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## Global Hydrometry Support Facility (WMO HydroHub)

### *Innovation Strategy* 2018-2020

***Prepared by: The WMO HydroHub Team***  
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## Document revision history

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# 1 Introduction

One of the key aims in establishing the Global Hydrometry Support Facility (WMO HydroHub) was to drive innovation in hydrometry by advancing beyond current technologies, accepted regulations and traditional approaches.

It is the **ambition** of the WMO HydroHub's **innovation activities** to improve the quality, efficiency and availability of hydrometeorological data from existing sources and to create new sources of free and open access data. Through these activities the availability of hydrometric information will improve for a broad community of users in support of **evidence-based decision-making**.

The strategy on how this ambition can be implemented reflects the fact that the WMO HydroHub is embedded into the WMO, the United Nations Specialized Organization for Weather, Climate and Water<sup>1</sup>. As such, the WMO HydroHub's approach to innovation centered on supporting and promoting an environment that strengthens WMO Members and enables their National Meteorological and Hydrological Services (NMHS) to derive their own benefits from new technological and scientific developments, while also embracing a culture of collaboration and sustained innovation in day-to-day operations.

The WMO HydroHub builds on the experiences of recent initiatives around the world such as the iMoMo<sup>2</sup> project which was supported by the WMO HydroHub's founding funder, the Swiss Agency for Development and Cooperation (SDC). Projects such as iMoMo have been successful in incubating innovative hydrological observation solutions but often experienced challenges when trying to integrate them in operational procedures within NMHS. It is this latter stage of the innovation chain where the WMO HydroHub will focus its efforts, aiming to create an enabling environment for innovative solutions within the NMHSs so as to foster uptake at an operational level to bring data and information services to decision-makers. Attention will be centered on identifying and promoting the benefits that innovation can bring while at the same time mitigating the boundaries that often prevent these benefits to materialize in practice.

The WMO HydroHub benefits from external project funding beyond WMO's regular budget which creates an opportunity to fund trials of new approaches within the WMO community. Such direct support allows partners to embrace innovative solutions, showcase the benefits for operational services and lead by example. These experiences can feed back to the community and enrich the regulatory process of WMO.

Through the World Hydrological Cycle Observing System (WHYCOS) initiative and other WMO capacity development and technical support activities, the WMO HydroHub will work together with national agencies and external partners to embed innovation in hydrological development projects under the auspices of WMO. As well actively involving NMHS and assisting them to close their capacity gap. This development context is an important source of information regarding the hands-on requirements of the community which the WMO HydroHub will use to help devise new innovative technological solutions and improved business processes.

The WMO HydroHub innovation strategy is designed to evolve as needs and capabilities change. This review and updating will be undertaken by the WMO HydroHub Innovation

<sup>1</sup> specifically: operational hydrology

<sup>2</sup> Innovative Technologies for Monitoring, Modeling and Managing Water, <http://www.imomohub.ch>

Committee and approved by the WMO HydroHub Advisory Council. These two bodies – whose members are affiliated to the public and private sector as well as academia – aim to leverage new thinking and new solutions in order to provide strategic guidance to the WMO HydroHub.

## 2 Defining Innovation in the WMO environment

*HydroHub Strategic Plan 2018—2020, Value Proposition:*

“The HydroHub refers to innovation as a series of efforts creating an environment that **integrates change into all established and new processes** put in place. The necessity to adapt to a rapidly transforming world cannot be addressed by short-term action, but only through a consistent long-term strategy.”

### Sustainability:

The notion of *innovation* is commonly used to refer to a wide variety of new approaches to technology, management, finance and society. While what we call *new* strongly depends on context (Is something new to the world, the market, a community?), it is the sustained capacity to adapt to a changing environment, not the current product portfolio or methods of service delivery, which allows successful organizations to stay at the top. For this reason, the WMO HydroHub will place particular emphasis on activities which build long-term innovation capacity within the global hydrometry community.

### In-house Innovation:

By putting in place effective and efficient *innovation management*, organizations can identify and adopt suitable new developments for their context in order to benefit from new science and technology. However, organizations that foster innovation not only adopt and integrate existing innovations, but also develop their own tools in cases where no appropriate solutions are readily available. In doing so, they take on both roles: end-user and innovator. Companies like Alibaba, Apple and Samsung<sup>3</sup>, to name only few, are competitive because they continuously evolve. Examples like Kodak<sup>4</sup> and Myspace<sup>5</sup> show that even market leaders can lose their position if they do not absorb new technologies fast enough. The WMO HydroHub will therefore support NMHSs to both adopt innovations from the wider hydrometric community but also encourage in-house development of new approaches to monitoring.

### Partnerships:

To be successful, organizations should consider the full innovation value chain from idea generation, through conversion into products, to diffusion to end-users. This involves a wide range of expertise and experience. Innovation therefore is fundamentally dependent on collaboration and communication to establish benefit-sharing partnerships across multiple sectors – something which lies at the heart of the WMO HydroHub innovation strategy – while also realizing that it is typically NMHS that assume the

<sup>3</sup> <https://www.bcg.com/publications/collections/most-innovative-companies-2018.aspx>

<sup>4</sup> <https://www.forbes.com/sites/chunkamui/2012/01/18/how-kodak-failed/>

<sup>5</sup> <https://www.theguardian.com/technology/2015/mar/06/myspace-what-went-wrong-sean-percival-spotify>

responsibility at national level to create and deliver services for the protection of life and property.

