

# Guide to Competency

2018 edition

WEATHER · CLIMATE · WATER



WORLD  
METEOROLOGICAL  
ORGANIZATION

WMO-No. 1205



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## FOREWORD

An important step towards the development of the World Meteorological Organization (WMO) competency frameworks to guide Members' service delivery and capacity development was taken in 2009 when a task team on aeronautical forecaster qualifications redefined the qualification requirements for meteorologists and meteorological technicians. It also recommended to the WMO Executive Council that a set of competency standards for aeronautical meteorological forecasters and observers be developed to further define the critical job skills and knowledge required of operational staff members working in aviation services. The WMO Executive Council, through its Resolution 9 (EC-LXI), endorsed the development of Aeronautical Meteorological Personnel (AMP) competency standards, which were mandated for implementation by 1 December 2013 and were included in *Technical Regulations, Volume I* (WMO-No.49).

Following this initial implementation step, WMO began to develop and implement competencies in many other key service areas as well. This direction is consistent with the use of competencies in many other disciplines and industries, and generally in human resources development practices around the world. Consequently, the World Meteorological Congress, at its Sixteenth Session, requested that the WMO technical commissions place a high priority on developing competency requirements for the core job tasks in their areas of specialization. Since then the number of such frameworks has grown to eleven and will further increase in the coming years. We believe that these frameworks represent an important element in the body of standards and guidance for WMO Members, helping to increase compatibility and consistency of service delivery.

The production of a guide on competency development, assessment and implementation was adopted as a priority by the Executive Council Panel of Experts on Education and Training in 2015, after the Executive Council, at its sixty-fifth and sixty-sixth sessions had noted the Panel's critical role in the competency implementation effort. This publication is the outcome of that decision. The effort was led by the WMO Education and Training Office, with contributions from many other WMO Programmes. The work of the lead author, Ms Andrea Henderson, was generously donated by the Australian Bureau of Meteorology Training Centre. WMO wishes to thank the authors and reviewers for making this publication available.

We expect that this Guide will aid Members, technical commissions and the WMO Secretariat in their efforts to develop and implement WMO competency frameworks for the improvement of service delivery worldwide.



(Petteri Taalas)  
Secretary-General



## **INTRODUCTION**

### **PURPOSE OF THE GUIDE**

The purpose of this Guide is to provide guidance to Members' organizations that are developing, implementing and/or maintaining competency-based training and assessment programmes based upon the World Meteorological Organization (WMO) competency frameworks established in the *Technical Regulations*, Volume I (WMO-No.49).

Examples of selected Members' best practices are included in this guidance material to facilitate transfer of knowledge and experience, and thus enable organizations to achieve compliance with the WMO requirements in the most efficient way.

This Guide will also be useful to WMO technical commissions and the expert teams engaged in developing and updating competency requirements (Part II, section 1), to training providers, including Regional Training Centres (RTCs), who will need the competencies to shape their training plans and course designs (Part III, section 3), and to National Meteorological and Hydrological Services (NMHSs) and other Members' organizations, which will need the competencies to guide their service provision and, in particular, their use in Quality Management Systems (QMSs) (Part I and Part III).

### **STRUCTURE OF THE GUIDE**

For ease of reference, the Guide is divided into three parts:

- I. Defining competency
- II. Developing a competency framework
- III. Implementing a competency framework.

### **MAINTENANCE OF THE GUIDE**

The Guide will be kept current through regular reviews and updates. The content is maintained by the WMO Education and Training Office (ETR).

### **WMO PUBLICATIONS**

The information contained in this Guide is generic and designed to cover numerous service areas. Some WMO technical commissions have developed specific material to complement their competency framework. These and other WMO publications are available through the [WMO online library](#) and individual [technical commission websites](#).

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## PART I. DEFINING COMPETENCY

### 1. QUALIFICATION VERSUS COMPETENCY

There are significant differences between academic qualifications and competencies. *Technical Regulations*, Volume I (WMO-No.49), describes qualifications as the minimum core knowledge, usually acquired through education, required to enter a profession.

Basic Instruction Packages (BIPs) are qualification frameworks based on satisfying a set of learning outcomes, and have been developed by WMO for specific technical areas. Successful completion of these initial programmes of study does not mean that an individual is immediately able to competently perform a corresponding job.

*Technical Regulations*, Volume I, defines competency as the knowledge, skills and behaviours required to perform specific tasks in the fulfilment of a job responsibility (Figure 1). Acquiring competency in specific areas will require ongoing job-specific education and training throughout an individual's career.

### 2. COMPETENCY STANDARDS VERSUS RECOMMENDED PRACTICES

WMO establishes competency requirements that become part of the WMO Technical Regulations (in the form of standard or recommended practices) for service areas and related personnel for which international harmonization and standardization is considered important. For instance, for service areas that are subject to stringent international regulatory frameworks, such as aeronautical meteorological services, competency requirements may be defined as "standards"; for other service areas, where harmonization of competency is considered desirable and beneficial for the Members, such requirements may be defined as "recommendations". Not every service area will need international competency requirements. The decision to develop an international framework should be linked to the evaluation of performance of the respective service and how it affects decision-making of external users/stakeholders at national and international level. It will be up to individual Members to establish additional national competency requirements, as deemed necessary.

**Competency framework** is a generic term used in this publication to describe all the details associated with a competency requirement or competency standard, including the top-level competency statement, competency description, performance criteria or components, and background skills and knowledge (see section 5 below).

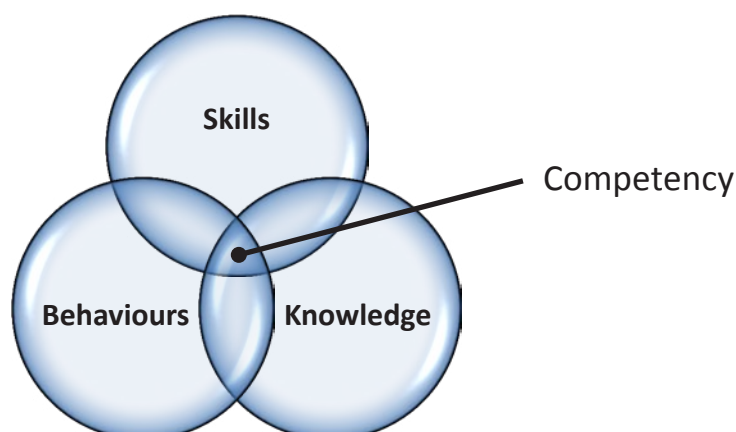


Figure 1. Competency is a combination of skills, knowledge and behaviours

### 3. MOTIVATION FOR COMPETENCIES WITHIN WMO

In 2009, a task team on aeronautical forecaster qualifications redefined the qualification requirements for meteorologists and meteorological technicians. In addition to the qualifications, the task team recommended to the WMO Executive Council that a set of competency standards for aeronautical meteorological forecasters and observers be developed for inclusion in the *Technical Regulations*, Volume I (WMO-No.49). That same year, the Executive Council endorsed the development of competency standards for Aeronautical Meteorological Personnel (AMP) and mandated implementation by 1 December 2013.

WMO has since recognized the benefits of developing and implementing competencies more widely. In 2010, the Executive Council agreed that the technical commissions should be responsible for developing generic job competencies and the associated education and training requirements for personnel undertaking tasks in their service areas. Furthermore, the World Meteorological Congress, at its Sixteenth Session, requested that WMO technical commissions place a high priority on developing the competency requirements for the core job tasks in their areas of specialization and incorporate these activities into their work programmes in the 2012–2015 financial period.

### 4. TYPES OF COMPETENCY

Fulfilling any job responsibility depends upon a range of skills and knowledge (Figure 2), as well as personal attributes or behaviours.

At the base is **core knowledge**, the background knowledge gathered through formal and continuing education that provides the basis upon which to analyse situations and apply skills. This core knowledge contributes to the qualifications (such as the BIPs) that precede technical competencies.

Above this are the **transferable skills**, including fundamental skills like communication, team work, creativity and leadership, as well as behaviours (attitudes) such as accountability, ethical treatment of others and commitment to quality. Also included are more technical, but still general skills, such as computer skills, writing, research and management. These are sometimes referred to as **core competencies**.

The most job-specific competencies are the **technical competencies** and their associated, or enabling, skills and knowledge. These include the specific tasks that must be done to fulfil a job

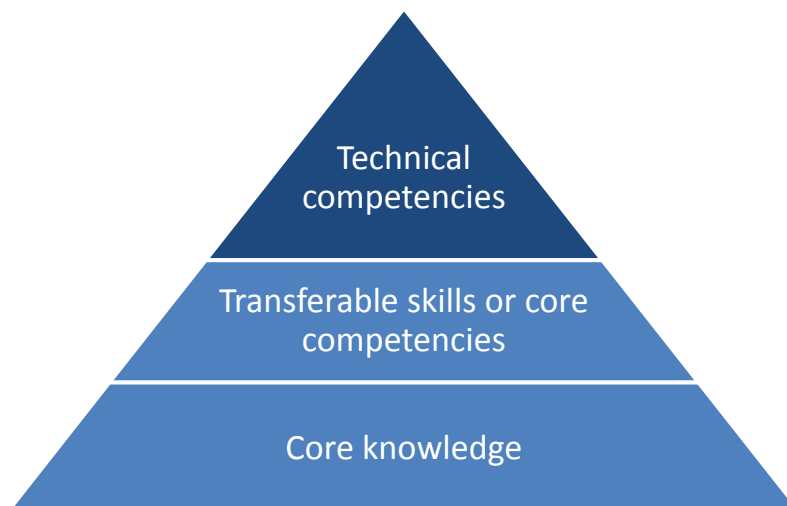


Figure 2. Relationship between the types of competency

responsibility, as well as the background knowledge and skills required for the task. Due to the defined areas of responsibility of the technician commissions, WMO competency frameworks currently focus on the technical competencies only. To accompany these frameworks, several enabling skill frameworks are being developed (see section 5 below).

## 5. ANATOMY OF A WMO COMPETENCY FRAMEWORK

WMO competency frameworks are composed of a preface followed by a three-section description of each competency. Such frameworks provide a common structure whilst allowing flexibility for the broad spectrum of institutions that use them. The three sections of a WMO competency description are defined in Figure 3. The second-level information provided in the second and third sections should be reviewed, and if necessary, customized by the organization to fit its service delivery model.

The preface includes a list of the top-level competencies, as well as additional critical implementation information. This information includes:

1. A description of whom the competency requirement applies to.
2. A conditional statement. This describes conditions that may cause the competencies to vary in different contexts. If a weather service does not provide certain weather products or services, or does not experience certain weather phenomena, it may not need personnel to perform all the tasks or to have all the skills and background knowledge described in the framework. For frameworks that fall under international regulation, these conditional statements apply only to the second-level information, which in this case is supporting guidance material, not international standards.
3. A description of the qualifications that are expected to provide essential background knowledge, where applicable.

The top-level competencies are published in the *Technical Regulations, Volume I* (WMO-No.49). Complete competency frameworks are contained in the *Compendium of WMO Competency Standards* (forthcoming).

