THE
WMO STRATEGY FOR SERVICE DELIVERY

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PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide a World Meteorological Organization (WMO) Strategy for Service Delivery that will assist National Meteorological and Hydrological Services (NMHSs) in the provision of weather-, climate- and water-related services to the public and decision-makers. The Strategy incorporates assessment of user needs and the application of performance metrics.

While there is no prescriptive way to provide services, the Strategy serves as a foundation to improve service delivery by sharing best practices, supporting mutually agreed upon guidelines, and by increasing user engagement throughout the delivery process, recognizing the many differences in cultures, structures, operational practices, resource and development levels across NMHSs.

This Strategy, which is at once broad yet flexible, seeks to do two things: (1) serve as a tool for evaluating current service delivery practices; and, (2) serve as high-level guidance for developing more detailed methods and tools for better integrating users into the service delivery process. It is adaptable to the unique needs of providers in both developed and developing countries, regardless of who the users are and whether providers deliver public or commercial products and services. The role of the WMO Secretariat in the implementation of this Strategy is to serve as facilitator and coordinator.

INTRODUCTION

The bottom line for most government organizations is their mission. To achieve the mission, organizations need resources, but resources are often in short supply and must be shared among competing organizations. This competition for scarce resources requires NMHSs to demonstrate their value by realizing cost efficiencies while delivering high-quality, useful products and services. Policy-makers and the public continually assess the effectiveness of NMHSs based on their ability to meet the service delivery standards of the nations they serve. By incorporating the role of users and customers in day-to-day operations, those customers and users are more likely to receive services that meet their needs.

The ability of NMHSs to meet national service needs is put to its most critical test when an extreme hydrometeorological event occurs. Even the best forecast, issued on time, is no defense if, for various reasons, it did not generate the desired response from those at risk. In other words, the forecast had little impact. Most of the utility of weather-, climate-, and water-related information occurs in communicating the information to users and the response of those users based on information received. Ultimately, the utility of weather-, climate-, and water-related information is the degree to which it has a beneficial impact on societal and economic outcomes. If the currently available information is underutilized, value can be increased by improving the forecast, improving communication, and by improving the decision-making process. Effective service delivery, then, is about providing products and services that bring utility to users and customers.

Much has been done for service delivery by the WMO through various international and regional institutions, programmes and structures, such as World Meteorological Centres (WMCs) and Regional Specialized Meteorological Centres (RSMCs), to prepare and provide products to serve as a basis for NMHSs to use in the provision of services. Similarly, at the national level, many NMHSs have focused significant efforts on improving service delivery by building relationships with various user communities to better understand and respond to their needs.

The present Strategy seeks to build upon and institutionalize such practices to strengthen service delivery across the entire WMO by describing key strategy elements and activities related to a service-oriented culture. The Strategy focuses on understanding the users' value chain to gain knowledge about users, the decisions they must make, and how weather-, climate-, and water-related information is applied to minimize risk and realize benefits not only to

a specific user group but also to society as a whole. With this knowledge, service providers are able to develop, produce and deliver services that are useful, relevant and responsive. NMHSs are able to measure the value of their information to society and continually evaluate and improve upon services. Adopting a more collaborative approach provides everyone in the service delivery process – providers, users, and partners – with a clear understanding of service needs.

LINK TO THE WMO QUALITY MANAGEMENT SYSTEM (QMS) FRAMEWORK

WMO encourages NMHSs to implement Quality Management Systems (QMS) and has defined a Quality Management Framework (QMF) to provide advice on development and use of QMS relevant to meteorological and hydrological organizations. The ultimate goal of a QMS is to encourage and to support the continual improvement of product and service quality, focusing on quality control, quality assurance and quality improvement.

Quality management assesses not only the final product or service but the series of steps or operations that occur for the final product or service to be produced and delivered in a manner that satisfies the customer. The insight gained through quality management allows NMHSs to find, fix, and prevent failure that might lead to a faulty product or service. In the context of weather services, for example, the processes that make up a weather forecast and service delivery are:

- Data collection and analysis;
- Modeling for prediction;
- Model interpretation and forecast production;
- Dissemination of products and services received by users; and,
- Understanding and use of forecasts.

To improve the quality of weather products and services, NMHSs must assess and analyze each step and sub-steps of the forecast process to determine where root problems may exist and how better to correct them. For example, QMS processes may find that a high-quality product is of marginal use because it is not received by the user in time for decision-making.

Improvements in service delivery, then, are a natural consequence of using QMS. The WMO Strategy for Service Delivery may be viewed as a supplement to the WMO QMF. Even if NMHSs have no internal or external requirement to apply QMS, this strategy stands alone as a useful tool to improve overall effectiveness of products and services and customer/user satisfaction.

AN EXAMPLE OF BASIC APPROACH TO QMS

The Malaysian Meteorological Service (MMS) has implemented a process-based QMS at the Kuala Lumpur International Airport (KLIA) Forecast Center as a means of institutionalizing effective service delivery. MMS implemented a QMS to improve the provision of consistent products and services that meet customer requirements; to improve customer satisfaction through continuous process improvement; and to establish quality metrics to measure, review, and control the forecasting processes.