### Integration:

The current fast pace of development in science, sensor technologies, IT and communication technologies, together with ongoing societal changes, means that the WMO community must **react to change faster than before**.

The WMO is actively working on a number of modernization programmes designed to assist hydrometeorological services around the world. Prominent examples in hydrology include: HydroSOS,<sup>6</sup> which aims to improve our understanding of current and future hydrological conditions; the Project for the Assessment of the Performance of Flow Measurement Instruments and Techniques (Project X)<sup>7</sup> and the evolution of the WHYCOS<sup>8</sup> programme for hydrological capacity development.

Closely related, WMO's Information and Communication Technology (ICT) modernization programmes, namely WIS<sup>9</sup>, WIGOS<sup>10</sup>, GDPFS<sup>11</sup>, implement the ICT infrastructure for global exchange of observation data, metadata and services for the weather, climate and water communities. For hydrology this takes the form of WHOS<sup>12</sup>.

The WMO HydroHub's innovation activities aim to integrate with and support these developments by operationalizing new hydrometry and ICT technologies, data management tools and management processes.

### Innovation Culture:

The necessity to adapt to a rapidly transforming world needs to be answered with a consistent long-term change of mind set. In the global WMO environment, the term *new* refers to solutions that are new to the WMO community, a specific user or context, i.e. a technology that is established in other sectors might be new to the WMO community or a specific national service. The objective analysis of the status quo and the pragmatic selection of solutions for operational uptake is key – state-of-the-art solutions, and making change part of business-as-usual are priorities that supersede the search for cutting-edge technologies.

In its efforts to **support innovation**, the WMO HydroHub will prioritize efforts that support the creation of an enabling environment and institutionalize change management, with the aim of integrating new solutions, processes and paradigms to improve operational hydrometry, data management and management processes.

A holistic understanding of context, improved communication and transparency is crucial to create trust between partners that leads to fruitful collaboration. The willingness to

<sup>6</sup> WMO Global Hydrological Status and Outlook System, <http://www.wmo.int/pages/prog/hwrp/chy/hydrosos/index.php>

<sup>7</sup> Project X, [http://www.wmo.int/pages/prog/hwrp/meetings/MC1-Project\\_X.php](http://www.wmo.int/pages/prog/hwrp/meetings/MC1-Project_X.php)

<sup>8</sup> World Hydrological Cycle Observing System, <http://hydrohub.wmo.int/en/whycos/>

<sup>9</sup> WMO Information System, <http://www.wmo.int/pages/prog/www/WIS/>

<sup>10</sup> WMO Integrated Global Observing System, [http://www.wmo.int/pages/prog/www/wigos/index\\_en.html](http://www.wmo.int/pages/prog/www/wigos/index_en.html)

<sup>11</sup> Global Data-Processing and Forecasting System, [www.wmo.int/pages/prog/www/DPS/gdps.html](http://www.wmo.int/pages/prog/www/DPS/gdps.html)

<sup>12</sup> WMO Hydrological Observing System, <https://public.wmo.int/en/our-mandate/water/whos>

break boundaries between communities and sectors is at the very heart of all innovation activities.

#### Impact:

The success of the WMO HydroHub's innovation activities will be determined by the value added for operational hydrometry practitioners – for example, new data made available to more stakeholders, more services created and delivered to users, provided solutions are re-used in different context and users have become more efficient executing recurrent tasks.

Data is collected, made available and transformed into products and services to **support evidence-based decision-making for good governance**.

Over time, sustainability, wide-spread use and cost-effectiveness of the provided innovative solutions define impact.

### 3 Key Innovation Areas

The WMO HydroHub has identified three key areas where innovation can have significant impact on the production and use of hydrometeorological data.

*Hydrometry* is a core expertise of the WMO community. Nevertheless, bringing innovation to a highly regulated field with decades of experience remains a challenging task. *Data management* is well regulated by WMO on a global level but a focus on national/regional operational levels could have significant impact on the quality and availability of hydrometeorological information, metadata and access to other relevant data sources. Innovation management experiences show that particularly high impact can be achieved at comparably low cost when introducing or improving general *management processes* and standard operating procedures (SOPs).

The three Key Innovation Areas together cover the full data value chain collecting *data* extracting the most useful *information* to create *knowledge* by bringing it into context and take *wise* decisions. In focusing its efforts on driving innovation in these three Key Areas, the HydroHub will support the producers, custodians and users of Hydrometeorological data. Its portfolio of activities will both support operational agencies in their production of data and information and also helping users adapt to such changes as they pursue new knowledge and wisdom.



Figure 1: Data for decision-making: the DIKW-Pyramid

### 3.1 Sensor Technologies and Monitoring Techniques

The WMO, through its Commission for Hydrology (CHy), supports NMHSs in “the measurement of basic variables characterizing the quantity and quality of water and sediment in the hydrological cycle”.<sup>13</sup> Recent developments including the advent of new low-cost sensors, growing remote sensing capabilities, improvements in ICT and the potential offered by participatory monitoring approaches, provide opportunities to modernize the approaches used to fulfill this mandate. At the same time, ongoing pressure to reduce cost, growing public demand for information and changing environmental conditions present challenges which those operating hydrometric monitoring networks must address.