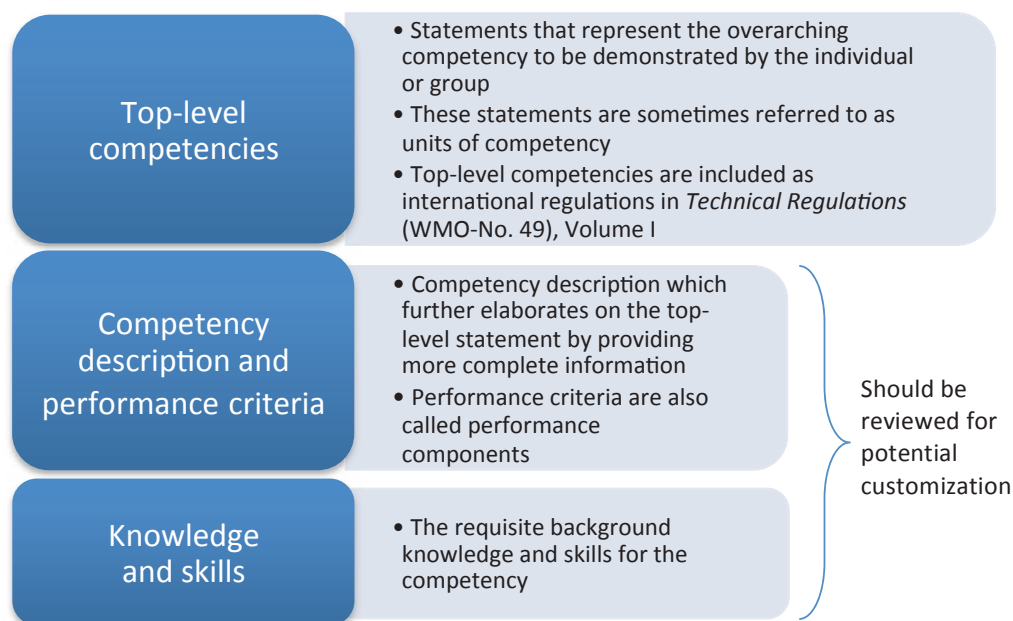


Figure 3. Three sections of a WMO competency description

## Enabling skills and knowledge

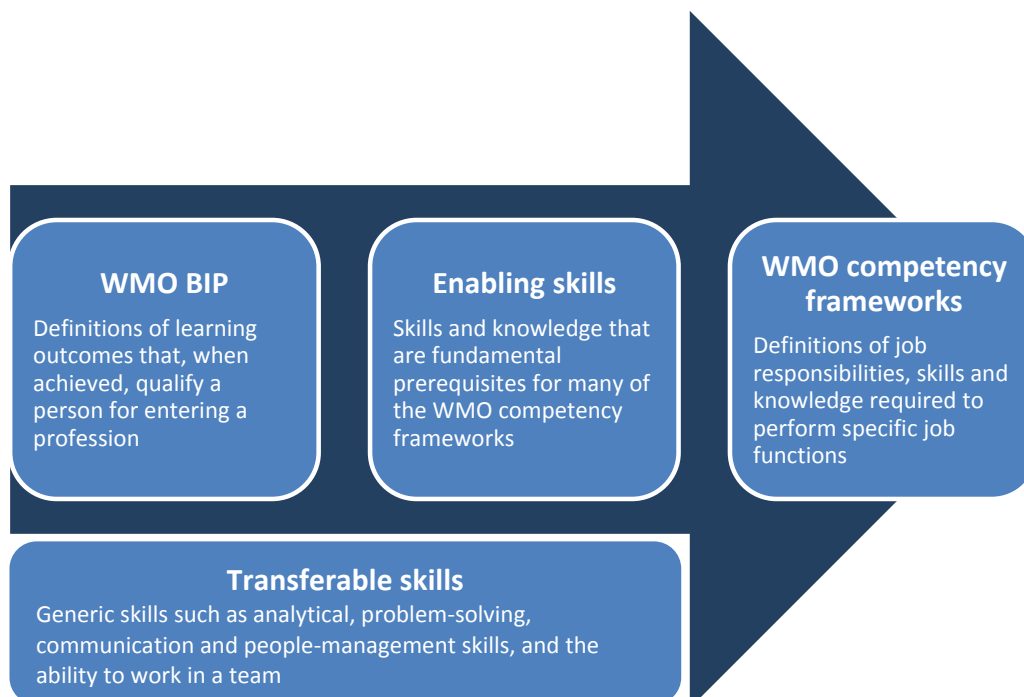
While the WMO competency requirements go a long way in describing the competency required of personnel responsible for delivering services, enabling or contributing skills in the use of specific data and products have been identified as critical for describing more precisely the performance requirements and learning needs of personnel. These enabling skills and knowledge are fundamental prerequisites for many of the competency requirements and are summarized in the background knowledge and skills section.

Three enabling skills and knowledge frameworks developed or being prepared for meteorological forecasters are:

- Satellite Skills and Knowledge for Meteorological Forecasters;
- Radar Skills and Knowledge for Meteorological Forecasters;
- Numerical Weather Prediction Skills and Knowledge for Forecasters.

The enabling skills will generally be taught during initial operational training, and will require updating as technologies and products evolve. Skills in these areas are integral to the competency requirements, and can be assessed either during training or during formal competency assessment. Deficiencies in these skills will contribute to deficiencies in meeting meteorological forecasting competency requirements, and should be addressed prior to undertaking full competency assessment.

The relationship between qualifications, enabling skills, transferable skills and WMO competency requirements is depicted in Figure 4.



**Figure 4. Relationship between qualifications, enabling skills, transferable skills and WMO competency requirements**

## 6. CHARACTERISTICS OF COMPETENCIES

WMO competencies have several characteristics that help competencies to stand the test of time and, when defined for international contexts, will allow for variations across organizations and regions:

1. Competencies address specific job functions.

There are no basic or advanced competencies, only those appropriate for different job functions. Competencies define what must be done, in other words, they describe the basic requirements for successful performance. However, they do not specifically define the level of skill expected, which will grow with experience and professional development. People can be novice or expert and possess the same competencies. They just apply them with varying levels of skill.

2. Top-level competencies are static and independent of technology.

Competencies should be defined in such a way as not to require significant changes over time. The introduction of new tools or data does not change the responsibility or the need to perform the tasks, even if they will be accomplished in a different way. Organizations may choose to adapt the second-level competency information to specific technologies employed in the service area.

3. Competencies are generic for the service area and are adaptable.

Competency frameworks broadly describe the service delivery requirements per job function. This is so that the framework can be applied in any Member's organization. Organizations are required to adapt the competency framework to meet their specific operational needs. More information on how organizations can adapt a competency framework is contained in Part II, section 1.

## 7. THE ONGOING COMPETENCY PROCESS

The competency-based approach is a systematic process<sup>1</sup> whereby:

1. Knowledge, skills and behaviours and their performance criteria for specific roles are defined for various contexts. For organizations implementing WMO competency frameworks, this will first require customizing the defined criteria to meet the organization's needs;
2. Suitable assessment tools are developed to measure the competency levels against the criteria;
3. Current competency is measured against the performance criteria;
4. Where gaps are identified between the required level of competency and current performance, relevant training solutions are identified or developed and implemented;
5. Competency is assessed using the defined tools to determine whether the level of competency has been met after the training has been conducted;
6. Steps 1 to 5 are documented in accordance with organizational requirements.

Steps 4 and 5 continue until the required level of competency is demonstrated. They can also occur periodically as part of an organization's QMS to ensure that competency is maintained over

<sup>1</sup> Civil Air Navigation Services Organisation (CANSO), 2016: *Aeronautical Information Management (AIM) Training Development Guidance Manual: A Competency-based Model for ANSPs*



time. The ongoing implementation of competency-based training and assessment is referred to in this Guide as a competency management system. For further details, refer to Part III. The competency process is summarized in Figure 5; each of the steps described may also include documentation requirements.

Many organizations are adopting a QMS, and in some service areas (for example, aviation) the implementation of a QMS is mandated by international regulatory bodies (for example, the International Civil Aviation Organization (ICAO)). Implementation of a QMS is a key driver to have demonstrably competent staff across an organization's service area(s). Implementation of competency-based training and assessment assists organizations in satisfying quality management requirements.

## 8. BENEFITS OF ADOPTING A COMPETENCY FRAMEWORK

Competency frameworks are being developed in many professions and industries, including those related to meteorology, hydrology and climatology. Several benefits can come from their application to skills maintenance in national and international contexts. Implementation of a competency framework:

- Improves the quality of service provision. For example, the Commission for Aeronautical Meteorology (CAeM) noted that one long-term benefit of the implementation of competency standards is that they will improve the quality of the meteorological services provided to international air navigation by ensuring that personnel meet the defined performance criteria and knowledge required to provide these services;
- Promotes national and international consistency. When competencies are adopted as standard practices, they promote consistency of service across organizations. Globalization means that personnel should be expected to perform at similar levels and have similar skills, whatever their country of service;
- Provides clear expectations by defining standards and measures for an individual and a team;

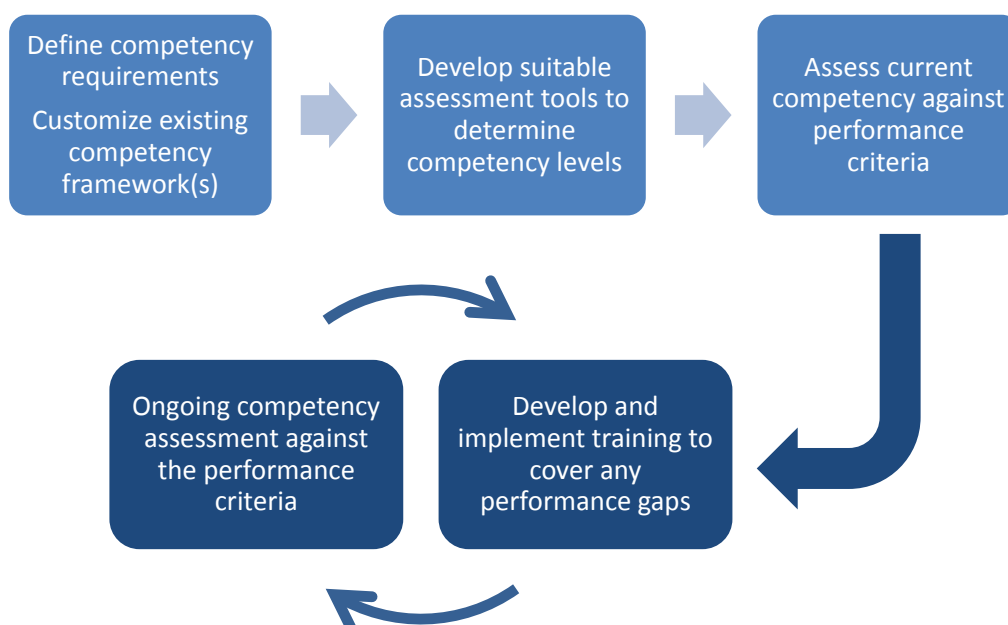


Figure 5. The ongoing competency process

- Assists organizations in meeting their operational objectives;
  - Provides a tool for evaluation by enabling organizations to perform a gap analysis between actual skills, knowledge and behaviours, and desired skills, knowledge and behaviours;
  - Provides guidelines for coaches/mentors/managers on specific behaviours that need development;
  - Enables effective, efficient and targeted training and development of resources;
  - Allows organizations to determine their ongoing training needs through periodic assessment of individuals against the required competencies;
  - Assists with career and succession planning. For example, managers and supervisors can use competency requirements to identify the skills, knowledge and behaviours required for new roles and perform a gap analysis to determine what areas need development;
  - Assists with capability development and workforce planning. Implementation of a competency framework enables organizations to understand where they are now and what will be required to get them to where they want to go;
  - Assists with change management. Meteorological service provision is a rapidly changing landscape, where service areas are evolving from a typical forecast product delivery service to a user-focused, impact-based service. Implementing competencies enables organizations to understand where they are now, and provides a tool to map the training requirements to acquire the skills and knowledge for where they want to go. Moreover, whilst service delivery methods and technology will change over time, the core competencies for service provision will remain fairly static. Therefore, competencies provide continuity, consistency and quality assurance through times of change, but still have the flexibility to evolve to reflect significant transitions in a role;
  - Provides a tool organizations can use to document their quality management process. The fundamental quality management cycle of “plan, do, check and act” is mirrored in the competency management cycle;
  - Provides the individual with the motivational reassurance of their own competence to fulfil the role;
  - Provides guidance to develop new services. For example, as the need for climate services unfolds with the implementation of the Global Framework for Climate Services (GFCS), a competency framework can assist in defining the human resources development requirements.
-

## PART II. DEVELOPING A COMPETENCY FRAMEWORK

### 1. WRITING A COMPETENCY REQUIREMENT

The information in this section is intended to provide WMO technical commissions, and their respective expert teams, with guidance in the development of a new competency framework for a service area.

#### 1.1 Identifying competencies

The process outlined in Figure 6 will help identify competencies for a service area. This process is further explained in subsections 1.1.1 to 1.1.6. Note that this is only one model for the identification of competencies; an array of alternative models exists. It is recommended that competency developers model their work on existing competency frameworks, such as those included in the *Compendium of WMO Competency Standards* (forthcoming). Developers are also encouraged to review section 2 for a discussion of challenges that are commonly encountered in developing a competency framework.

Once all six steps have been completed, the competency development task team should have sufficient information to construct the three sections of the competency framework. The information can then be compiled according to Part I, section 5, and submitted for review and approval (see subsection 1.2 below). It is important to note that because any competency framework has to be relevant to all WMO Members, the top-level competency statements must not imply technology or infrastructure requirements. The competency development task team should test the draft material against a range of Members' capabilities to check applicability at a global scale.

