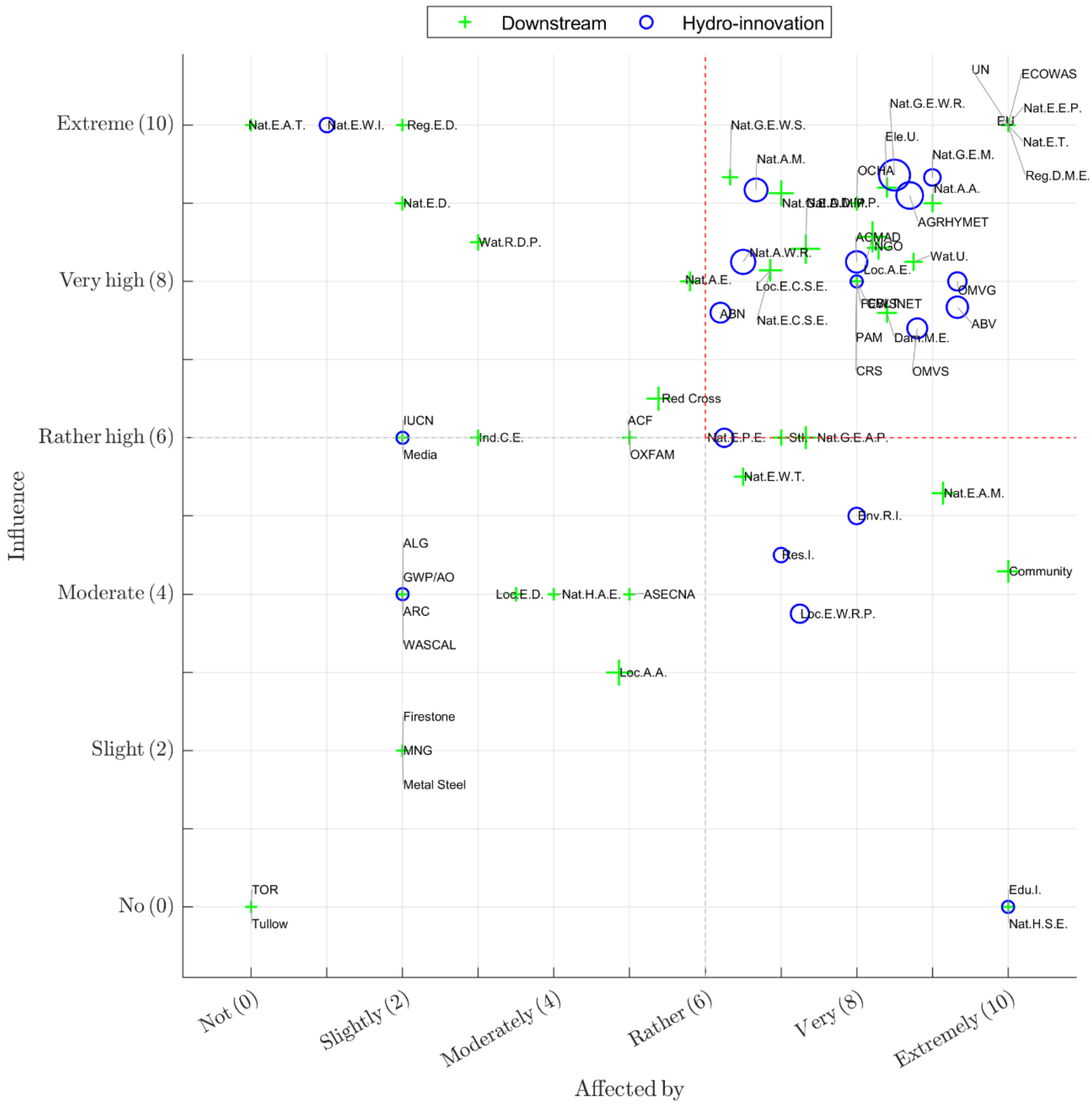

Figure 4. "Influence" / "affected by" plot according to the classification of stakeholders as hydro-innovation stakeholders (blue circles), or as downstream stakeholders (green crosses). The size of the symbols indicates how often a stakeholder was mentioned (the larger the symbol, the more times it was mentioned).

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These analyses give a good overview of which interests and parties should potentially be further included in the FANFAR co-design process. As a summary, the interests of the stakeholders that were perceived as being of “high importance” were: “resource planning” (31%), “economic service and operations planning” (25%), and “rescue aid” (18%). Other “important” interests were also mentioned, namely “technical”, “civil society”, “disaster management”, and “environment”. Nearly half of the stakeholders (46%) would mainly use the FANFAR flood forecast and alert system for “alert information”, 21% for “forecast refinement”, and 16% for “water related information”. Only few would use it for “meteorological data” (8%) and “forecast production” (4%).

The social science framework used during this co-design workshop, allowed us to identify:

- stakeholders that desire to continue their involvement in co-design activities;
- stakeholders that may be interested in participating in future co-design activities.

5. Concluding remarks and acknowledgements

The outcome of all interactions during the first FANFAR workshop in Niamey, Niger in September 2018 was compiled. It has already been used to technically improve the FANFAR systems to better correspond to the users’ needs and preferences, and will be continued to be used to this end. This will allow for a fuller integration and adaptation of the FANFAR flood forecast and alert system to West African conditions.

There was a high commitment of all stakeholders to actively participate in the FANFAR system refinement process in Workshop 1. For the FANFAR consortium, this is an important step towards a sustainable uptake of a flood forecast and alert system. Indeed, the results are very promising.

We wish to express our gratitude to all participants for their time, their valuable contributions and their patience and open-mindedness to go along with our methods and participate in all the different activities. We also thank our host AGHRYMET for the wonderful hospitality, and we thank the European Union for funding (Horizon 2020 / Grant Agreement 780118).

We look forward to the continued discussions with participants to further improve the FANFAR flood forecast and alert system in the next workshops.