Innovation in operational hydrometry through the adoption of new sensor technologies and monitoring approaches has great potential to significantly reduce cost and improve efficiency while also increasing the quality and quantity of monitoring data. Opportunities could result from increasing the space-time density of observations using low-cost sensors, reducing the cost of discharge measurement through the use of non-contact technologies or the integration of satellite data.

While proof-of-concept studies in hydrometry have often successfully demonstrated that new technologies can be functional, widespread adoption by operational agencies is poor. Aspects like the total cost of ownership (TCO) need to be analyzed, access to necessary training needs to be secured and successful integration of new observation data into hydrological models and established IT processes must be demonstrated. For new technologies and emerging monitoring techniques, many of these questions are still open rendering a good technology immature for operational use. The WMO HydroHub will close this gaps by: promoting dialog between innovators, regulators and operational services; triggering TCO studies; motivating the evolution of international regulations; sharing experience from current research and pilot projects and; connecting producers of innovative sensors with operational agencies that can provide reliable comparison measurements. Through these activities, to name only few, the WMO HydroHub will support innovation in hydrometry.

### 3.2 Data Management for Water

Data management technologies and SOPs are operational tools that facilitate turning data into end-user services for decision-making. This key innovation area therefore includes everything from sensor telemetry systems, data quality control and database operations and maintenance through to international data exchange policies and formats to service dissemination.

New technologies such as big data analysis and artificial intelligence provide opportunities to greatly improve quality control processes while new paradigms such as distributed collaboration opens doors to foster better data exchange. The WMO HydroHub will focus its attention on finding and implementing pragmatic solutions which improve operational data management routines within national services and other stakeholders.

The multiplication of software can be relatively cheap, in comparison to sensor hardware, and uptake of solutions that pragmatically implement common tasks can be very fast, especially for free and open source software. Nevertheless, robustness, operational cost

<sup>13</sup> WMO Basic Document No. 1, p. 109, <https://public.wmo.int/en/resources/library/basic-documents-no-1-2015-edition-wmo-no-15>

and ease of maintenance are criteria that apply for software as well. Insufficient recognition of these non-functional requirements often hinder operational use of software.

Limited technology scouting projects can create good examples of robust and useful operational software modules that showcase benefits of applying best practices in ICT development. Open source databases such as MCH (WMO Meteorology, Climatology and Hydrology database system)<sup>14</sup> will be promoted as valuable tools for practical application in selected contexts.

The world wide web, geospatial information technologies, mobile internet and social media allow more direct, more tailored and more interactive service delivery than ever before and have great potential to improve service delivery.

### 3.3 Management Processes

High rates of technological change, increased demand for hydrological information and declining budgets are putting strains on the operational management of observing networks. Many Members are struggling today with the progressing automation of observations, with challenges to maintain sensors or with procedures to rescue historical data. Common gaps are found also in less technical areas including communication with end-users, negotiation of NMHS with their national governments, coordinating national contributions to international frameworks or basics of procurement and quality management.

UN Water explicitly highlights the importance of governance and management processes to enable and accelerate progress in its Sustainable Development Goals (SDG 6) Synthesis Report 2018 on Water and Sanitation<sup>15</sup>: “Good water governance provides the political, institutional and administrative rules, practices and processes for taking decisions and implementing them.”

Improved management processes and standard operating procedures help to optimize and streamline routine work and are key to sustainable operations. Techniques such as risk based network maintenance and ways of merging information from traditional networks with what can be provided by citizen science approaches, offer opportunities for reducing operating costs and improving service quality. The WMO HydroHub will support the sharing of good management practices by providing case studies, guiding material, templates for recurring administrative tasks and other knowledge products.

## 4 Innovation Activities to Deliver Expected Results

The WMO HydroHub’s innovation activities particularly contribute to the implementation of Strategic Priority Area (SPA) 2 “Embedding Innovation in Hydrometry” as described in the WMO HydroHub Strategic Plan 2018-2020, Section 6.2. This chapter lists the most relevant activities contributing to the three Expected Results of SPA 2.

<sup>14</sup> <http://www.wmo.int/pages/prog/hwrrp/mch/index.php>

<sup>15</sup> [http://www.unwater.org/publication\\_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/](http://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/)

## Strategic Priority Area 2: Embedding Innovation in Hydrometry

**Goal:** The WMO HydroHub strengthens fit for purpose and sustainable monitoring capabilities through innovation in applied monitoring systems for the benefit of local water users and national hydromet services, as well as decision-makers at the national, transboundary and global level.

### 4.1 Expected Result 2.1

Expected Result 2.1	An innovation fund is established to allow to flexibly invest into efforts that support innovation in hydrometry and data sharing.
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#### 4.1.1 Innovation Projects and Calls

Leveraging its position as an externally funded project operating from within the WMO community, the WMO HydroHub can systematically identify obstacles and missing tools and directly intervene to implement suitable pragmatic solutions.