##### 1.1.1 Identifying key components of the job function

Identifying key components of the job function will require a job or task analysis. The most common place to start is with the job description or duty statement. For example, every position

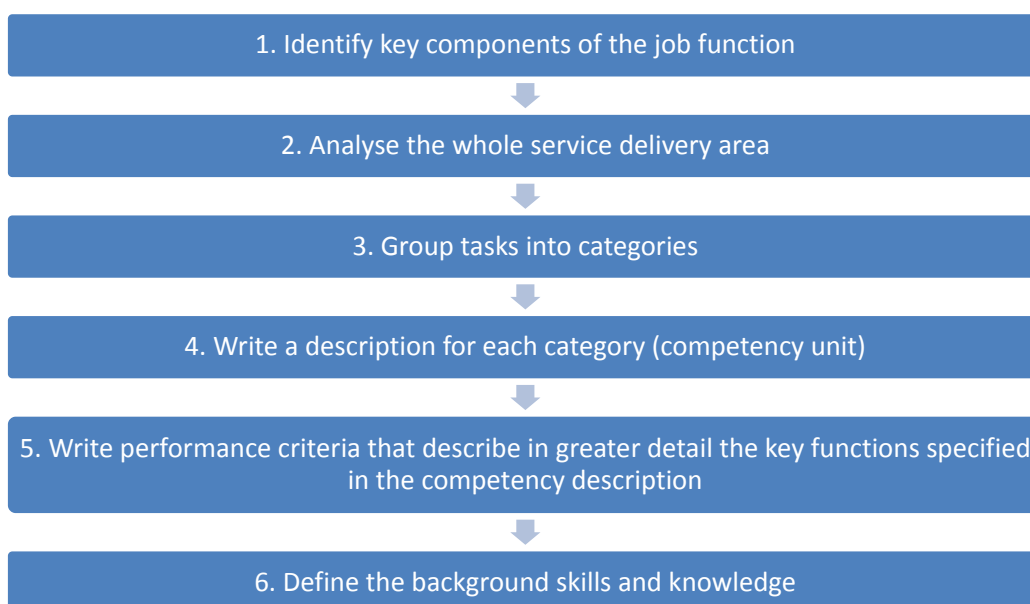


Figure 6. Recommended process for identifying competencies for a service area

should have a statement that describes the job functions and responsibilities. These descriptions can be collated into a comprehensive list of key tasks for each job function. Be aware that job descriptions might not be current, and that they don't always accurately represent the actual job functions.

If job descriptions are not available, the competency development task team can use other methods such as interviews, surveys and brainstorming workshops to establish a list of key job components. For operational positions, task schedules may also provide critical information.

It is recommended to utilize experts within the service area, where possible, to check and refine the proposed competency statements. Brainstorming efforts with experienced operational staff can prove to be both effective and revealing. Participants should be selected by managers on the basis that they can make a positive contribution to the process of developing competencies.

The number of components identified will tend to vary from one job to the next, and it is important not to assume that one size fits all. The framework developed should match the job functions and responsibilities. Of course, where certain functions and responsibilities are common across multiple jobs, then the same or very similar components will likely be identified.

### 1.1.2 ***Analysing the whole service area***

Look at variations in job descriptions among all personnel involved in the service delivery area. For example, in aeronautical meteorological forecasting, the competency framework needs to cover the meteorological support to aerodrome operations (ground), terminal area operations (low to medium level) and en-route operations (medium to high level). In climate services, some staff might be responsible for deriving products from past climate data for key national users, while others are focused on creating climate projections for the same users. In public weather services, forecasters might focus on providing services specific to various industry sectors or for the general public media outlets.

If different job functions support these different roles, the competency development team needs to consider all of them.

### 1.1.3 ***Grouping tasks into categories***

The categories (competency units) may be self-evident and link back to the job descriptions, or they may evolve naturally from commonalities between the tasks identified. It is recommended to limit the number of categories to no more than seven. The aim for each category is to create a succinct competency statement to define a top-level competency.

The competency should describe what to do, not how to do it. The statements are independent of technology and institutional specifics, and should start with a verb so that they represent an action to be taken by the individual or group. Bloom's Taxonomy was developed to assist with the writing of learning outcomes, and provides a useful framework for the development of competency criteria (Figure 7). The highest levels of this taxonomy, analysing, evaluating and creating, indicate the actions that are appropriate for high-level competencies. Use of appropriate action verbs will be discussed further when developing performance criteria or components.

These top-level competencies should be defined in a way that they are unlikely to need changes in the next decade and can still be valid even after changes in technology or in the core background knowledge of the associated discipline.

For example, one item in the job description for an operational forecaster may read "provide continuous national situational awareness of both surface and upper-air meteorological products and observations including changes, and relay important information to relevant user". There

are two parts to this job description: situational awareness of the weather through monitoring and analysis, and communication. These can be split into two top-level units of competency, as follows:

- Analyse and monitor continually the weather situation;
- Communicate meteorological information to internal and external users.

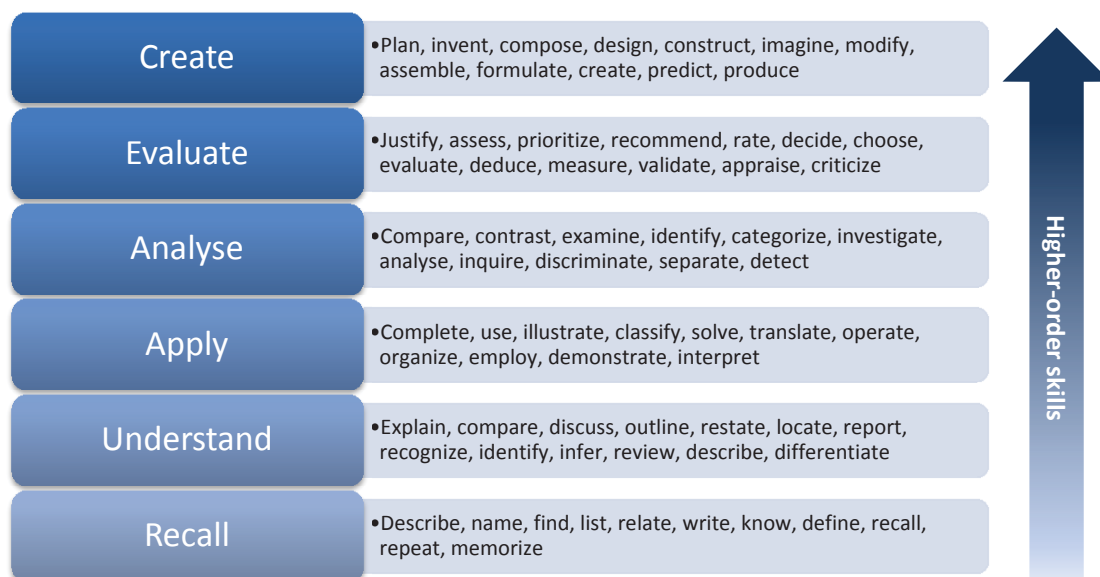
Other categories will also be derived from further statements in the job description. For an operational forecaster, these include forecasting routine weather parameters, issuing warnings for hazardous weather, and quality management/assurance of weather products. Tasks identified in subsections 1.1.1 and 1.1.2 above are then separated into the relevant competency.

#### 1.1.4 **Writing a description for each category**

Once the categories, or what is now considered the top-level units of competency, have been defined, each will need a description. The purpose of the description is to provide more information to complete and clarify the top-level statement. When preparing a description for a top-level competency statement, you should aim to answer the “what”, “when” and “how” questions. For communication elements, you should also consider with whom the communication takes place.

Recall the top-level unit of competency “analyse and monitor continually the weather situation” for our operational forecaster. The description should explain more clearly what is being analysed, when (or rather, how often), and why it is being monitored.

For example, for a public weather service forecaster, the description reads: “observations and forecasts of weather parameters and significant weather phenomena are continually monitored to determine the need for issuance, cancellation or amendment/update of forecasts and warnings according to documented thresholds and regulations”. Note that the observations and forecasts of weather parameters and significant weather phenomena are being monitored (what), they are being monitored continually (when), and according to documented thresholds and regulations (how).



**Figure 7. Bloom's Taxonomy of educational objectives, including sample descriptors. Objectives are ranked from highest-order skills (create) to lowest (recall)**

### 1.1.5 **Writing performance criteria**

So far you have used the key job tasks identified in subsections 1.1.1 and 1.1.2 above to create top-level competency statements ( see subsection 1.1.3) with their accompanying descriptions ( see subsection 1.1.4). The next step is to define performance criteria or components, which elaborate on the competency statement, further differentiating responsibilities and identifying a range of situations. The term “performance criteria” in this case does not mean standards for judging performance quality, but rather the defining characteristics of performance. In this sense, “criteria” and “components” might both be used to label the details of a competency.

In defining performance criteria, you will need to avoid jumping ahead to describe background skills and knowledge, in other words, what you need to know to perform the job tasks. The performance criteria are steps in the task, or components of the task.

Recall that our operational forecaster needs to “provide continual national situational awareness of both surface and upper-air meteorological products and observations including changes”. What does the forecaster actually do to achieve this goal? The forecaster needs to:

- Analyse and diagnose the weather situation as required in forecast, warning and alert preparation;
- Monitor the evolution of weather parameters and validate current forecasts, warnings and alerts based on these parameters;
- Evaluate the need for amendments to forecasts and updates of warnings/alerts against documented criteria and thresholds.

Also, the forecaster is required to relay important information to users. Therefore, the forecaster needs to:

- Use the approved communication channels to disseminate forecast, warning and alert products;
- Explain meteorological data and information using suitable terminology to meet specific user’s needs.

By using this one item in the job description, we have identified several performance criteria or components, which are included in the second level of the competency requirement. For some service areas, these statements will be brief, while for others they will require more detail. Avoid combining multiple components into the one statement.

Recall from subsection 1.1.3 that action verbs from the revised Bloom’s Taxonomy indicating a task, such as analyse, diagnose, monitor, evaluate, use, and explain, should be used, and are especially important when describing performance criteria. Performance is never described using the verbs “know” or “understand”, which indicate background knowledge only. Nor does the phrase “demonstrates knowledge of” turn “know” into an action verb appropriate for a performance criterion.

Ensure that the performance criteria or components identified are specific to the technical area. Broad statements such as “effective communication skills”, “team work” and “knowledge of information technology” should be avoided. These transferable skills are more likely to be background (or assumed) knowledge and skills, which are prerequisite for the performance component. These will be considered in the next step.

### 1.1.6 **Defining the background skills and knowledge**

These are the skills and knowledge required to perform the job function. For each of the performance components identified, there will be assumed skills and knowledge.

For instance, continuing with our example, diagnosing the weather will require knowledge of synoptic and mesoscale meteorology, dynamical and thermodynamical processes, and conceptual models in four dimensions (time and space); analysis and monitoring of the weather will likely involve skills in satellite and radar imagery interpretation, and in interpretation of data presented on a thermodynamic diagram; the forecaster will also need to know what hazards are associated with specific weather patterns, what thresholds each hazard has for the issue of a warning, etc. Analysis of the evolving weather pattern may require background knowledge in meteorological dynamics of the atmosphere, and use of Numerical Weather Prediction (NWP) products.

Unless directly related to technical criteria of performance, avoid including transferable skills (those common to many job responsibilities) in this section. If they are considered critical, they can, like qualifications, be included in the preface to the competency framework.

Information on the background skills and knowledge may also be found in:

- Recruitment information for job roles: what are the selection criteria for the position? For example, does the forecaster need to know what forecast and warning products are issued for specific user groups? Do they need to have experience working with particular regulatory bodies?
- Prerequisite qualifications: what qualifications are required to perform the job tasks? For example, a meteorologist must have completed the Basic Instruction Package for Meteorologists (BIP-M).<sup>2</sup> Delve into the syllabus to determine the relevant background knowledge and skills for each unit of competency.

## 1.2 Drafting, approval and publication process

The WMO technical commissions are responsible for drafting competency frameworks. The commissions may establish various expert groups to prepare the drafts, which are then reviewed and endorsed by the relevant technical commission following wide consultation. To be included in the WMO Technical Regulations as standard or recommended practices, the top-level competencies must be approved by the Executive Council or Congress following formal consultation with Members.

To ensure consistency, the Executive Council has requested that its Panel of Experts on Education and Training be consulted in the development of the proposed competency framework so as to ensure that the language, layout and approach of the proposed frameworks are consistent with existing frameworks. One of the aims of this Guide is to assist the task teams in their development work.