The top management of the MMS is responsible for the QMS processes and is constantly upgrading its effectiveness through:

- Identifying customer needs and ensuring customer/client satisfaction through questionnaires, feedback, and reviews;
- Regular communication with Regional Forecast Offices to ensure and fulfil customer satisfaction achieved through various avenues like meetings, staff discussions, training, etc.;
- Determining the quality policy and objectives;
- Conducting management reviews; and,
- Identifying and ensuring availability of resources like skilled personnel, infrastructure, finances, training and internal audit teams.

WHAT IS SERVICE DELIVERY?

Defining service delivery first requires a common definition of service, which this Strategy defines as a product or activity that meets the needs of a user or can be applied by a user. To be effective, services should possess these attributes:

- **Available and timely:** at time and space scales that the user needs;
- **Dependable and reliable:** delivered on time to the required **user** specification;
- **Usable:** presented in user specific formats so that the client can fully understand;
- **Useful:** to respond appropriately to user needs;
- **Credible:** for the user to confidently apply to decision-making;
- **Authentic:** entitled to be accepted by stakeholders in the given decision contexts;
- **Responsive and flexible:** to the evolving user needs;
- **Sustainable:** affordable and consistent over time; and,
- **Expandable:** to be **applicable** to different kinds of services.

Service delivery, then, is a continuous, cyclic process for developing and delivering user-focused services. It is further defined in four stages:

- **Stage 1: User Engagement** - identifying users and understanding their needs, as well as understanding the role of weather, climate, and water-related information in different sectors;
- **Stage 2: Service Design and Development** - process between users, providers, suppliers, and partners of creating, designing, and developing services, ensuring user needs are met;
- **Stage 3: Delivery** - producing, disseminating, and **communicating** data, products and information (i.e., services) that are fit for purpose and relevant to user needs; and,
- **Stage 4: Evaluation and Improvement** - process to collect user **feedback** and performance metrics to continuously evaluate and improve upon products and services.

Specifically related to weather-, climate- and water-related services the following four principles embody effective service delivery:

- User engagement and feedback are essential in designing and delivering effective services;
- Sharing best practices leads to effective and efficient service design and implementation;
- Partnership with other international and regional organizations also engaged in delivering services is essential in maximizing the use of weather, climate and water information for decision-making; and,
- The concepts and best practices of service delivery are applied to all WMO activities and accepted by the entire WMO.

AN EXAMPLE OF COLLABORATION AMONG DIFFERENT AGENCIES

The National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation in the United States developed the Communicating Hurricane Information Program (CHI) to focus on advancing the understanding by decision makers (e.g., emergency managers, elected officials) and the general public of hurricane outlooks, forecasts, watches, and warnings. The program illustrates how national agencies can partner to support integrated weather-society work that advances fundamental understanding and addresses agencies' needs in fulfilling their missions.

MOVING TOWARD A SERVICE-ORIENTED CULTURE

This Strategy defines six elements and associated high-level activities necessary for moving towards a more service-oriented culture. The elements should assist providers in identifying current areas of success, which may be shared as best practices across the WMO, and areas where improvements are needed. The elements and suggested activities described below serve as a framework to guide the development of implementation plans that provide more

detailed processes, methodologies, and tools.

WORKING WITH USERS IN DESIGNING AND DEVELOPING PRODUCTS - THE LEARNING THROUGH DOING (LTD) PROJECT OF CHILE

Since 2008, the Meteorological Service of Chile (DMC) has been working with the Public Weather Services Programme (PWSP) of WMO to implement the Learning Through Doing (LTD) project with the objective of enhancing Service Delivery to the fisheries, agriculture and transport sectors. The Project is based upon engaging users from these sectors with a view to determining their needs and requirements, and to design and produce improved products to meet those needs. It also focuses on enhancing the dissemination and communication channels to ensure that the users access products easily. Multidisciplinary teams have been formed between DMC and the user sectors to steer the implementation of the project.

For example, regarding the transport sector, services target the Los Libertadores Border Complex which serves daily flow of traffic between Argentina, Brazil, Paraguay, Uruguay and Chile. Users for meteorological products and services include the public transport services, tourists, freight transportation companies, and passengers. The needs of each of these users are different, which requires different products and services to meet their specific needs.

The new line of products designed, consists of daily weather forecasts and weather warnings. The full report including all the sectors is available at: http://www.wmo.int/pages/prog/amp/pwsp/Activities_and_Reports_en.html

As of 2010 the project had developed 22 new meteorological products and services; improved professional and technical skills in designing and implementing products and services improvements; and enhanced dialogue and cooperation between users with the DMC, resulting in increased uptake of meteorological products and services.