Innovation projects will be funded to demonstrate the advantages of new technologies, showcase the benefits of innovative approaches in management or to provide operational tools that close omnipresent gaps that significantly obstruct work on the ground.

Successful implementation of an innovative concept will bring valuable lessons learned that can feed into WMO's regulatory process and development frameworks. An innovation call on hydrometry could exemplify how non-standard data can be integrated in traditional forecasting models or the application of modern ICT paradigms could enrich discussions in the relevant WMO commissions. Good practices and guidelines derived from these practical experiences will be shared with and between users that contribute to a community of practice of hydrometry practitioners.

Innovation projects will take a wide variety of shapes:

- A specific recurrent gap or obstacle has been identified and implementers can be found through a request for proposals of an innovation call. Hands-on tools are implemented and released under open source licenses that allow for free reuse in operations, projects and research, avoiding future redundant implementations.
- In an open call for innovation, specifying an area of interest rather than a concrete deliverable, innovators describe a gap or obstacle together with an approach for an innovative solution. Projects are selected by their expected impact on the ground and the potential that outcomes can be successfully up-scaled.
- A case study or market research is conducted. The resulting documentation can be used to guide e.g. a procurement process for technologies or software tools, as input to create good practices and template material for wide reuse, or documentation and software for use in education and training.

To finance these projects, a flexible source of funding is needed allowing to react faster and more directly to an identified need than it is usually possible in the context of development projects. For this purpose, a multi-donor innovation fund will be established. A number of successfully implemented innovation activities, such as Innovation Calls, together with a clearly communicated strategic direction and an elaborate portfolio of future activities will allow potential donors to invest in the innovation fund without

knowing what exact deliverables will result from their contribution. Trusted partnerships and the credible brands of *WMO* and *WMO HydroHub* will have to be established and maintained to be successful.

The success of the innovation fund over time will strongly depend on the ability to systematically develop a portfolio of innovation projects within the strategic innovation areas and launch successful innovation calls for their implementation. The *WMO HydroHub* will continually monitor its information sources to identify challenges, assess their impact and find partners to implement solutions. In addition, public idea contests and dedicated workshops can be source of input for innovation call themes.

The intellectual property created through the Innovation Fund (and other *WMO HydroHub* activities) will generally be made available under adequate open-source licenses that also demand to make derivative products available under such license.<sup>16</sup> Doing so constitutes a significant advantage supporting the creation of open-source tools because it requires any entity that improves or commercializes *WMO HydroHub* solutions to re-share their products, hence contributing to the freely available tools. This mechanism is especially desirable in the development context, since it fosters cooperation instead of competition.

Further details concerning the Innovation Fund including resource mobilization aspects and risk management considerations will be covered in separate documents.

## 4.2 Expected Result 2.2

Expected Result 2.2	Improved collaboration between NMHSs, the research community and the private sector in the area of hydrometric innovation.
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### 4.2.1 Community of Practice

Recognizing the potential of online collaboration, the *WMO HydroHub* aims to provide a platform that allows Members' experts to engage and assist each other – see *WMO HydroHub Strategic Plan 2018-2020*. The platform will help connect the global water monitoring community, thus benefiting all aspects of the *HydroHub*. In the context of the *HydroHub's Innovation Strategy*, the Community of Practice will, once implemented, help experts to produce mutual support around the use of new technologies and approaches and provide a forum for new ideas.

Direct communication on working-level between operational hydrologists and innovators will complement more traditional international collaboration in the *WMO* context that is typically carried out by higher-level staff members of NMHS. The CoP will not only enable its users to get hands-on advice from other practitioners but will also represent a unique tool for the diffusion of innovative solutions created by the *WMO HydroHub* – helping revealing acceptance and impact on the ground and showing how they can be improved.

### 4.2.2 Innovation Workshops

The *WMO HydroHub* will convene Innovation Workshops<sup>17</sup> which bring experts from different communities together to identify and solve coordination issues between communities with the goal to increase mutual understanding. Workshop themes will be selected from the whole data value chain, allowing innovators and entrepreneurs from

<sup>16</sup> e.g. Creative Commons Share-Alike (cc-by-sa), <https://opendefinition.org/licenses/cc-by-sa/>

<sup>17</sup> Innovation Workshop 2017: <https://public.wmo.int/en/events/workshops/innovation-hydrometry-from-ideas-operation>

private sector, academia and experts from NMHS to discuss a wide variety of topics relevant to operational hydrometry.

Where possible the WMO HydroHub will jointly organize its Innovation Workshops with at least one partner that is not directly part of the WMO community so as to maximize the input of different ideas and viewpoints.

Exposing different communities to each other can be a very fruitful exercise to reveal barriers and understand different points of view. Innovation Workshops can be a way to generate innovative ideas how to overcome these barriers, improve communication and align future efforts.

The next Innovation Workshop will be co-organized with the International Association of Hydrological Sciences (IAHS) and take place in New York in March 2019.

#### 4.2.3 Innovation Camps

The WMO HydroHub will organize Innovation Camps which bring together operational hydrologists and innovators for a period of between three days to a week. The Camps will focus on a well-defined problem and allow participants to jointly generate ideas and convert them into innovative solutions over the period of the event. Dependent on the problem of focus the events may take the form of a hackathon, data deep-dive or field based sensor development, trials and intercomparisons. Output may include software, prototypes of a sensor or other tools which will then be shared with the wider community.