Service areas that have gone through the process of developing competencies have stated that the most important tool for achieving success was consultation. A lead expert on the development of competencies for AMP stated that consultation was managed through the structure of the Expert Team on Education, Training and Competencies (ET-ETC) within the CAeM, with linkages to other groups, such as the Executive Council Panel of Experts on Education and Training, the WMO Education and Training Office, the International Conference on Computer-aided Learning and Distance Learning in Meteorology (CALMet), and organizations that had pioneered meteorological competencies. The consultative process took several years before a final version was approved.

The technical commissions may develop and maintain the second-level information of the competency frameworks without further approval from the Executive Council or Congress. The Executive Council or Congress need to be consulted only when changes that substantially

<sup>2</sup> As defined in the *Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology*, Volume I (WMO-No.1083).

alter the competency frameworks are proposed. For example, a substantial change is one that is adding or removing a competency requirement, or one that is modified to such an extent that its original context is changed.

The full frameworks are included in the *Compendium of WMO Competency Standards* (forthcoming). The current status of competencies being developed by the WMO technical commissions is available at <http://www.wmo.int/pages/prog/dra/etrp/competencies.php>. Refer to the specific subject area for the endorsed top-level competencies and associated performance criteria.

Once the competencies are approved, it is the responsibility of the technical commissions to maintain the currency of the competency frameworks.

## 2. COMMON CHALLENGES

Several WMO technical Programmes have gone through the process of developing competency requirements for their service area. They cite several challenges faced during the development and approval process, which are listed below. This list is included for the benefit of technical Programmes that are currently embarking on or have yet to consider a competency framework. It is useful to review the list and establish mechanisms to proactively manage the challenges before they become obstacles to success. Information contained in this Guide will assist in this process.

Challenges in developing competency requirements to date fall in the following categories:

### Definitions and concepts

- No universally agreed definition of competency, hence the need to follow the definition now established by WMO (see Part I, section 1);
- Defining terms and competencies in a concise way;
- Overcoming misconceptions about describing competency, and what should be developed and assessed.

### Developing the frameworks

- Ensuring that the language is unambiguous, appropriate for the operational context and translates well into the other official languages of WMO;
- Establishing a consistent template for competency requirements where one does not exist;
- Determining what information goes into a competency requirement;
- Involving practitioners and managers in the competency development process to ensure that all aspects of service provision are considered in the competency framework;
- Defining competency requirements across multiple roles within a service area;
- Developing a global competency framework that can be adapted for nearly 200 countries at different levels of development, service capability and staff numbers;
- Ensuring that the competency system uses workplace competencies as a starting point, not the learning outcomes previously defined for education and training;
- Defining the minimum standards for the job, not standards of excellence;



- Distinguishing transferable skills (for example, team work, communication, problem-solving) and enabling skills (for example, satellite interpretation, radar interpretation, proficient use of information technology (IT)) from technical competencies, and deciding where they stand in relation to the competency requirements;
- The time and effort required to develop competencies and relevant supporting documentation.

### **Implementing the frameworks**

- Overcoming misconceptions about the value of competency assessment for the individual, the assessor and the organization;
  - In the case of aeronautical meteorological service provision, determining who the regulator will be and how competency will be assessed and validated;
  - If required, gaining acceptance of competencies from the national regulator;
  - If the competencies are not part of an international regulatory framework, determining how implementation will take place and be monitored (for example, within a national QMS);
  - Fitting a competency-based system alongside a qualification-based system;
  - Deciding whether minimum qualifications need to be set alongside the competency requirements;
  - Where skill progression is required (for example, junior/probationary forecaster, forecaster, team leader, deputy chief forecaster, chief forecaster), developing competencies to capture that information in a structured and coordinated way;
  - Communicating the competency framework to Members and gaining acceptance of the need for implementation;
  - Getting the message across to service providers that they can and must adapt the competencies to their local needs;
  - Working through the process of getting approval for the complete set of competencies;
  - Establishing a process for ongoing review to ensure that the frameworks remain current.
-

## **PART III. IMPLEMENTING A COMPETENCY FRAMEWORK**

### **1. ADAPTING A COMPETENCY FRAMEWORK**

When implementing competencies for training and assessment, the relevant service area managers of Members' organizations should first review and adapt the second-level information, including the performance criteria and background skills and knowledge, to meet their specific circumstances, taking into account institutional structures and responsibilities, technology, staffing, service levels, and weather, water and climate phenomena that impact the country or area of responsibility. The support of upper-level management is essential to ensure the successful implementation and ongoing management of the competency framework.

Note that only second-level information is adaptable. The top-level competencies represent internationally agreed WMO regulations. The adaptation of a competency framework to the unique requirements of an individual country or region represents a third level of competency information.

Within a quality management framework, the considerations and rationale for any adaptations made to the competency framework should be documented and reviewed periodically to ensure ongoing linkage with international standards and recommended practices.

For wide-scope competency frameworks, such as the one for climate services, an organization may not need to implement all the top-level competencies if it does not provide all the services covered in the framework. Nonetheless, the complete framework can be considered as a path to eventually increase the areas of service provided. Alternatively, organizations may add competencies to comply with their own or national regulations or requirements. The three sections of a competency definition provide a flexible framework for Members' organizations whilst recognizing the vastly different services they provide and their varying capabilities.

Very often, an organization may not require all the performance criteria and background skills and knowledge as they are presented in the WMO competency frameworks. In some instances, organizations may need to elaborate on or add to the second-level competency information. Whilst in other cases, removal of some of the performance criteria may be required. In summary, organizations will need to ask the question "what does that look like in our service area?"

How an organization customizes WMO competency requirements depends on several factors:

- The organization structure, which determines who in the organization must demonstrate competency;
- Whether an individual or group needs to demonstrate competency over multiple service areas (aviation, marine, public weather services);
- Whether an individual or group performs all the functions, some of the functions, or more than the functions described in the second-level competency information;
- Whether the competencies are internationally regulated or are recommended practices;
- What resources the organization possesses to manage a competency programme, including training, competency assessment and quality management.

As the following examples will demonstrate, competency requirements can be adapted and implemented in different ways. Each organization will need to assess which method best suits its operational needs.

**1.1 Example of aviation forecasting competencies**

Table 1 provides an example of how the first criterion for Aeronautical Meteorological Forecasters (AMF) has been adapted for organizational use by the Bureau of Meteorology, Australia. A scoping study within the Bureau of Meteorology revealed that all forecasters involved in the provision of aeronautical meteorological forecasts needed to be able to demonstrate the traits described in the table. The primary tasks within the second-level (performance) criteria were highlighted and rewritten into observable activities. The assessor was quickly able to use this tool to evaluate the competency of forecasters in a workplace observation assessment. The primary tasks could also be assessed in a supervisor’s report.

The scoping study further revealed that not all aspects of the competency framework applied to all forecasters. For example, the Bureau of Meteorology divides forecasting into high-level (above 10 000 feet) and low-level (below 10 000 feet) operations. The forecast parameters between the two vary greatly, and many of the listed elements in the competency standard didn’t apply to high-level forecasting. Therefore, some elements were not considered for assessment when applying the competency framework to high-level forecasting operations (Table 2). Once more, the performance criteria were expanded to give the assessor examples of the skills, knowledge and behaviours to look for.

**Table 1. Example of customized Aeronautical Meteorological Forecaster competency for support to low-level flight operations**

<b>1. Analyse and continually monitor the weather situation</b>		
Previously issued forecasts are continually checked against observed parameters and weather phenomena to determine the need for issuance, cancellation or amendment/update of forecasts and warnings in accordance with documented thresholds and regulations.		
WMO second-level competency criteria	Criteria adapted to the national/organizational framework	
1.1 Analyse and diagnose the weather situation as required in forecast and warning preparation. Note that analysis may be defined as answering the question “what is happening?”, and diagnosis as answering “why is it happening?”	(i)	The forecaster can establish the broadscale and synoptic situation using satellite imagery and surface and upper-air observations and analysis. NB: Manual chart analysis is not compulsory; however, forecasters must be able to describe both the surface and upper-air conditions and influences.
	(ii)	The forecaster can identify what and where the weather-producing features are.
	(iii)	The forecaster can explain the expected evolution of the synoptic pattern during the forecast period.
1.2 Monitor weather parameters and evolving significant weather phenomena, and validate these against current forecasts and warnings on the basis of those parameters.	(i)	The forecaster demonstrates active and continuous weather-watch using appropriate visualisation/observation/analysis tools.
	(ii)	The forecaster routinely compares observations to current forecasts. For example, he/she compares Terminal Aerodrome Forecast (TAF) or Area QNH forecast against METARs when they become available (at least once per hour), and ARFOR against wind flights, satellite images, radar and synoptic chart as new data become available.
1.3 Appraise the need for amendments to forecasts and updates of warnings against documented criteria and thresholds, and notify the relevant meteorological office of any divergence between observed and forecast conditions.	(i)	The forecaster amends forecasts in accordance with amendment criteria or when justified.
	(ii)	The forecaster follows local documented procedures (Aviation Operations Manual) in notifying stakeholders when forecasts/warnings deteriorate/improve below/above the defined thresholds.

Source: Bureau of Meteorology Training Centre, Bureau of Meteorology, Australia

**Table 2. Example of customized Aeronautical Meteorological Forecaster competency for support to low-level and high-level flight operations**

<b>2. Forecast aeronautical meteorological phenomena and parameters</b>			
Forecasts of meteorological parameters and phenomena are prepared and issued in accordance with documented requirements, priorities and deadlines.			
WMO second-level competency criteria	Criteria adapted to the national/organizational framework		Applies to:
Forecast the following weather phenomena and parameters: (a) Temperature and humidity;		The forecaster predicts temperature and humidity, demonstrating the following: analysis of observed and model temperature, and moisture profile at various locations; understanding of diurnal and synoptic trends in temperature over an area, including advection and drainage; awareness of local influences on temperature and humidity.	Low-level forecasting operations only
(b) Wind, including temporal and spatial variability (wind shear, directional variability and gusts);		The forecaster estimates winds, demonstrating the following: analysis of wind through various layers of the atmosphere both on the large-scale and at a location, diagnosing local effects, updraft and downdraft, wind shear and potential gusts.	All forecasters
(c) QNH;		At a minimum, the forecaster critically analyses model-derived QNH in forecasts by assessing synoptic-scale mean sea-level pressure observations and NWP data, and applying local adjustments based on diurnal effects, aerodrome altitude and anticipated pressure tendencies.	All forecasters
(d) Cloud (types, amounts, height of base and vertical extent);		The forecaster determines cloud characteristics (amount, vertical/horizontal extent, type, cloud top temperature (CTT)) through appropriate visualisation/observation/analysis tools. He/she critically analyses the satellite image for these characteristics and compares observations to model guidance. The forecaster demonstrates understanding of cloud microphysics and of topographical and synoptic influences on cloud formation/deterioration.	All forecasters
(e) Precipitation (intensity and temporal variations, onset, cessation and/or duration, amount and types), and associated visibility;	(i)	The forecaster assesses the environment for the likelihood/potential for precipitation, on the basis of analysis of expected cloud, synoptic dynamics and topographical influences.	Low-level forecasting operations only
	(ii)	The forecaster diagnoses and forecasts precipitation, on the basis of historical events, current observations, NWP data and understanding of local influences, providing sound meteorological justification for the forecast.	Low-level forecasting operations only
(f) Fog or mist, including onset, cessation and/or duration, and associated reduced visibility;	(i)	The forecaster assesses the environment for the likelihood/potential for fog/mist over an area and at specific aerodromes, using the region's fog/low cloud aid where available.	Low-level forecasting operations only
	(ii)	Where fog/mist is possible/likely, the forecaster applies a scientifically justified process to the forecast, including the probability selected, time of onset and cessation, affected locations and visibility.	Low-level forecasting operations only

(g) Other types of obscuration, including dust, smoke, haze, sand-storms, dust-storms, blowing snow, and associated visibility.	(i)	The forecaster assesses the environment for the likelihood/potential for raised dust/sand, blowing dust/sand, dust storm/sand storm, and smoke/haze. He/she demonstrates an understanding of the role of temperature, instability, wind strength and rainfall.	Low-level forecasting operations only
	(ii)	The forecaster can identify source regions of dust events in their area of responsibility.	Low-level forecasting operations only
	(iii)	Where other types of obscuration are possible/likely, the forecaster applies a scientifically justified process to the forecast.	Low-level forecasting operations only

Source: Bureau of Meteorology Training Centre, Bureau of Meteorology, Australia

**1.2 Example of competencies required for calibration, instruments, observations and network management**

The following example is not one of adaptation, rather it illustrates how competencies required for calibration, instruments, observations and network management are applied differently in the Pacific region depending on the size and existing capability of each NMHS. Successful competency-based training in this region has largely been one-to-one and targeted to individuals. Longer, more generic training has been delivered in the region, but with less success because the training needs of participants from Pacific Islands varied greatly.