Strategy Element 1. Evaluate User Needs and Decisions

At the core of effective service delivery is the user of weather-, climate- and water-related information. Users take many forms – from the general public to government ministries, military, and private industry. Many NMHSs serve customers and users in government, including disaster management, agriculture, transportation, health, and tourism. NMHSs may also engage with intermediaries, such as the media, who represent a user group or who further develop products and services for end-users. The role of the provider is to identify those users, including intermediaries, understand what they need, and how NMHSs can meet those needs, either individually or in partnership with other providers and partners. The evaluation of user needs is not a one-time requirement but a continuous and collaborative part of the service delivery process.

Key Activities for Accomplishing

Depending on the user group, the provider should develop regular opportunities to engage with users to discuss needs, and performance. These are opportunities for the provider to better understand the user's business, including: their mission and goals; the types of decisions made on a regular basis; how risk is managed; and how the provider's services may contribute.

Typical questions to ask of any user or customer are:

- What is your mission?
- How do you do it?
- What are your goals and how can we contribute?
- How do you use our services?
- How can we make it work better?
- What types of decisions do you have to make?
- What would help you make better decisions?
- How do you measure success?

Providers should facilitate communication and use of weather-, climate-, and water-related information, and in some cases, provide training on specific products and services. User engagement is also a good opportunity to discuss, promote, and facilitate interdisciplinary research and development efforts for user-specific products and services.

How to engage users will vary by user group and by country. Interactions may be

formal or informal, in-person or virtual, and may occur through user forums, focus groups, workshops, meetings, conferences, surveys, correspondence, or face-to-face with individual users. Frequency will vary, but must be ongoing and most likely more than once a year. Engagement should include not only the users, but also partners, such as private sector organizations and the media, and other government organizations as necessary.

AERONAUTICAL METEOROLOGICAL SERVICES

Customer focus is the first and foremost of the quality management principles to be adopted by aeronautical meteorological service providers. Customer requirements are documented through relevant ICAO and national regulatory bodies, and the quality of services as perceived by the customers is monitored. The means to achieve this include verification and evaluation processes, the conduct of regular customer satisfaction surveys, liaison group meetings with representatives of the customers (e.g., pilots, dispatchers, air traffic personnel, civil aviation regulators, etc.) and visits to the operation facilities of airlines and to meteorological offices. User suggestions and feedback are formally recorded and followed up. A formal response is given to the user before a suggestion or feedback is considered closed. Specific to aviation, the liaison group meetings also provide a forum for considering and documenting agreements on local arrangements in the provision of the aeronautical meteorological services as stipulated in ICAO Annex 3 / WMO Technical Regulations [C.3.1]. This user engagement process also goes a long way in satisfying the audit requirements of the Quality Management System and aviation safety oversight.

Services for airports could be considered an area for improvement. These are not covered by ICAO regulations except for TAFs and basic warnings, and have to be agreed between airport operators and service providers. This can lead to difficult situations when airports experiencing serious disruptions by weather elements are either not relying on met information at all in their operations, or receive them from independent service providers which are not coordinated with the services for airlines and air traffic management.

NMHSs should leverage existing WMO guidance and tool kits (see Appendix B), as well as new guidance and best practices coordinated by the WMO Secretariat to build a core set of service delivery criteria. NMHSs should develop methods and tools to document and validate user needs and expectations and to communicate them within the organization and to other partners as necessary. User needs should then be converted into requirements to be met by existing or new products and services.

User requirements should be evaluated to ensure that they fall within the mission of NMHSs and that NMHSs have the capability to meet those requirements. Evaluating user needs for such purposes is what this Strategy calls *fit for purpose*. NMHSs should not evaluate user needs in isolation, but do so collaboratively with users, providers, and partners. *Fit for purpose* demonstrates an agreement, either implicitly or explicitly, among all involved and acknowledges some or all of the following:

- Current and evolving user needs;
- Provider capabilities, including strengths and limitations;
- What services will be provided and how they will be provided;
- How services will be used;
- Expectations of acceptable outcomes and provider performance;
- Acceptable cost or level of effort; and,
- Risks inherent in applying information to decision-making.

TEMPLATE FOR BASIC COMPONENTS OF A SERVICE LEVEL AGREEMENT

ARTICLE I. PARTIES
Describe the parties involved in the SLA

ARTICLE II. SCOPE

Section 2.01 Scope
Describe the purpose and extent of the SLA

Section 2.02 Assumptions
Define any assumptions that underlie the defined scope

Section 2.03 Goals and Objectives
Describe what the parties are expecting to accomplish with the SLA

ARTICLE III. ROLES AND RESPONSIBILITIES
For all parties involved in the SLA, describes the role of each party and the responsibilities for supporting the SLA and delivering the products and services defined within

ARTICLE IV. EFFECTIVE DATE AND TERM
The date the agreement is effective its duration

ARTICLE V. DELIVERY AND PERFORMANCE
Describe in detail what each party is responsible for delivering and the key performance indicators to ensure compliance

ARTICLE VI. REPORTING, REVIEWING AND AUDITING
Describe oversight and reporting on the agreement; when the agreement should be reviewed, and reporting points of contact

ARTICLE VII. COST / FUNDING AND PAYMENT
Document costs associated with the SLA, who is responsible for paying, or funding, and when payment should occur. Cost may be broken down by specific line-items, such as labor, supplies, equipment, travel, training, etc.