Innovation camps are especially suited to support early career scientists and parallel subject experts that may create surprising and exciting results, while deepening their understanding by taking a different point of view on their subject matter.

### 4.3 Expected Result 2.3

Expected Result 2.3	Removal of barriers to the use of innovative technologies by NMHSs and others collecting hydrometeorological data.
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#### 4.3.1 Standardization and WMO Regulations

Technical regulations, manuals and guides are a most valuable resource for NMHSs when establishing, maintaining and operating observing networks. Issued by WMO's CHy together with the WMO Commission for Instruments and Methods of Observation (CI MO) or by other standardization bodies such as OGC<sup>18</sup>, ISO<sup>19</sup> and CEN<sup>20</sup>, these materials inform the procurement of observation equipment and design of monitoring practices so as to ensure the resulting measurements are comparable around the world.

While alignment of efforts in a global community is crucial, regulations can also be powerful barriers for innovation. It is a constant challenge to formulate concise regulations that effectively facilitate international collaboration without excluding innovative solutions.

To help integrate innovative monitoring technologies and techniques into operational practice, the WMO HydroHub will work with partners to explore ways of adapting current standards and regulations. The integration of low-cost technologies in an existing observing system, when cost-effectivity is of major importance, or combination of new

<sup>18</sup> Open Geospatial Consortium, <http://www.opengeospatial.org/>

<sup>19</sup> International Organization for Standardization, <https://www.iso.org/>

<sup>20</sup> European Committee for Standardization, <https://www.cen.eu/>

data sources such as citizen observations with data from traditional observing systems, represent just two areas where this could help. These applications are currently not covered in WMO regulations, and existing provisions might even prevent their use in a practical context.

Opening up the discussion towards assessing and classifying inherent properties of observation data, such as measurement accuracy and enhancing metadata, will help to select the most appropriate technology for a given application. The selection may e.g. be based on a compromise between observation accuracy and economic considerations. Objective recommendations or the establishment of an assessment and certification scheme would communicate expectations and capabilities and lead to a strengthening of the position of academia and small and medium-sized enterprises (SME) in the market.

The WMO HydroHub plans to feature up to four case studies of partner organizations<sup>21</sup> on its website until the end of 2019.

Figure 2 shows graphically the WMO HydroHub innovation activities in context of other relevant activities that the WMO HydroHub either contributes to or is influenced by (shown in gray). It follows the innovation value chain from the left (idea generation) through the creation of new solutions (idea conversion) to upscaling and sustainable operations on the right (idea diffusion). Activities are stacked according to the three dimensions of innovation management from operational, at the bottom, through strategic and normative, at the top. The figure shows that the WMO HydroHub identified important aspects through-out this whole space.

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<sup>21</sup> such as <https://www.imomohub.com/case-studies>