Table 3 compares the application of competencies in two Pacific small island developing States (SIDS). Country 1 is a well-developed and well-resourced meteorological service provider, with an established training section. The competency framework provided a structure to identify and deliver training, and also provided a tool to improve collaboration between divisions responsible for network management. Country 2, on the other hand, has limited access to funding and is reliant on external support to receive training. Therefore, it was necessary to break up the competency implementation process into more stages to address its needs.

**Table 3. Comparison of the application of competencies in two Pacific small island developing States**

	<i>Country 1</i>	<i>Country 2</i>
Observations	<p>Competencies already well met but ongoing refresher training required</p> <p>Generally reliable observations with access to excellent training facilities</p> <p>Focus moves to improving communication across divisions and building collaborative tools to monitor performance of instruments and systems</p>	<p>Competencies focus on conventional observations</p> <p>Focus moves to building capability in remote sensing and confidence with instruments and telemetry</p>
Instruments	Competency requirement shared between two divisions, according to job functions	Competencies were addressed in two stages over time to meet phased development capabilities
Calibrations	<p>Staged approach to training and competencies</p> <p>Some elements removed as capability not present</p>	<p>Competency not assessed</p> <p>Currently no facilities or capacity; new budget provisions are required to enable this capability to develop</p>

	<i>Country 1</i>	<i>Country 2</i>
Network management	Competency spread over many groups  Competencies provide consistent structure	Competency owned by a single division

Source: National Institute of Water and Atmospheric Research, New Zealand

The National Institute of Water and Atmospheric Research (NIWA), New Zealand, prepared a workbook as a practical guide to assist staff of the Pacific Island Meteorological and Hydrological Services in the management of national climate networks and operational services. It was developed in response to the training needs of staff in the Solomon Islands and similar SIDS. The workbook is set out in a logical sequence of objectives, tasks and checklists to help with planning and development of a robust climate network and high-quality observational records, through to the delivery of information to aid decision-making and mitigation of climate risks. A critical aspect of the checklists is linking each objective to the relevant competency framework.

Typically, an organization would adapt competencies and create assessment tools based on existing competency frameworks. However, at the time of preparing the worksheets, the competencies defined by the Commission for Instruments and Methods of Observation (CIMO) were at the drafting stage, therefore NIWA used several resources to create the workbook. For example, objective 4.1 in the workbook reads: “technical staff are able to select instruments that are best suited to the observing environment, will deliver the required data quality and reliability, and will meet the objectives of the project”. This objective encompasses elements of the instrumentation competencies, the observation network management competencies, as well as several WMO publications on observations and instrumentation. Table 4 is the accompanying checklist to support the objective.

**Table 4. Checklist extract from NIWA training workbook on climate networks and operations**

	<i>Instrument selection and integration</i>	<i>Completed</i>
Instrument selection	Ensure that new instruments fit with what is already in network	
	Ensure that instruments are sufficiently robust to withstand and measure extreme conditions	
	Ensure that instruments fit with project/organizational objectives and stakeholder requirements	
	Ensure that any new instruments are compatible with existing data logging and communication systems	
	Ensure that new instruments are compatible with national and institutional rules and procedures	
	Ensure that instruments meet WMO guidelines and quality standards	
Instrument assembly and laboratory work	Assemble instruments in laboratory	
	Test with recommended calibration procedures	
	Ensure that all operating manuals, system manuals and wiring diagrams are available and understood	
Training and familiarization	View and understand instrument calibration certificates	
	Be familiar with measurement accuracy requirements	
	Complete training required for operating procedures. Be familiar with operating instructions, installation diagrams and configuration	

<i>Instrument selection and integration</i>		<i>Completed</i>
Packing and transport to site	Work through checklist for installation materials and equipment	
	Work through checklist for tools to be installed and instruments for performing field checks	
	Arrange suitable packing and transport	
Technical service team	Consider setting up a technical service team with key responsibilities: <ul style="list-style-type: none"> <li>• Instrument technician for both electronic and analogue instruments</li> <li>• IT technician with computer and programming skills</li> <li>• Technical manager</li> </ul>	
	Regularly send staff to technical training programmes	
References	<i>Guide to Meteorological Instruments and Methods of Observation (WMO-No.8)</i> <i>Guidelines on Climate Observation Networks and Systems (WMO-No.1185)</i> <i>Guidelines on Climate Metadata and Homogenization (WMO-No.1186)</i> NIWA Electronic Weather Station Installation Manual NIWA Automatic Weather Stations Operations Manual Instrument manufacturer certificates and specifications CIMO Draft Competency Framework for Instrumentation	

Source: National Institute of Water and Atmospheric Research, New Zealand

Given adequate resources, a useful step would be to map each of the tasks in Table 4 with performance criteria listed in the competency requirement.

**1.3 Sharing evidence**

Organizations should pay close attention to the adaptation of competency frameworks when assessing several competency areas. In particular, assessment programmes should be efficient, with evidence shared across disciplines where possible. For example, elements of the competency frameworks for public and marine weather services and aeronautical meteorological forecasting are similar. Therefore, organizations collecting evidence for mandated aviation assessments should investigate ways to use this evidence to satisfy the requirements under the competency frameworks of public and/or marine weather services.

Similarities exist between the Aeronautical Meteorological Observer (AMO) Competency Standard and the more general competency framework for meteorological observations (developed by CIMO). Services for international air navigation are regulated and aviation observations must comply with the AMO Competency Standard. Observers supplying observations to users not in aviation do not currently have regulated competency standards, therefore, application of the more general competency framework for meteorological observations is considered recommended practice only.

Table 4 provides an example of how several competency frameworks can be consolidated into one assessment tool or checklist. A similar checklist could be developed for use in assessing marine, public weather service and aviation competencies.

**2. COMPETENCY ASSESSMENT**

Competency assessment is conducted to determine if someone can perform the job to the level of skill and knowledge required, and is a critical element in implementing competency requirements. Competency assessment is required for competency frameworks that are internationally regulated, and is a recommended practice for all other competency frameworks.



We know whether an individual is competent after he/she has completed an assessment that verifies that all aspects of the competency can be applied in an operational context. Just as new drivers must typically demonstrate that they can drive a car by actually taking the examiner for a drive, so too, under the WMO competency framework, personnel must demonstrate competence by undergoing an assessment process, in this case on a regular basis. Assessment may involve a variety of assessment methods.

The interval between competency assessments depends upon many things. In some countries, Aeronautical Meteorological Forecasters are reassessed on a six-month or annual basis. In other countries, in-depth reassessment may be undertaken only every five years with less intensive assessment in the interim period. The reassessment period should be documented and included in the organization's QMS.

Competency assessment requirements will vary depending on the service area and the structure of the NMHS providing the service. In the case of Aeronautical Meteorological Personnel, application of the competency framework is mandatory, thus an assessment programme is likely to be more formal and rigorous than a competency assessment for another service area. Natural variations may still occur due to the conditions governing the application of competencies in that service area.

Table 5 provides some sample assessment tools applied to different programme areas. Example A might be implemented by an organization with high staff numbers and a large infrastructure, budget and training programme. Example C might be implemented by a small organization with limited staff, training options and infrastructure. Example B might lie somewhere in between.

**Table 5. Examples of different types of competency assessment programme**

	<i>Example A</i>	<i>Example B</i>	<i>Example C</i>
Aeronautical meteorological forecaster	Comprehensive assessment of individual staff members, using a range of tools, such as: <ul style="list-style-type: none"> <li>- Quizzes</li> <li>- Interviews</li> <li>- Simulations</li> <li>- Workplace observations</li> <li>- Case studies</li> <li>- Portfolio of forecasts</li> </ul>	Verification statistics of forecasting skill, with a performance review against competency criteria	Combination of supervisor's reports, self-assessment and portfolio of forecasts/warnings
Climate service personnel	Comprehensive assessment covering verification statistics, portfolio of climate products and a workplace observation	Portfolio of climate products and supervisor's reports	Performance appraisal of personnel against the competency criteria
Observing instrument calibration personnel	Logbook or register of the instruments calibrated, plus practical demonstrations of instrument calibration, and troubleshooting test	Practical demonstrations of an instrument being calibrated	Logbook records of calibrations performed, plus copies of calibration certificates

After an individual has undergone assessment, they are deemed either competent or not yet competent in each competency assessed. If they are deemed competent, they should be issued with a statement listing the acquired competencies, as well as any constructive feedback. If they are deemed not yet competent, they should be given clear and constructive feedback on their performance and be provided with guidance on future options, including training and mentoring, to achieve competency. These options would typically be documented in the organization's QMS covering the competency framework.



The following sections are adapted from the *Guidelines for Assessing Competence in VET* by the Western Australian Department of Education and Training.<sup>3</sup> They describe the requirements for a comprehensive assessment programme, which should be tailored to suit the needs of the organization or service area. For non-regulated competency frameworks, the following information should be used as a guide to recommended practice.

## 2.1 Principles of assessment

Assessment principles state that assessments must be valid, reliable, flexible and fair. Assessors must ensure that assessment decisions involve the evaluation of sufficient evidence to enable a judgement to be made on the competence of the candidate, in other words, the person whose competence will be assessed.

**Validity** refers to the extent to which the interpretation and use of an assessment outcome can be supported by evidence. An assessment is valid if it integrates required knowledge and skills with the practical application of a workplace task, and if the assessment outcome is fully supported by the evidence gathered.

**Reliability** refers to the level of consistency and accuracy of the assessment outcomes; that is, the extent to which the assessment provides similar outcomes for candidates with equal competence at different times or places, regardless of the assessor conducting the assessment. It also implies repeatability, in other words, that the candidate can demonstrate competence on more than one occasion, and in more than one context.

**Flexibility** refers to the opportunity for personnel to negotiate certain aspects of their assessment, timing for example, with their assessor. All candidates should be fully informed (through the assessment plan) of the purpose of assessment, the assessment criteria, the methods and tools used, and the context and timing of the assessment.

**Fair assessment** does not advantage or disadvantage particular candidates or groups of candidates. This may mean that assessment methods are adjusted for particular candidates (such as people with disabilities or from different cultural backgrounds) to ensure that the methods used do not disadvantage them. An assessment should not place unnecessary demands on candidates that might prevent them from demonstrating competence. For example, an assessment should not demand a higher level of English language or literacy than that required to perform the workplace standard outlined in the competencies being assessed. The assessment process should not prevent anybody from demonstrating their competence, skills or knowledge because the design of the assessment differs from the work and places them at a disadvantage.

In summary, assessment processes used must:

- Be consistent with the tasks and standards of the service area;
- Comply with the relevant assessment guidelines;
- Use a process that integrates knowledge and skills with their practical application in a workplace task (holistic approach);
- Target the correct qualification level;
- Be customizable.

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<sup>3</sup> Government of Western Australia, Department of Education and Training, 2008: *Guidelines for assessing Competence in VET*, Perth.

## 2.2 Assessment process

This section and its subsections outline the key processes and steps an organization should consider when developing a competency assessment programme. Organizations should adapt the steps outlined in this section and its subsections to their own circumstances taking into account national legislation, work practices and organizational culture. Members are encouraged to adapt and extend this material in developing their own documentation describing the implementation and use of their competency assessment programme.

Figure 8 shows the key themes covered in this section, which lead to the planning and conducting of an assessment activity. This is the best practice to follow whether the assessment programme is small or fully comprehensive.

### 2.2.1 Types of evidence

Evidence is the information gathered which, when matched with the requirements of the competency, provides proof of competence. Evidence can take many forms and be gathered from a number of sources. It can be direct, indirect, or third-party supplementary, as noted in Figure 9.

No single form of evidence is better than another. Indeed, applying direct, indirect and third-party supplementary evidence in combination can be the most effective (and fair) means of assessing an individual's competence. In other words, the evidence selected must reflect the skills, knowledge and language encompassed in the competency framework. For example, competency in forecasting may be demonstrated by collecting some or all of the following evidence:

- A portfolio of actual forecasts and warnings;
- Direct observation of the task in real time, by the assessor in the workplace;
- Completion of simulated examples, such as a case study;
- Answers to questions on forecast and warning processes.

Quality evidence for the individual and the context must be chosen appropriately and should meet the four rules of evidence noted in Figure 10.