ARTICLE VIII. CHANGES AND MODIFICATIONS
Describe the process by which changes or modifications will be made to the SLA and who is responsible for making changes

ARTICLE IX. TERMINATION
Describe terms for termination of the SLA and the process for terminating

NMHSs have limited resources and capacity, and therefore cannot be expected to provide everything to everyone. A clear *fit for purpose* understood by all parties sets clear expectations and minimizes risk for NMHSs while achieving the best possible solution for users. If appropriate, NMHSs may want to explicitly outline the agreement reached with the user in a service level agreement. Agreements with other suppliers or partners may be documented in operating level agreements. Such agreements should be prepared in such a way as to reflect the current scientific uncertainties associated with forecasting weather, climate and hydrological events.

Effective user engagement throughout the entire service delivery process builds knowledge of user needs. It also builds an understanding of the impact of weather-, climate-, and water-related information on protecting life and property, sustaining the environment, and promoting economic development and prosperity. This knowledge leads to more effective products and services that are better aligned with external demands with a clear *fit for purpose*.

Strategy Element 2. Link Service Development and Delivery to User Needs

Building knowledge of users is of marginal utility if such knowledge is not integrated into the design, development and delivery of services. NMHSs with service-oriented cultures produce products and services with the user at the center of the development process. This means that NMHSs need processes and tools for translating requirements into tangible products and services and then validating that user needs and expectations are met.

WORKING WITH THE CUSTOMER TO OPTIMIZE FLOOD WARNINGS

Flood forecasting methodology, developed by Schröter et al[1]. (2008) was applied to two small river basins in Austria and Spain. The methodology was based on an assessment of the effectiveness and efficiency of Early Warning Systems (EWS) for flash floods. It focused on the development of optimal alerts through the analysis of trade-offs between the benefits of an increased lead time and the simultaneous decrease of warning reliability associated with the longer lead time. Determining the ability to reduce flood damage was based on a survey of users. The approach considered that the increase in lead time provided valuable opportunity for preparedness and prevention; whereas, the decease of warning reliability would cause economic loss in the case of false alarms. The assessment concluded that increasing lead time for flash flood events does not produce the maximum societal benefits due to the decreasing reliability (i.e., increasing false alarm rate). In fact, to maximize damage avoidance and minimize production loss due to false alarms, the optimal lead time is not the longest lead time. In the Besòs basin in Spain, for example, the optimal warning lead time was two hours. In practice, this is the time where a "watch" becomes a warning.

1 Schröter, K., M. Otrowski, C. Velasco, H.P. Nachtnebel, B. Kahl, M. Beyene, C. Rubin M. Gocht, 2008: Effectiveness and Efficiency of Early Warning Systems for Flash-Floods (EWASE). First CRUE ERA-Net Common Call – Effectiveness and Efficiency of Non-structural Flood Risk Management Measures, 132pp. Available from www.crue-eranet.net

Linking service development and delivery to user needs necessitates an operating model that delivers forecasts and information when and how the user specifies and provides users with the necessary support. Users will have different requirements so the key is to develop an operating model that is flexible and adaptable to wide-ranging and evolving user demands. This includes workforce, systems, technical and physical infrastructures.

One approach is to create a model in the form of a real or virtual co-location of meteorologists and users of weather-, climate- and water-related information who work together to deliver products and services. This approach integrates hydrometeorological information with user-specific data to determine impacts on the public and industry, such as: energy grid management; construction; flood control and urban inundation; hospitals and health practitioners, emergency preparedness and response; transportation; and so forth. Meteorologists may have temporary (short-term) or permanent assignment that enables them to work side-by-side with road management and maintenance specialists, public health experts, emergency responders, and others. The benefit to users is an operational network that evolves to meet specific user needs, forecasts systems targeted to user decisions and an integrated system that aligns weather-, climate- and water-related information with societal and economic impacts and user-specific information.

PUBLIC WEATHER SERVICE PLATFORM - METEOROLOGICAL SERVICE DELIVERY IN THE MEGA CITY OF SHANGHAI

The Shanghai Meteorological Bureau (SMB) of the Chinese Meteorological Administration (CMA) established an Integrated Public Weather Services (PWS) operations platform in 2009 to strengthen the integration between SMB, other agencies and specialized users. The goals of the Platform are: to transform PWS delivery into routine work by specialized duty officers; and to provide highly targeted and tailored services to a variety of institutional, governmental, specialized users and the public.

Under the direction of the Chief Service Officer (CSO), the Platform develops products for decision-making for 26 sectors which include government departments, emergency response agencies, the public, and weather sensitive users. The daily forecasts and warnings dissemination mechanisms for the PWS Platform include SMS (Short Message Service), television, radio, newspapers, magazine, the Web; Basic Grid Unit management system, electronic screens, telephone and fax.

Key Activities for Accomplishing

NMHSs should develop and improve upon processes and tools to document and communicate user requirements to all parties involved, including the research community, developers, partners, budget and finance officials, and others. Users should be brought in at various stages of the design and development process to evaluate and test products and services to ensure that they meet requirements and allow for optimal decision-making.