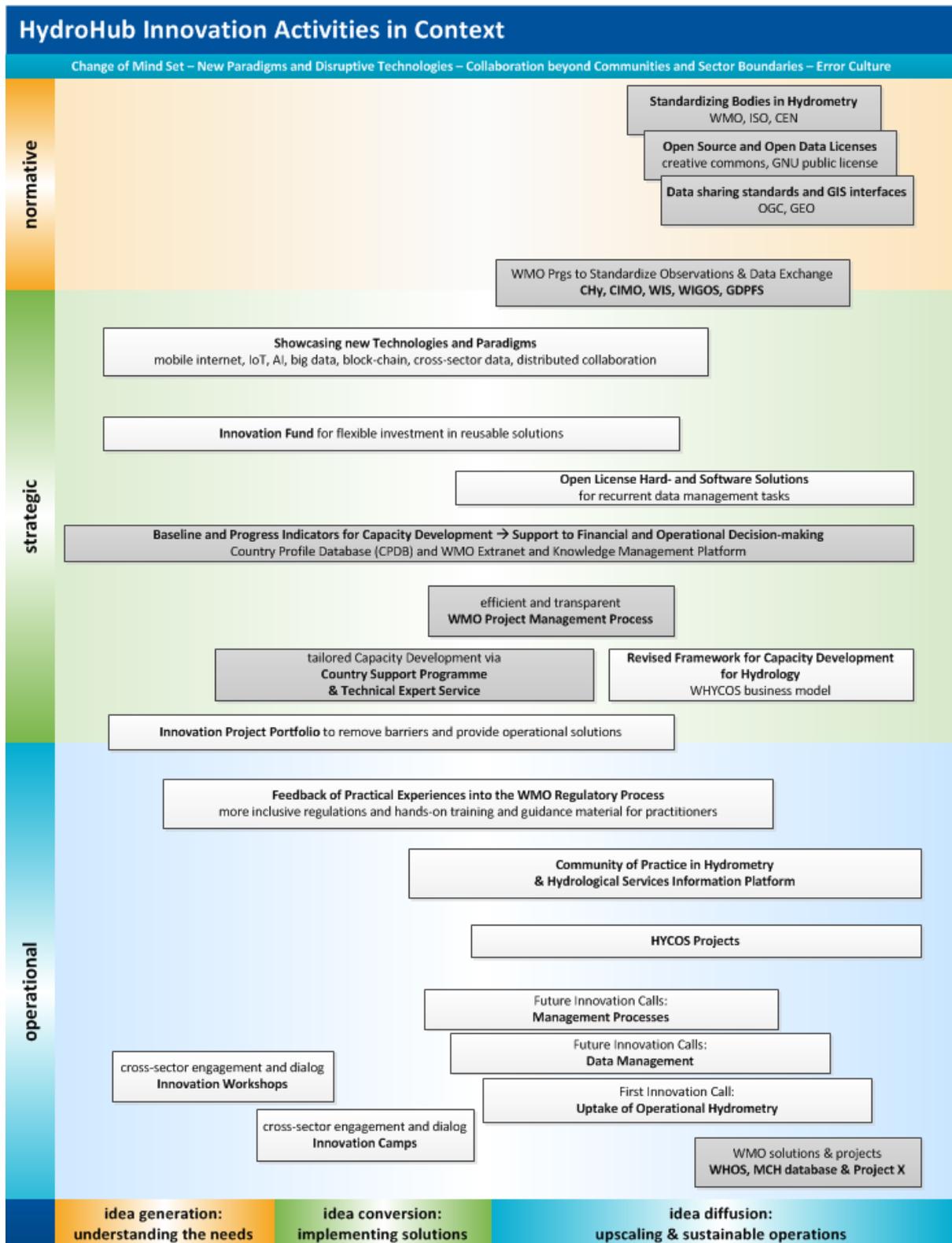


Figure 2: WMO HydroHub Innovation Activities in Context from ideas to operations with relevant external activities

## 5 Contribution to other Strategic Priority Areas

The WMO HydroHub’s Strategic Plan 2018-2020 is structured around five Strategic Priority Areas. While innovation activities are focused around delivering Strategic Priority

Area 2, innovative approaches are a cross-cutting theme and contribute also to other SPAs.

Ref.: 04396/2018-3.4 CLW

### Strategic Priority Area 1: Building Hydrological Monitoring Capacity

**Goal:** The WMO HydroHub provides an efficient, innovative and sustainable framework to support operational systems in hydrometry and water monitoring of national hydromet services.

An important goal of the evolution of the WHYCOS programme is to increase sustainability of HYCOS<sup>22</sup> project deliverables. The WMO HydroHub will target increased use of new technologies and approaches in future HYCOS projects by promoting the use of outputs from Innovation Projects once they have reached operational maturity and involving staff from HYCOS project regions in Innovation Workshops and Camps. Furthermore the experiences gained from HYCOS projects will form an important source of information for the WMO HydroHub's innovation projects (Section 4.1.1) by providing evidence of specific technical requirements and typical issues faced in development projects. Using this information the WMO HydroHub will be able to align future Innovation Fund calls, workshops and camps to target improvements with areas of HYCOS project need.

### Strategic Priority Area 3: Enabling Hydrometeorological Data Sharing

**Goal:** The WMO HydroHub supports the free and open sharing of hydrological data around the world.

Increased willingness to share data freely and openly can be driven by provision of cost-effective, easy to implement technical solutions that greatly reduce the initial hurdle to contribute. This can be achieved by supporting the development and application of existing data exchange and processing solutions, including WHOS and MCH, but also by targeting innovative tools for information management. Selected recurrent tasks that can be implemented in open source software projects, such as data logger firmware or data format converters, could be a target for dedicated innovation projects (Sections 4.1.1).

### Strategic Priority Area 4: Connecting the Global Water Monitoring Community

**Goal:** The WMO HydroHub supports improved collaboration and information sharing within the NMHS community in order to increase the quality and sustainability of water monitoring.

The WMO HydroHub's Innovation Workshops, Camps and Projects will, along with the Community of Practice, play a key role in supporting direct interaction between information providers and consumers. Technical staff members of NMHS will be brought together with each other and with experts from WMO working bodies as well as private sector and academia.

The figure on the following page exemplifies how WMO HydroHub activities collect data and exploit information to establish an environment supporting the different stakeholders to take informed decisions.

Stakeholders comprise beneficiaries of innovative solutions and improved information services incl. policy-makers and civil society, as well as implementing partners and donor agencies funding innovation.

<sup>22</sup> HYCOS projects implement the WHYCOS programme

Baseline information for idea generation and gap analysis is collected, a tracking over time allows for impact assessment. Positively assessed outputs are collected in good practices and lessons-learned that feed into the regulatory process.