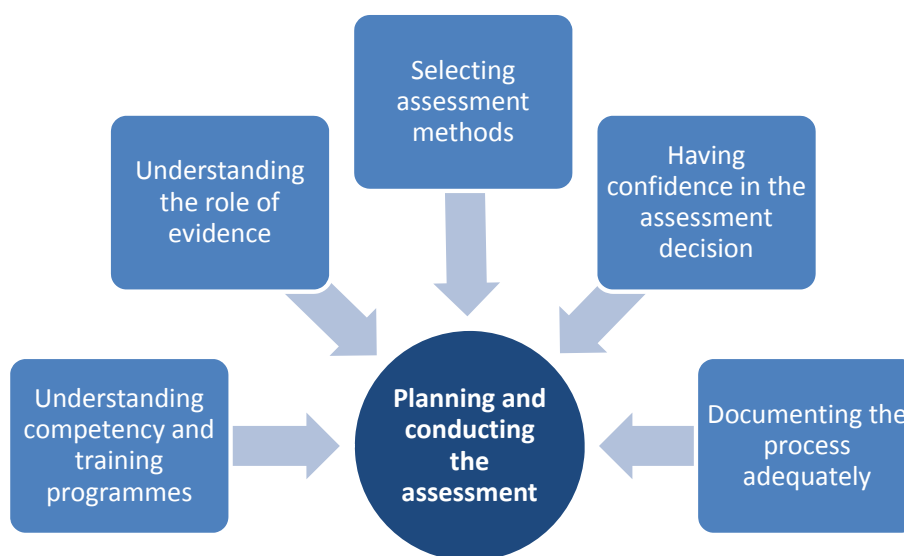
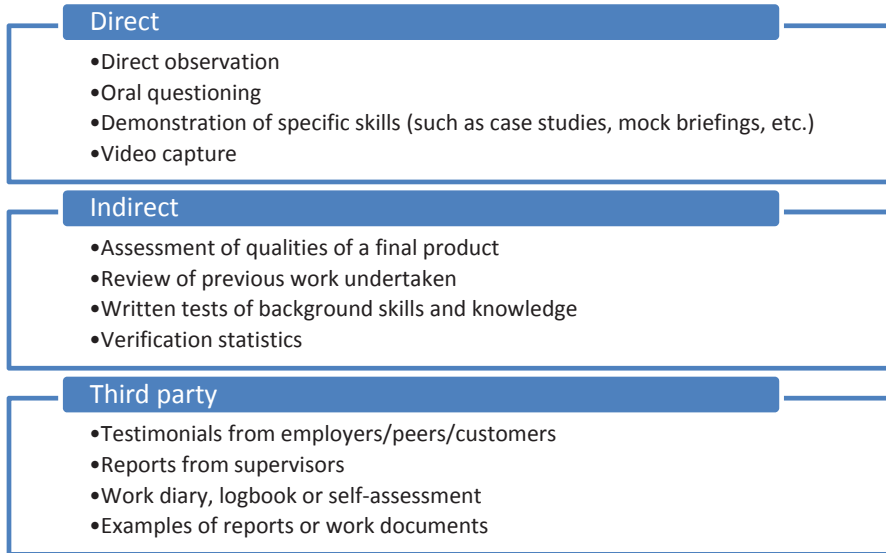


Figure 8. Issues to consider when planning and conducting an assessment

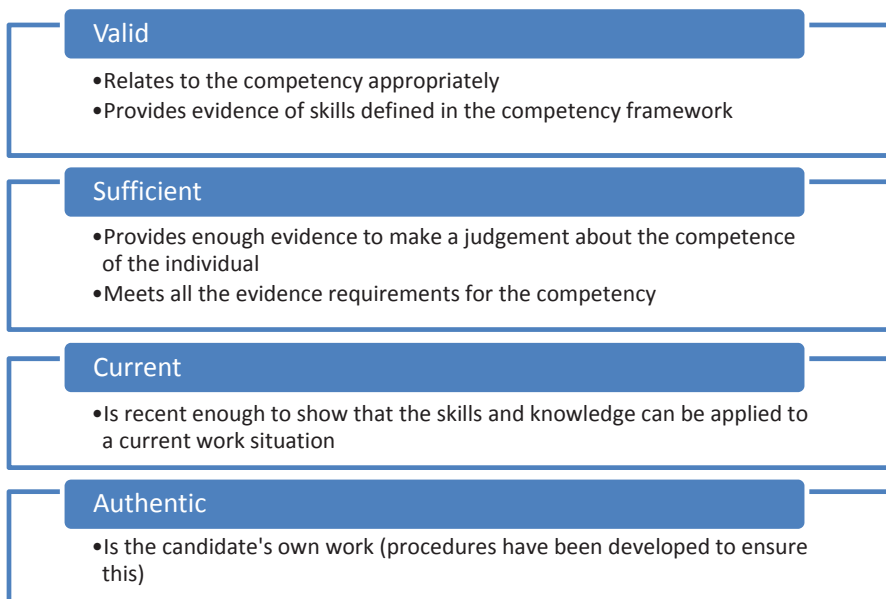


**Figure 9. Different types of evidence**

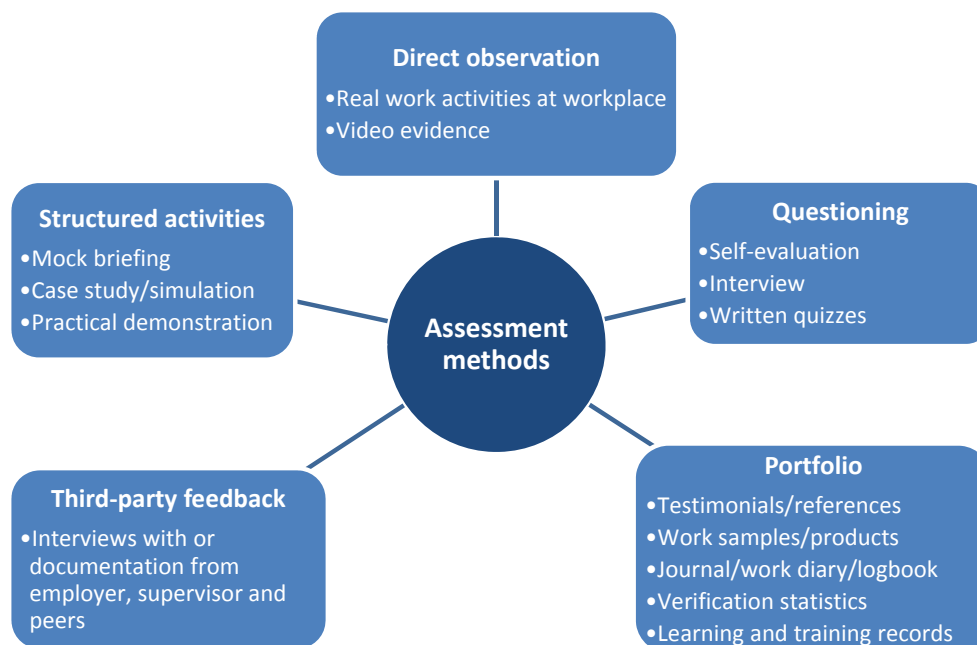
A record of the evidence should be kept by the organization in the event of an appeal or an audit by a national regulator (for example, for aviation services). It is the responsibility of the assessment institution to establish guidelines on the minimum evidence requirements, including the retention period, in accordance with the organization’s QMS.

**2.2.2 Assessment methods**

Assessment methods are the means of collecting the evidence required to demonstrate satisfactory performance (Figure 11). In identifying the assessment methods, resources and facilities required for the assessment should be considered, including any workplace simulation requirements.



**Figure 10. Rules of evidence**



**Figure 11. Suggested methods for competency assessment**

### 2.2.3 **Assessment tools**

Once the method has been selected, the means for collecting and analysing the evidence are then chosen or designed. These means are called assessment tools. In general, the term assessment tool is used to describe a document that contains both the instrument and the instructions for gathering and interpreting evidence. Instruments are the specific questions or activities developed from the selected assessment method(s) to be used for the assessment. A profile of acceptable performance and the decision-making rules for the assessor may also be included. Procedures include the information/instructions given to the candidate and/or the assessor regarding the conditions under which the assessment is to be conducted and recorded.

For example, if the evidence-gathering technique being used is a workplace observation followed by a brief interview, then the assessment tool might consist of:

- Instructions specifying the activities to be undertaken by the candidate, the key points to be observed and the performance issues to be considered by the assessor;
- A checklist for the key observation points and decision criteria, a series of questions and a checklist for responses on required knowledge for the interview.

All assessment activities and materials should be flexible, fair, safe, cost-effective and appropriate for the organizational context.

Assessment strategies and tools should be developed in consultation with relevant stakeholders and tested on an appropriate sample of employees, if possible, or reviewed before use.

### 2.2.4 **Assessment matrix**

Once the assessment tools have been established, it is good practice to map them back to the performance criteria. Table 6 provides an example of assessment tools used in competency assessments of Aeronautical Meteorological Forecasters (AMF) in Australia, and how they map back to the elements of competency.

**Table 6. Sample assessment matrix for AMF competencies**

		Aeronautical Meteorological Forecaster								
		Quiz on ICAO Annex 3 (I)	Weather hazards quiz (I)	Local procedures quiz (I)	Simulation/Case study (D)	Workplace observation (D)	Supervisor's report (T)	Mock briefing (D)	Portfolio of forecasts/warnings (I)	Logbook (T)
C1. Analyse and continually monitor the weather situation	1.1				x <sub>s</sub>	x	x			
	1.2					x	x			
	1.3				x <sub>s</sub>	x	x			
C2. Forecast aeronautical meteorological phenomena and parameters	2.1		x <sub>s</sub>		x	x			x <sub>s</sub>	
	2.2	x				x			x	
	2.3					x			x	
C3. Warn of hazardous phenomena	3.1		x <sub>s</sub>		x		x <sub>s</sub>		x	
	3.2	x							x	
	3.3								x	
C4. Ensure the quality of meteorological information and services	4.1			x		x				x <sub>s</sub>
	4.2			x						
	4.3					x			x	
	4.4			x <sub>s</sub>		x				x
C5. Communicate meteorological information to users	5.1					x	x <sub>s</sub>	x		
	5.2				x			x		

Ideally, each performance criterion should be assessed at least twice to demonstrate that the forecaster can apply the skills and knowledge in a variety of contexts. More than three assessment tasks for one performance criterion may be considered redundant. In a small organization, using two assessment tools might be difficult unless one of them requires less effort, such as existing or extended supervisor’s reports.

Evidence is defined as direct (D), indirect (I), or third-party (T); x denotes the main evidence gathering activity, while x<sub>s</sub> denotes a supplementary activity that may be required as a backup if sufficient evidence is not collected.

**2.2.5 Reasonable adjustment**

It is at this stage that issues of reasonable adjustment for individual needs should be considered. For example, an individual may have a disability that prevents him/her from undertaking certain activities or performing in standard ways, but he/she may still be competent in the unit(s) of competency being assessed. In this instance, reasonable adjustments should be made to the assessment activity to ensure that the individual still has the opportunity to demonstrate the competencies being assessed.

To ensure that an individual’s special needs are addressed, the following questions could be asked, as appropriate or required in the organizational context. If any of the answers are yes, further action to customize the assessment might need to be taken.

- Does the individual live in a remote location? Will this create any barriers in relation to the assessment procedure or assessment methods? For example:

- Some communities do not have access to certain workplace equipment;
- If an individual has to travel to a metropolitan area for an assessment, the additional costs and stress involved in this need to be considered;
- If the assessor would have to travel, the additional cost needs to be considered.
- Does the individual speak a language or dialect other than the national language?
- Does the assessment procedure require the individual to use language, literacy or numeracy skills beyond those required for performance in the workplace?
- Does the assessment involve anything that does not occur in the service area and may be contrary to an individual’s cultural background? For example:
  - Individuals from some cultural backgrounds may not feel comfortable with assessment procedures involving competitive behaviour;
  - Individuals from some cultural backgrounds may not understand assessments based on hypothetical situations or role plays;
  - Some individuals may benefit from the presence of a support person while being assessed, for example someone from their family or community;
  - Individuals from some cultural backgrounds may consider it inappropriate to make an educated guess and therefore fail to complete certain types of knowledge-based tests like multiple-choice or true/false tests;
  - Individuals from some cultural backgrounds may tend to underassess their level of skills (to demonstrate modesty), and may consequently underperform in certain types of assessment such as self-evaluations or oral questioning;
  - Cultural attitudes may lead an individual to indicate that he/she understands an instruction, when in fact he/she does not.
- Does the assessment procedure involve activities that are not part of the service area, such as assessing the individual in front of others in a situation that may be stressful, for example women in a male environment?
- Does the individual have a disability that does not reduce job performance but may require some adjustments?