Processes should be monitored and evaluated. (See Strategy Element 3 for more details on evaluation and monitoring).

To implement this strategy element, consideration should be given by the WMO to leverage existing guidance and best practices to develop a minimum set of standards and benchmarks for the design, development and delivery of products and services that integrate users throughout the process. Using the standards and benchmarks as a basis for evaluation, NMHSs should conduct a current assessment of their service design, development and delivery practices to identify gaps between current practices and the WMO standards. NMHSs should use structured problem solving and process improvement methods (see Appendix B) to develop and implement plans to close service design, development, and delivery gaps. WMO Members are strongly encouraged to share results and experiences obtained through these activities.

Strategy Element 3. Evaluate and Monitor Service Performance and Outcomes

Service delivery does not stop once the product or service has been delivered. User outreach and engagement must continue to ensure that services are received and acted upon and full benefit is achieved by the user. NMHSs should have a core set of metrics to measure the end-to-end-to-end service delivery process and its outputs. Each metric should only measure a specific aspect of the process but collectively, the metrics should enable an organization to demonstrate its strengths and identify its areas for improvement in terms of effectiveness, efficiency, impact, satisfaction, and value to its stakeholders, customers, users, partners, and employees. Specifically, metrics should possess the following attributes:

- **Specific** – Metrics are specific and targeted to the area being measured. For example, a good metric for customer satisfaction would be direct feedback from customers on how they feel about a service or product. A poorer metric would be the number of customer complaints because it is not specific nor a direct correlation to customer satisfaction and, as such, can be misleading;
- **Measurable** – Ability to collect data that is accurate and complete;
- **Actionable** – Metrics are easy to **understand**, interpret, and act upon;
- **Relevant** – Measure only those things that are important **and** relevant to an organization's goals and objectives. A common mistake is to measure everything, which is time consuming and produces meaningless results;
- **Timely** – Metric data can be collected when it is needed;
- **Agreed Upon** – Externally-based metrics should be agreed upon by the NMHSs and **customers**, users, or partners. As discussed under strategy element one, agreeing upon acceptable levels of performance is part of the evaluation of user needs, or fit for purpose;
- **Owned** – Metrics should have clearly identified owners. Ideally these owners should be **individuals** with the ability, influence and resources to take action to ensure targets are met; and,
- **Consistent** – Any two given metrics should not promote conflicting behaviors.

The following are examples of the types of metrics important for evaluating and monitoring service performance:

Forecast Accuracy

A service-oriented culture demands use of accuracy measure from the perspective of the user, which differs from some of the accuracy measures widely applied within the Numerical Weather Prediction (NWP) community. A service-oriented organization should use forecast parameters which have direct impact on users' activities and operations. Accuracy of warnings and of temperature predictions are good examples of 'service-oriented' accuracy metrics. Specific examples currently in use include:

- Rolling average of percentage of forecast maximum and minimum temperatures for today and tomorrow lying within 2 degrees Celsius of actual values; and,
- Measure of Storm-based Tornado False Alarm Rate.

Customer Satisfaction

User engagement is at the heart of a service delivery culture, and measurement of customer, or user, satisfaction is both necessary and hugely useful in assessing performance and areas for future development.

User surveys are already in widespread and regular use within the WMO. Surveys may have several levels of formality, scope and standardization, ranging from frequent customer liaison visits or user workshops, to bulk information gathering exercises using standardized surveys via e-mail, the web or by telephone. Both formal and informal methods for gathering user feedback are appropriate and useful. Surveys may be undertaken at routine intervals, or following a significant weather event. Satisfaction is often situational (environmental or economic) or influenced by public or media perceptions. These external factors can be minimized by using large and representative samples, longer periods of investigation or multiple events. Small-scale and highly-specific customer survey results are best used alongside larger survey results from which statistically valid conclusions can be more easily drawn. Further, customer satisfaction results can prove important when viewed alongside accuracy metrics, highlighting differences between customer perception and technical performance. Specific examples currently in use include:

- Telephone customer satisfaction surveys conducted immediately after a severe weather event has occurred or has been forecast;
- Yearly measure of customer satisfaction as measured on an external benchmarking scheme by an external assessor of public-sector organizations; and,
- Annual mail surveys to external users on quality of web services.

Customer Service

Customer service metrics are related to customer satisfaction, but tend to deal with monitoring the effectiveness of the processes designed to allow continuous feedback from users and customers, rather than the content of the feedback itself. They can also be used to measure various aspects of the contract between NMHSs and their customers. Customer service metrics of these types tend to be well-defined and can be simple to formulate, at least initially, though there should be regular checks for relevance and the targets may need to be finely tuned to ensure they are realistic. Specific examples currently in use include:

- Respond to correspondence from all quarters within a maximum of 5 working days, and answer with courtesy all telephone calls within a maximum of 2 minutes;
- 95% or more of annual average of complaints answered within 28 days; and,
- 85% or more of annual average of all calls to be answered within 20 seconds.