Ref.: 04396/2018-3.4 CLW

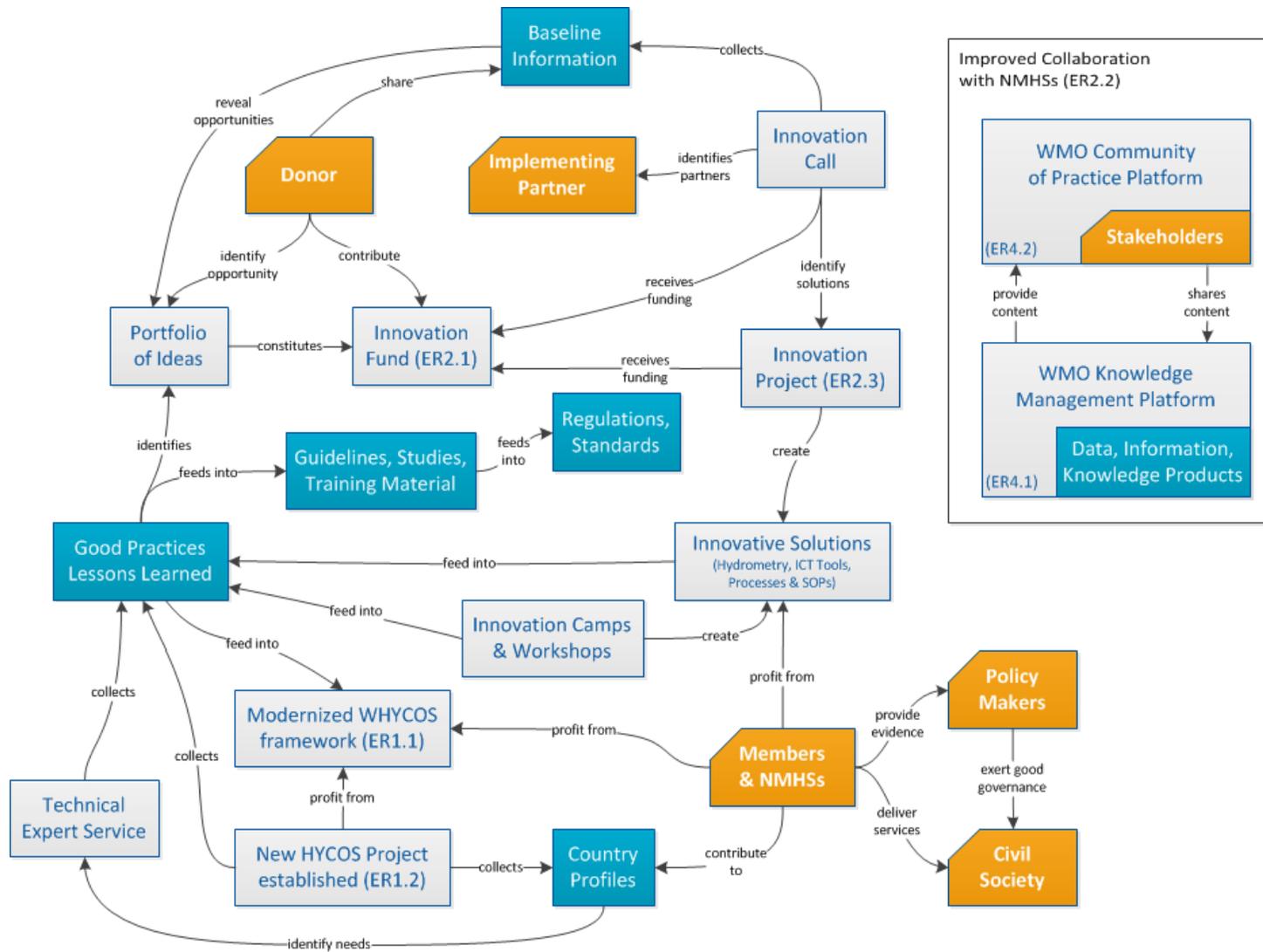


Figure 3: WMO HydroHub activities in context with stakeholders

## 6 Innovation Roadmap

Activities	2018	2019	2020
Innovation Strategy	Finalized and approved by AC	Periodic updates	Periodic updates
Innovation Calls	Process defined and documented First call launched One/two projects awarded	Revision of process One new call launched Project delivery	Revision of process One new call launched Project delivery
Innovation Fund	Fund defined and documented Webpage published Portfolio of activities created Engage with potential donors on concrete call subjects	Fund established Funding collected from more than one donor, target 200k Continuous update of portfolio	Funding collected from more than one donor target 200k Continuous update of portfolio
Innovation Workshops & Camps	One inter-communities workshop / camp organized Lessons learned, guidelines etc. published	Joint WMO/IAHS event March 2019 in New York	One Innovation Workshop or Camp
Community of Practice	Communities: partnering with Int. Hydrometry Network, Climate Services Partnership (CSP) and others Implementation: (Integrate in WMO project) concept agreed with CPDB/Extranet project team	First implementation ready first users on the shared platform Migration of existing CoPs Approval of WMO Members for extended scope of CPDB/Extranet	Extended CoP functionality available for users 3-4 active communities
Partner Case Studies	publish one study on the WMO HydroHub website	publish three more studies on the WMO HydroHub website	publish two more studies on the WMO HydroHub website

Note: Outputs from all activities should be published in an appropriate form such as guidelines, reports, lessons learned, on the WMO HydroHub's website and through WMO's social media channels (see WMO HydroHub Communication Strategy 2018-2020).