Provided that sufficient quality evidence can still be collected for the assessment decision to be made, it is acceptable to adapt the assessment methods to reflect the individual’s needs and situation.

### 2.2.6 ***Ensuring the integrity of the assessment decision***

Figure 12 shows the main components necessary to ensure that any assessment decision is sound. Assessors use their expertise and appropriate assessment tools to synthesize the evidence before them in a systematic way, and holistically relate it to the requirements of the unit(s) of competency. While the process of holistic assessment is encouraged, assessors must be confident that an individual is demonstrating mastery of the full competency. The assessor or assessment team must possess the relevant qualifications or requisite competencies defined by the organization to perform the assessment (see subsection 2.6 below).

Confidence in assessment decisions is enhanced when validation processes are used. The validation processes listed in Figure 12 provide some examples for the purpose of illustration

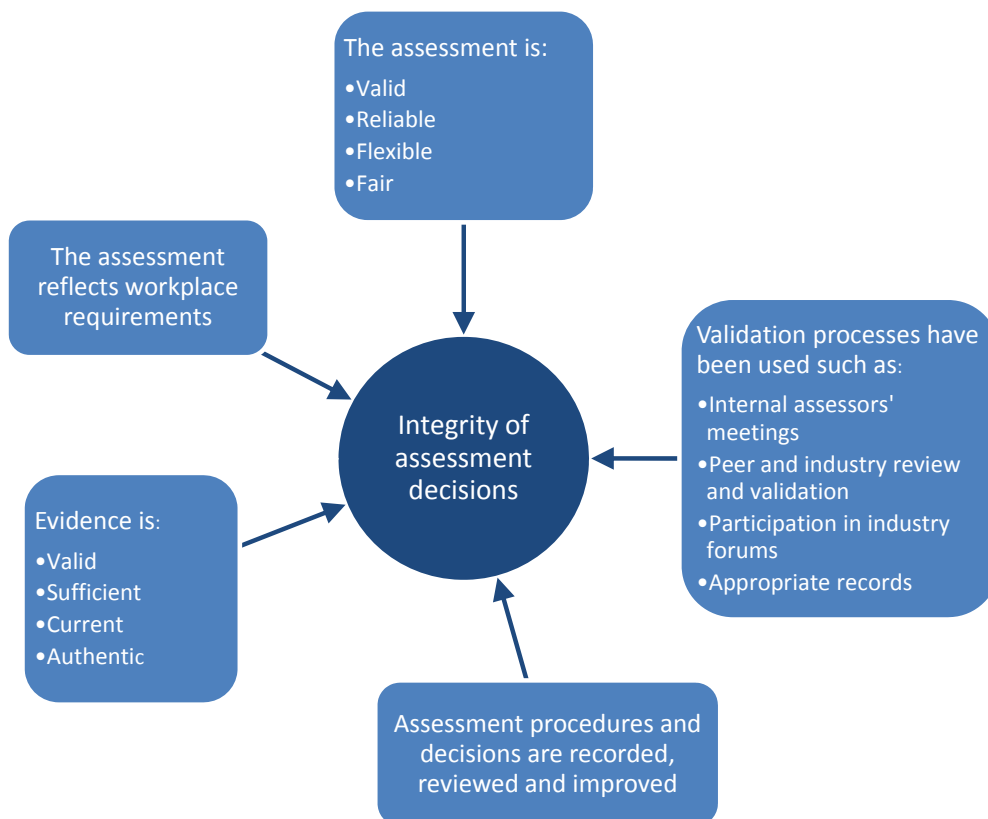
only. To maintain the quality and consistency of assessments, each assessment programme should have established processes for validation, which may be made available for auditing purposes when necessary.

### 2.2.7 **Planning and conducting the assessment**

With the development work done, the assessor can now plan and conduct the assessment. Figure 13 demonstrates the steps likely to occur in planning and then conducting an assessment.

When planning an assessment, the service area manager needs to ensure that:

- Trained assessors are prepared to conduct the assessment;
- The assessment tools or materials have been checked and trialed with an appropriate sample of people or reviewed by others where trials are not undertaken;
- Assessment procedures have been reviewed to ensure that the tasks to be performed reflect workplace requirements;
- If appropriate, assistance from more experienced assessors or industry experts is sought;
- The time and place for assessment have been agreed upon with the candidate and other relevant parties;
- The needs of the candidate have been determined and any reasonable adjustments have been made to the assessment;
- All appropriate personnel have been advised of the assessment;



**Figure 12. Factors maximizing the integrity of assessment decisions**

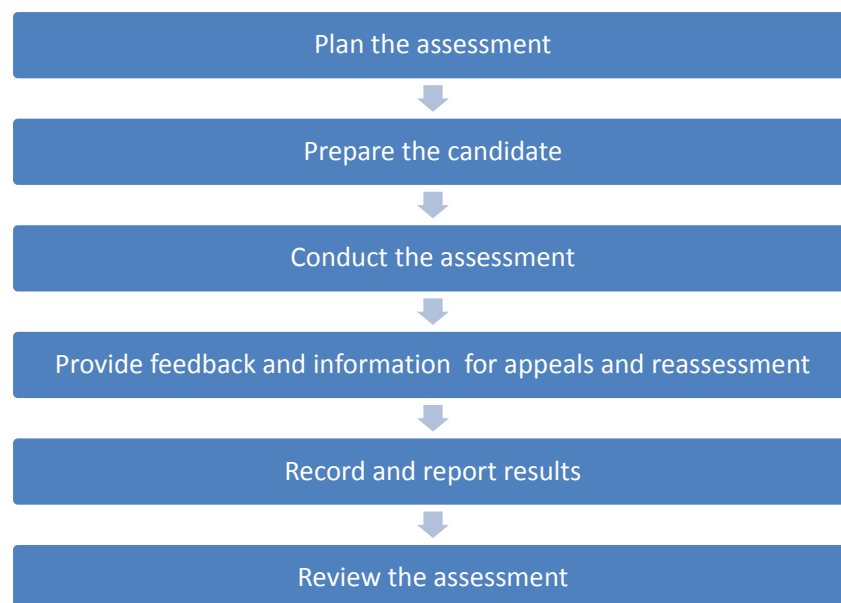
- Assessments are planned in accordance with relevant work health and safety regulations;
- A conflict resolution and appeals policy is in place in case of disagreement.

When preparing the individual for assessment, the assessor needs to ensure that:

- The candidate has been notified of the scope, context and purpose of assessment;
- The candidate has understood the assessment plan and any other appropriate documentation;
- The relevant performance requirements have been provided and explained to the candidate;
- The assessment procedure and expectations of the individual have been clarified and agreed upon between the candidate and the assessor;
- Any legal or ethical responsibilities associated with the assessment have been explained to the candidate and other relevant parties;
- The appeals process has been explained to the candidate;
- Information has been conveyed using language and techniques suited to the candidate and other relevant parties;
- The need for any additional evidence gathering has been identified and the candidate has been informed.

When conducting the assessment activity, the assessor needs to ensure that:

- The assessment is conducted in accordance with the assessment plan;
- Evidence specified in the assessment procedure is gathered using the agreed tools or materials;



**Figure 13. Steps in planning and conducting an assessment**



- Evidence is gathered in accordance with reasonable or allowable adjustments where applicable;
- Evidence is evaluated in terms of validity, sufficiency, currency and authenticity;
- The assessment decision is made in accordance with the specified criteria;
- The decision is recorded, in accordance with the organization's QMS.

When providing feedback, the assessor needs to ensure that:

- Clear and constructive feedback is given to the candidate and any other relevant personnel (such as their direct supervisor), and appropriate language and strategies are used;
- Feedback includes guidance on overcoming gaps in competency, or further goals or training opportunities if appropriate;
- The candidate is given information on reassessment opportunities and the appeals process;
- Any assessment decision dispute is reported to appropriate personnel and resolved using appropriate conflict resolution methods.

### 2.2.8 ***Providing feedback***

Competency assessment can be a stressful process for many people, and assessors need to be mindful of the impact an assessment outcome can have on an individual personally and/or professionally. Deficiencies or issues identified during the assessment process should be treated sensitively and in confidence. Feedback should be provided directly to the candidate in a timely fashion, conveyed in an objective and constructive way, whilst allowing sufficient time for them to respond.

Assessors should ensure that candidates are provided with feedback that includes details of the assessment outcome, the reasons for the outcome, and the appeal and reassessment options used in the organization. Any inadequacies should be communicated in a language that encourages the candidate to engage in a process to achieve competency. If inadequacies are identified, the assessor should liaise with the candidate's supervisor to determine how the candidate can achieve competency. This plan should be developed after the result is given and any appeals have been processed.

When recording results, the assessor needs to ensure that:

- Assessment results are recorded accurately and in accordance with national/organizational record-keeping policies and procedures;
- Confidentiality of assessment outcomes is maintained;
- Appropriate documentation is completed.

### 2.3 **Appealing an assessment decision**

A candidate should be given an opportunity to appeal the assessment decision. It is the responsibility of the training and assessment institution to ensure that an appeals process is in place.

In the case of an appeal, the evidence will be reviewed to determine whether the assessment decision was fair. Therefore, it is the responsibility of the assessor to ensure that the evidence is kept, in sufficient detail to enable the review.

#### 2.4 **Grievance due to the assessment process**

A complaint may be registered by anyone involved in, or affected by, the assessment process. Complaints or grievances may concern, but are not limited to, the following situations:

- A candidate feels that the assessment process is not being applied fairly;
- The assessment process presents unacceptable levels of anxiety for the candidate/assessor;
- A candidate feels that reasonable adjustment has not been applied;
- The candidate has not been adequately informed of the assessment or assessment requirements;
- The candidate/assessor feels they are being subjected to harassment as a direct result of the assessment process;
- Other personnel in the operational environment are adversely affected by the assessment taking place;
- The supervisor is unsatisfied with the administration of the assessments in his/her office.

For QMS purposes, it is the responsibility of the organization to keep a record of complaints or grievances that have been made directly regarding the assessment process, and of any remedies implemented in the event that further action is required.

#### 2.5 **Recognizing prior learning and current competency**

An organization may decide that existing or new personnel may already have skills and knowledge that would likely enable them to achieve a positive result in the full, standard competency assessment process. An alternative, shorter assessment of prior learning and current competency may be acceptable to the organization given sufficient evidence. It will be for the organization to determine, in a consistent, fair and transparent way, whether or not an individual's prior learning or current competency is sufficient to apply an alternative competency assessment approach.

Recognition of prior learning should be granted only if the prior learning is sufficiently documented, just as any learning used as part of a portfolio is documented in the full competency assessment process. Recognition of current competency is the formal acknowledgement that an employee is already competent, either through extensive work experience or as evidenced by an external competency assessment conducted by another organization. Organizations undertaking this assessment need to determine how much of the competency requirement has been satisfied through prior learning or experience.

To ensure consistency, fairness and transparency, issuing organizations should establish a systematic, organization-wide approach to recognizing prior learning and current competency, including policies and procedures that govern implementation.

#### 2.6 **Assessor qualifications and competency requirements**

Competency assessments are carried out by a designated assessor. It is the responsibility of the organization arranging competency assessments to determine the qualification and competency requirements of the assessors. It is recommended that the assessor has sufficient experience (preferably several years) in the field in which he/she is assessing, or is trained in using assessment tools created by someone with sufficient experience in the field.