Compliance, Timeliness & Resilience

Metrics of this kind are designed to measure the details of service quality away from conventional measures such as accuracy. These metrics may measure user requirements, mandates, or internal requirements for producing and disseminating data and information. Specific examples currently in use include:

- 100% of Australian Tsunami Bulletins issued from the Joint Australian Tsunami Warning Centre (JATWC) are available to emergency services and the public within 40 minutes of a significant event in the Pacific or Indian Ocean; and,
- Monthly measurement of percentage of METAR and TAF bulletins issued on time.

Reach

As this Strategy identifies, effective services must be available, timely, and useful. Measuring the reach of services demonstrates how well NMHSs deliver products and services that users are aware of and can access. In the case of public weather services, there has traditionally been a reliance on the "push" of information to the wider public via the media – usually television and radio. It is necessary to measure the effectiveness, or reach, of this communication route, and the growing importance of other media, such as the Web, to reach the public. Specific examples currently in use include:

- Percentage of telephone survey responders who affirmatively responded to seeing or hearing a warning for a specific severe weather event;
- Number of referrals to the website from external sites; and,
- Maintain full functionality of public website over 99.5% of the time (three month rolling average).

WORKING WITH THE USERS – KENYA METEOROLOGICAL DEPARTMENT (KMD)

The Kenya Meteorological Department (KMD), through its Public Weather Services (PWS) Division serves the general public and a cross section of specialized users which includes the media, the disaster community, agriculture, energy and health sectors. In order to serve these users effectively, it has taken steps to understand their specific needs and to organize its service delivery operations to respond optimally to such needs. It has accomplished this through carrying out user surveys and increasing interaction with them in training workshops and through the meetings of multidisciplinary teams which have been created for the service delivery improvement.

Over the years, the scope of user groups has expanded and the demand for new products increased. A good example is a recent request by the Kenya National Examination Council (KNEC) for monthly weather forecasts and weekly updates to help them with the logistics of transporting examination papers to remote places using roads that could quickly be rendered impassable by heavy rains. New methods of weather dissemination options such as the RAdio InterNET (RANET) community radio stations have evolved too, serving areas that are highly prone to extreme weather such as flooding and drought. The community radios have been very effective in issuing warnings and forecasts in local languages.

KMD has also focused on public education and outreach through activities such as radio and television discussion programmes and organizing school visits to KMD facilities, in order to prepare the public to respond adequately to warnings.

Impact

Measuring forecast accuracy, timeliness, and reach do not tell the complete story of service delivery effectiveness. Measuring the impact of a product or service demonstrates the value or benefit received, often measured in terms of societal or economic impact. Measuring impact tells NMHSs whether or not their products and services are useful and relevant. Measuring impact may require a significant cultural shift within an organization because it typically uses more subjective methods based in social science. Effective impact metrics

should be based on the input and collaboration from users and partners, including those in the social science community, such as economists and sociologists, who have expertise in measuring social and economic impacts and human behavior. Specific examples currently in use include:

- Decrease in weather-related aviation delays; and,
- Cost avoidance from unnecessary evacuations.

Internal Processes

Good service delivery is reliant on insight into the organization's internal processes. Effective and efficient internal processes have direct impact on the quality of service delivery, the value of products and services, and the cost effectiveness of an organization's day-to-day operations. Measurement of an organization's internal processes should be driven largely by the QMS used, and the key processes defined therein. Specific examples currently in use include:

- Internal and external audits to review ISO9001 capabilities; and,
- Periodic review of research activities by an external committee from the research community.

Milestones

Milestones are also an internal metric often associated with project and programme management. Milestones measure the delivery of a product, service or system, or the completion of a phase, or step, in the delivery of a product, service, or system. They should refer to specific, in-year activities, with new milestones defined and agreed for the new review period. Examples include:

- Provide location forecasts, observations and mountain weather hazards in local languages by end of the fiscal year; and,
- Begin deployment of next generation radar capability in quarter XX of fiscal year YY.

Key Activities for Accomplishing

Once measures are collectively identified and a methodology defined for how data will be collected, NMHSs should collect baseline performance data. Baseline data informs both providers and users of current ability and capacity and serves as input when determining reasonable but stretch targets for future performance. Performance measurement data should be collected and reviewed at regular intervals by everyone in the value chain. NMHSs should use this data to reward and promote success, as well as to modify the service delivery process if performance is not meeting targets.

Care must be given in the design of any performance monitoring system to minimize the number of metrics to the extent possible, and to select metrics that provide the best measurement of service-related outcome. This is often not a simple process and the benefits of such measuring are best realized if the metrics are stable over a reasonably long period. Before implementing a system of performance metrics Members are encouraged to review the experiences of those Members who already have in place such monitoring.

Strategy Element 4. Sustain Improved Service Delivery

Service delivery should continuously evolve, along with user demands and changing external drivers, such as new technologies or science advancements, changing users, and evolving user capacity. For example, if the aviation sector improves its ability to avoid weather systems, thus becoming more weather resilient, the original services to the aviation sector must evolve. Likewise, if a sector becomes more weather sensitive, such as the energy sector, then the services should also reflect that evolution. Evolution of services may also mean that a specific product or service should be retired because it is no longer required by the user, or can be provided more efficiently and effectively by another provider.