## 7 Abbreviations and Acronyms

Abbr./Acr.	Description
AC	WMO HydroHub Advisory Council <a href="http://hydrohub.wmo.int/en/members-advisory-council">http://hydrohub.wmo.int/en/members-advisory-council</a>
CEN	European Committee for Standardization <a href="https://www.cen.eu/">https://www.cen.eu/</a>
CHy	WMO Commission for Hydrology <a href="https://public.wmo.int/en/our-mandate/how-we-do-it/technical-commissions/commission-hydrology-chy">https://public.wmo.int/en/our-mandate/how-we-do-it/technical-commissions/commission-hydrology-chy</a>
CIMO	WMO Commission for Instruments and Methods of Observation <a href="https://public.wmo.int/en/our-mandate/how-we-do-it/technical-commissions/commission-instruments-and-methods-of-observation-cimo">https://public.wmo.int/en/our-mandate/how-we-do-it/technical-commissions/commission-instruments-and-methods-of-observation-cimo</a>
CoP	Community of Practice
COTS	Commercial Off-The-Shelf products
CPDB	WMO Country Profile Database <a href="https://www.wmo.int/cpdb/">https://www.wmo.int/cpdb/</a>
CSP	Climate Services Partnership <a href="http://www.climate-services.org/">http://www.climate-services.org/</a>
GDPFS	WMO Global Data-processing and Forecasting System <a href="http://www.wmo.int/pages/prog/www/DPS/gdps.html">http://www.wmo.int/pages/prog/www/DPS/gdps.html</a>
GIS	Geographic Information System
GISC	WMO Global Information System Centers <a href="http://www.wmo.int/pages/prog/www/WIS/GISCs_en.html">http://www.wmo.int/pages/prog/www/WIS/GISCs_en.html</a>
HYCOS	WHYCOS component projects e.g. <a href="https://public.wmo.int/en/resources/bulletin/case-study-implementation-of-igad-hycos-project-uganda">https://public.wmo.int/en/resources/bulletin/case-study-implementation-of-igad-hycos-project-uganda</a>
HydroSOS	WMO Global Hydrological Status and Outlook System <a href="http://www.wmo.int/pages/prog/hwrrp/chy/hydrosos/index.php">http://www.wmo.int/pages/prog/hwrrp/chy/hydrosos/index.php</a>
IAHS	International Association of Hydrological Sciences <a href="https://iahs.info/">https://iahs.info/</a>
IC	WMO HydroHub Innovation Committee <a href="http://hydrohub.wmo.int/en/members-innovation-committee">http://hydrohub.wmo.int/en/members-innovation-committee</a>
ICT	Information and Communication Technology
iMoMo	Innovative Technologies for Monitoring, Modeling and Managing Water <a href="https://www.imomohub.com/">https://www.imomohub.com/</a>
ISO	International Organization for Standardization <a href="https://www.iso.org/">https://www.iso.org/</a>
MCH	Meteorological, Climatological and Hydrological database mgmt. system <a href="https://public.wmo.int/en/resources/bulletin/mch-database-management-system">https://public.wmo.int/en/resources/bulletin/mch-database-management-system</a>
NMHS	National Meteorological and Hydrological Services
OGC	Open Geospatial Consortium <a href="http://www.opengeospatial.org/">http://www.opengeospatial.org/</a>
OPACHE	Open Panel of WMO Commission for Hydrology Experts <a href="http://www.wmo.int/pages/prog/hwrrp/chy/opache.php">http://www.wmo.int/pages/prog/hwrrp/chy/opache.php</a>
OSCAR	WMO Observing Systems Capability Analysis and Review Tool <a href="https://oscar.wmo.int/surface/">https://oscar.wmo.int/surface/</a>
Project X	Project for the Assessment of the Performance of Flow Measurement Instruments and Techniques <a href="http://www.wmo.int/pages/prog/hwrrp/meetings/MC1-Project_X.php">http://www.wmo.int/pages/prog/hwrrp/meetings/MC1-Project_X.php</a>
SDC	Swiss Agency for Development and Cooperation <a href="https://www.eda.admin.ch/sdc">https://www.eda.admin.ch/sdc</a>
SDG	United Nations Sustainable Development Goals <a href="https://sustainabledevelopment.un.org/">https://sustainabledevelopment.un.org/</a>
SME	Small and medium-sized enterprises
SOP	Standard Operating Procedure
SPA	HydroHub Strategic Priority Area cf. HydroHub Strategic Plan 2018-2020
TCO	Total Cost of Ownership
TEB	Tender Evaluation Board

Abbr./Acr.	Description
ToR	Terms of Reference
UNHCR	United Nations High Commissioner for Refugees <a href="http://www.unhcr.org/">http://www.unhcr.org/</a>
WDQMS	WIGOS Data Quality Monitoring System <a href="http://www.wmo.int/pages/prog/www/wigos/tools.html">http://www.wmo.int/pages/prog/www/wigos/tools.html</a>
WHOS	WMO Hydrological Observing System <a href="https://public.wmo.int/en/our-mandate/water/whos">https://public.wmo.int/en/our-mandate/water/whos</a>
WHYCOS	WMO World Hydrological Cycle Observing System <a href="http://hydrohub.wmo.int/en/whycos/">http://hydrohub.wmo.int/en/whycos/</a>
WIGOS	WMO Integrated Global Observing System <a href="http://www.wmo.int/pages/prog/www/wigos/index_en.html">http://www.wmo.int/pages/prog/www/wigos/index_en.html</a>
WIS	WMO Information System <a href="http://www.wmo.int/pages/prog/www/WIS/">http://www.wmo.int/pages/prog/www/WIS/</a>