Key Activities for Accomplishing

The role of NMHSs is to ensure users are able to reap full benefit of services by promoting, facilitating and coordinating improvements in interdisciplinary research,

observing networks, modeling, and technology. NMHSs should keep users informed of new opportunities and advancements – first to validate that user needs continue to be met, but also to increase user knowledge. This can be achieved through various education, outreach and communication activities and should be part of ongoing user engagement described in element one. NMHSs also have a role in institutionalizing service delivery processes internally and among partners to achieve and maintain service excellence. The application of QMS is an effective tool for institutionalizing processes.

NEW TECHNOLOGIES IN THE SERVICE OF USERS

The Hong Kong Observatory (HKO) has evolved its service delivery by implementing mobile platform and social networking services in 2010. HKO developed an iPhone application named MyObservatory to take advantage of the iPhone's communication capability and its geo-positioning function. In addition to providing weather forecasts and warnings, MyObservatory automatically provides the latest location-specific weather conditions, such as temperature, wind, and weather photos from the weather stations closest to the user. MyObservatory proved hugely popular and was on the top of free download lists for months. HKO also began experimenting with social networking services in 2010 by launching a Twitter service, http://twitter.com/hkobservatory, to issue weather warnings and disseminate information. The number of HKO's Twitter "followers" grew from a few hundred to thousands in a couple of months and continues to increase. By evolving their service delivery methods to meet changing user demands and expectations, HKO found new, cost-effective ways to reach a greater number of people.

Strategy Element 5. Develop Skills Needed to Sustain Service Delivery

To achieve the elements above and succeed in user-focused service delivery, NMHSs must identify and develop the required capacity. The WMO Secretariat should also identify and develop the ability to facilitate and support service delivery. Capacity includes developing the necessary skills, processes, and technologies that enable, support, and sustain a service-oriented culture. Much of this Strategy has already described needed processes and tools that will enable service delivery. Cross-cutting across the entire Strategy and critical to its success is the development and enhancement of workforce skills.

Key Strategies for Accomplishing

Efforts should be made to identify the necessary skills relevant to an organization's operating model and objectives and then conduct a gap analysis to discover what skills are lacking within the organization and how those gaps can be bridged through a combination of training, employee development, and recruiting. The WMO Secretariat, in collaboration with the relevant technical commissions, is in the process of identifying requirements for specific competencies within NMHSs and the associated education and training needs for service delivery tasks. NMHSs must ensure their workforce has the necessary mix of technical skills to meet societal demands and user needs. Additionally, NMHSs need skills that enable effective service delivery. Such skills include, but are not limited to: communication; customer service; management, problem solving; and performance management.

DEVELOPING SKILLS TO SUSTAIN SERVICE DELIVERY

The China Meteorological Administration (CMA) has made every effort to cultivate a culture of service delivery by reforming an operational-based system into a service oriented one. It has paid much attention to team-building, interdisciplinary research, outreach, application of new technology, and utilization of social resources in service delivery. It takes special measures to encourage employees to communication more effectively with users. CMA was authorized by the central government to host a number of training courses on disaster prevention and mitigation each year with the nationwide participation by nationwide city mayors. It also regularly trains the voluntary weather information deliverers at grass-root level. A specific example is township leader training programme which was initiated as a pilot project in 2010.

Strategy Element 6. Share Best Practices and Knowledge

A second cross-cutting strategy that will enable a service-oriented culture is sharing

and applying best practices and knowledge across the WMO – a strategy already highlighted earlier in this document. The WMO Secretariat should enable sharing of practices, approaches and tools. What works in one country may not meet the user needs in another country, but service delivery is a collaborative process where providers, partners, suppliers, and users can all learn from one another.

IMPLEMENTATION APPROACH

Implementing this Strategy requires more detailed action plans for developing the processes, methodologies, and tools to enable each of the strategy elements of the four phases of service delivery.

The maturity and formality of service delivery among NMHSs varies significantly. Further, NMHSs operate differently due to a combination of internal and environmental factors. For example:

- Some NMHSs are completely government owned and offer services only to other areas of government and the public. Some are fully privatized and offer commercial services. Many lie somewhere between these extremes;
- Some NMHSs act as data suppliers to private forecast providers, while some undertake fully commercial operations in direct competition with these private organizations. Some play both of these roles;
- Some NMHSs use their own NWP models and forecasting and production systems. Others use those supplied by external organizations; and,
- Most NMHSs only provide services to their own country, whilst other NMHSs may offer to provide services to others.

The bottom line is that a one-size-fits-all implementation approach will not be effective. Members need flexibility for developing their own unique approaches. How to implement this Strategy within NMHSs will depend on service priorities as well as current service delivery capacity. One approach would be to develop implementation plans that focus on creating, growing, or sustaining a service delivery culture based on the maturity and formality of NMHSs' current capacity. The idea of creating a service delivery culture may at first seem overwhelming to some NMHSs and so they may wish to start incrementally by focusing on a particular service area that is an organizational or governmental priority. NMHSs may want to engage with the WMO Secretariat to identify and implement service delivery pilot projects that can easily demonstrate value and be replicated across other service areas, or even by other NMHSs. Additionally, WMO Members should seek opportunities to transfer knowledge through advanced capacity-building approaches, such as engaging in regional partnerships and documenting best practices. All implementation approaches and plans should factor in QMS practices and processes.

APPROACH TO SERVICE DELIVERY IMPLEMENTATION IN THE TAJIK HYDROMETEOROLOGICAL SERVICE

As part of the modernization of the Tajik Hydrometeorological Service, specific investments are being made to enhance service delivery. Tajik Hydromet recognizes the importance of service delivery as an element of modern meteorological service. The nascent sectors have new and emerging needs for meteorological services and in many cases, it is important for the NMS staff to have sufficient training in the user sector to be able to communicate effectively with those clients, resulting in a more collaborative approach to service delivery. The approach taken is to invest in training for both the Tajik Hydromet staff and the technical personnel from the weather-sensitive sectors in line with the four stages of the service delivery system.

In the Republic of Tajikistan, the particularly important users are energy sector, agriculture and disaster reduction. For example, under this approach staff of the Emergency Management Committee (EMERCOM) local divisions will receive meteorological training to raise awareness of weather hazards and facilitate better utilization of hydrometeorological information in EMERCOM operational activities. The training will enhance EMERCOM capacity to disseminate hydrometeorological information about severe weather conditions to the regional and local branches of the Committee, and zone the country based on the probability of occurrence of hazardous hydrometeorological events.

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Appendix A. Service Delivery Definitions

Collaborating Organization/Partner – An organization or entity (e.g., a university, a specialized non-government centre, a relevant government agency) of a WMO Member that provides complementary/ additional weather, climate or water information to NMHSs or directly to users, under terms and conditions that have been mutually agreed.

Coordinator – An organization or entity that facilitates or coordinates the delivery of products and services. For this Strategy the WMO Secretariat serves in this role. Working closely with Members, the Secretariat sets standards for weather-, climate- and water-related products and supporting services. This includes observations, data quality and telecommunications. The data underpinning meteorological and related products require international coordination and validation to guarantee that they meet the needs of the product generating centres. The communication systems that move data and products globally are coordinated through the Secretariat. The assessment, and objective verification of products that are generated by one country and used by others may also be coordinated by the Secretariat and the results shared and used in the process of improving the quality of products for all.

Fit for Purpose – results from collaboration and dialogue among users, providers, **suppliers**, and partners and demonstrates a clear agreement, either implicitly or explicitly, among all involved. A clear fit for purpose acknowledges:

- Current and evolving user needs;
- Provider capabilities, including strengths and limitations;
- What services will be provided and how they will be provided;
- How services will be used;
- Expectations of provider performance; and,
- Risks inherent in applying information to decision-making.

NMHSs (always used in the plural) – National Meteorological Services (NMSs) and National Hydrological Services (NHSs); NMS – A National Meteorological or Hydrometeorological Service; NHS – A National Hydrological Service.

Operating Level Agreement – An agreement among providers, suppliers, and **partners** detailing how a service or group of services would be delivered.

Product – A product is basic **information** such as observations, datasets, or information that is created by an analysis or forecast process.

Providers – Individuals or entities that produce or acquire weather, climate or water information or products that are then supplied in support of users' needs in this regard. Providers may include NMHSs, partners, other meteorologically-relevant agencies and the private sector. This Strategy focuses only on WMO NMHSs.

Service – A product delivered or activity that is carried out (advice, interpretation, etc.) that meets the needs of a user or that can be applied by a user.

Service Delivery – A continuous process for **developing** and delivering user-focused services, defined by user engagement, service design and development, service delivery, and evaluation and improvement.

Service Level Agreement – A contract between a service provider and a user or customer, it details the nature, quality, and scope of the service to be provided. Also called a service level contract.

Users – Individuals, organizations, or intermediaries with responsibilities for decisions and policies in sectors that are sensitive to weather, climate and water and for whom products and services are provided. If the user has paid directly for the service, he/she is generally called a customer. This Strategy defines users at national levels, with the exception of international users in the aviation and shipping sectors.

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Appendix B. Further Reading

(1) WMO/TD-No. 1256, "*Guidelines on Quality Management Procedures and Practices for Public Weather Services,*" http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm

(2) WMO/TD-No. 1023, "*Guidelines on Performance Assessment of Public Weather Services*" http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm

(3) WMO/TD-No. 1103, "*Supplementary Guidelines on Performance* Assessment *of Public Weather Services"*, http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm

(4) For more information on QMS, see: http://www.wmo.int/pages/prog/amp/QMF-Web/home.html .

(5) For more information on survey designs and examples, see: http://www.wmo.int/pages/prog/amp/aemp/training-info2_en.html

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