In addition to carrying out assessments, assessors are usually required to liaise with a range of stakeholders affected by the assessment process. As such, assessors are required to have a high level of interpersonal and communication skills. Desirable characteristics of an assessor include, but are not limited to:

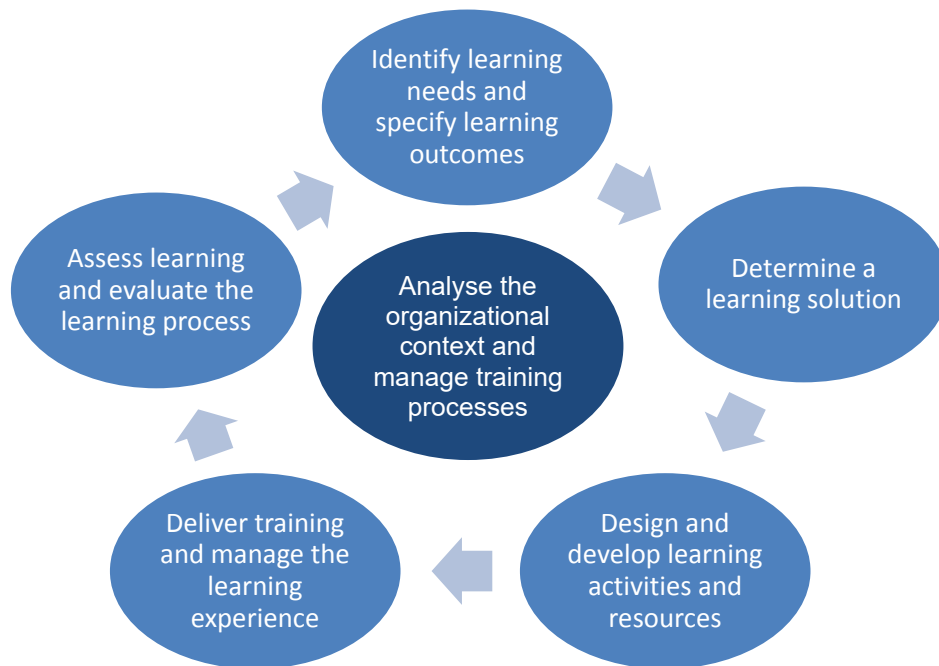
- Approachable and friendly. Assessors should be able to put candidates at ease by creating a non-intimidating assessment environment. This includes being relatable by demonstrating empathy and understanding with the individuals being assessed;
- Knowledgeable or having expertise in the area being assessed. An assessor with experience or expert knowledge of the service area is more likely to perform a sound critical analysis of the evidence presented. Moreover, managers and supervisors are more likely to have confidence in the assessment decisions if the assessor is seen to be credible or respected in the field;
- Perceptive and observant, able to derive information pertinent to the assessment process and evidence requirements;
- Patient. Conducting assessments can be time consuming and sometimes physically demanding. Assessors require patience in dealing with candidates throughout the assessment process, particularly when many people require assessment or multiple assessments are required for a single candidate;
- Unbiased and consistent across the assessments, thus ensuring integrity in the assessment decision;
- Self-aware, and able to identify their own biases and sources of frustration before they affect the individuals being assessed or the assessment outcome;
- Diplomatic, able to navigate the complexities of assessments with respect to cultural and organizational sensitivities.

### 3. **COMPETENCY-BASED TRAINING**

The goal of competency-based training is to focus on specific competencies that an individual must attain or enhance. Often supervisors and trainers will look for evidence of a change in behaviour and performance following training. Competency requirements provide significant advantages to trainers by guiding them in making training decisions. They have the most significant impact on how learning needs are determined, how learning outcomes are specified, which learning activities are conducted and, finally, what kinds of learning assessment are used and how training achievements are documented.

This section will show how to use competencies in making training decisions. As competency-based training approaches are described in detail in *Guidelines for Trainers in Meteorological, Hydrological and Climate Services* (WMO-No. 1114), this section will be brief. Users are, therefore, advised to refer to the above-mentioned publication and the [WMO Trainer Resources Portal](#) for more in-depth treatment of many of these topics.

A typical training process, as described in *Guidelines for Trainers in Meteorological, Hydrological and Climate Services* (WMO-No. 1114), is shown as a cycle in Figure 14. The core activities that underlie the training process, shown in the centre of the cycle, are analysis of the organizational context and management of training processes. Competency frameworks, as the specification of job performances to be achieved, are a significant component of the organizational context of a training institution. In many ways, they will also determine the design of the training process and provide a baseline for its evaluation and management. The learners' achievement of competence is in the end what determines the success of the process and its management.



**Figure 14. A typical training cycle**

The following sections describe the critical aspects of each activity in the process, particularly as they relate to competency-based training.

### 3.1 **Learning needs**

With a competency framework in place for the job area, the process of identifying learning needs is half-way done. Knowing what learners need to do and how they need to fulfil their job responsibilities eliminates guesswork.

Training Needs Assessment or Analysis (TNA) is the process of determining when training is needed and what learning outcomes it should try to achieve. Given the resources and time involved in implementing a competency assessment and training programme, the TNA should include a prioritization of the needs it identifies. Without a valid TNA, the training intervention might be used to address problems it cannot solve, or might not address the highest-priority needs, either way resulting in a significant expense without much gain.

A learning need is created by a performance gap. A performance gap is the difference between the desired and actual performance of one or more persons. A performance gap might become apparent during a competency assessment, or be evident for newly hired staff, or might appear when an organization changes its processes and procedures. Not all performance gaps can be solved by training.

A recommended process for TNA is outlined in Figure 15. While the process can take a lot of time, if followed in detail, not every source of data needs to be sought. As an organization begins to know itself, the TNA reduces uncertainties and saves time.

1. Identify the desired competencies. The existence of a competency framework doesn't quite eliminate this step, because an organization might still need to decide how the framework applies to its own case—for example, an international standard like a WMO framework will need to be examined and might require adaptation by each region, country and organization.

2. Compare the desired competency to existing performance. This step is completed by performing competency assessment (see Part III, section 2). For international training, this step is more difficult, but still essential. It can be handled through a pre-training assessment, for example, and students can be selected on the basis of criteria related to their job experience. Where an organization has a QMS in place, this should be consulted to ensure consistency of the performance standards for the service area.
3. Determine the sources of competency gaps. This step is always important because the source of less than competent performance could be related to lack of effective tools, an environment that lacks motivation to perform, or poor processes and procedures. In these cases, training will not help. Another possible gap is lack of sufficient experience, which might be addressed by guided practice.
4. Determine training priorities. In many cases, it might not be possible to address all performance gaps, and priorities must be established. Even when demonstrated competency is mandated, and any gaps will need to be addressed by some means, the sponsor of the competency-based training programme may need to prioritize to determine the sequence and the learning solutions used.

Training needs assessment data can be gathered via surveys or interviews with staff and managers, direct observations, performance records and customer feedback.

### 3.2 Learning outcomes or objectives

Defining learning outcomes to be achieved by training, including consideration of the level of performance required, is also a training step directly facilitated by use of a competency framework.

Learning outcomes are the intended outcomes of training in terms of what the learner should be able to do following an education or training event, such as a class, course, or programme of study. Documenting learning outcomes during planning will guide you in the development of your training event: it will help determine what content is required (or not required) and what activities and practice opportunities will help learners achieve benefits from training. Even more directly, learning outcomes provide guidance on how to assess learners. Finally, learning outcomes communicate to learners what they can expect to gain from a training event or

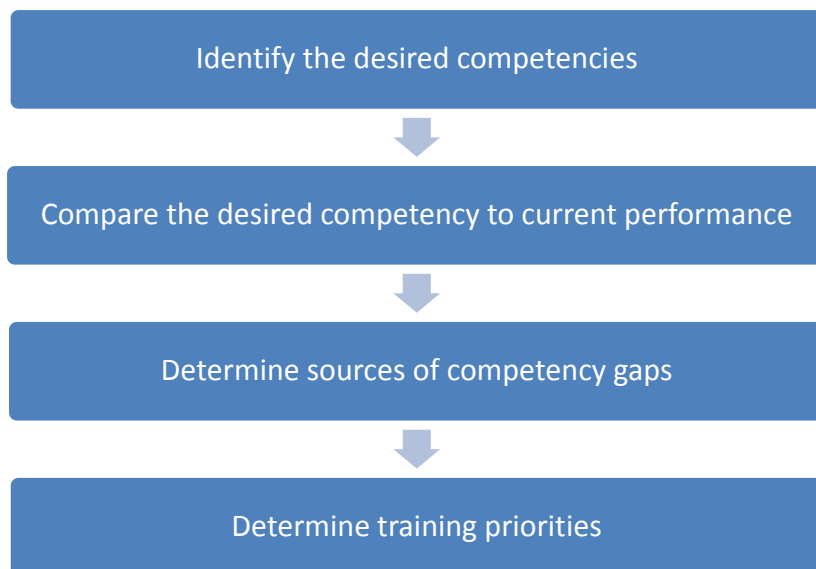


Figure 15. Recommended process for a training needs analysis

resource, and what they will be expected to demonstrate during assessment. Learning outcomes based on competency frameworks ensure that training and assessment will be relevant to priority tasks (Figure 16).

While competencies are typically written at a high level, describing general job tasks or responsibilities, learning outcomes should be written at the level of training assessment (which is not the same as competency assessment of job performance). They should be written like the performance criteria or performance components used within a competency framework. More specifically, they should represent those tasks that will be directly assessed to determine if learning has taken place.

If training is designed for a specific set of competencies, then the learning outcomes should not be difficult to identify. For example, a competency may be written as: “Forecast marine weather phenomena, variables and parameters”, and the performance criteria for this competency may include the following:

- Prepare forecasts and warnings for the following weather phenomena, parameters and variables, including spatial extent, onset and cessation, duration, intensity and temporal variations:
  - Wind, including directional variability, speed and wind gusts;
  - Sea state (total wave height, wind wave height, swell height, swell direction and period, significant wave height);
  - Damaging or large waves.

In this case, the learning outcome for the training session might be: “Forecast the onset and cessation of large coastal waves using remote-sensing and numerical weather prediction data.”

Learning outcomes written in specific detail provide nearly all the information you need to assess learning, including when possible the task, the criteria for performance, and the specific data to be utilized.

Well-written learning outcomes describe learning in terms of what a learner should be able to do following training, not just what they should know or understand. This helps to ensure a direct connection to required job competencies and job tasks.

Examples of well-written learning outcomes:

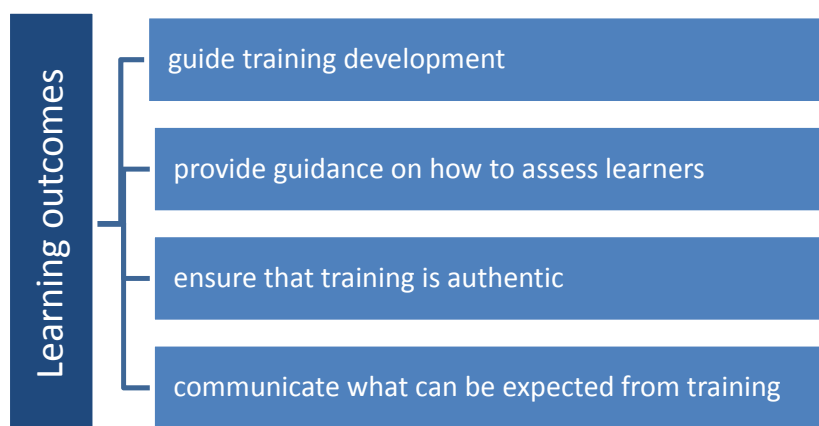


Figure 16. Purposes of learning outcomes

- Prepare warnings of hazardous weather associated with tropical cyclones in accordance with national thresholds, national formats, codes and technical regulations on content and accuracy;
- Verify that observation instruments are within expected calibration limits;
- Identify and retrieve climate data from different sources to generate climate products;
- Create discovery metadata records describing products and services;
- Take account of the context of learning and the training development process.

While these learning outcomes might require additional details to make them specific enough to be used for an assessment, note that each describes a task or action that can be practiced and assessed against the competencies. Focussing on the outcomes does not suggest that understanding is not important, rather understanding can be assumed if the learner can also perform a complex task such as those described above. The reverse may not be true.

### 3.3 Learning solutions

Learning solutions is a term used to describe the available modes of training delivery (for example, online or classroom learning) and the environments that can be created to provide learning opportunities (for example, a course, self-directed study, on-the-job mentoring or coaching).

Once the learning needs and outcomes have been identified, the next step in planning is to select the learning solutions to be used. Trainers should resist the temptation to jump to a quick decision; instead, they should examine the needs and constraints to come up with the best solution or combination of solutions (Figure 17). Often, the most attractive or most



Figure 17. Examples of learning solutions

adequate solution from an educational point of view is not suitable due to technical or budgetary reasons. Thus, trainers need to choose their learning solutions in the context of the resources of their organizations.

Professionals can develop their competence through formal, semi-formal and informal learning solutions:

### **Formal**

Training that includes specified learning outcomes and assessments, for example, courses in a classroom and online;

### **Semi-formal**

Individualized and less structured learning, such as internships or working directly with an assigned coach or mentor, and other on-the-job training programmes;

### **Informal**

- Unstructured but critical learning modes include learning through experience, from peers and communities of practice, and through self-study;
- Accessing information and using learning resources on one's own;
- Through experience, doing a job and trying to improve the outcomes of work after reflection.

Trainers should not overlook the wide variety of opportunities to learn. The choice of activities for the training event occurs in the following steps, which are described in the next sections.

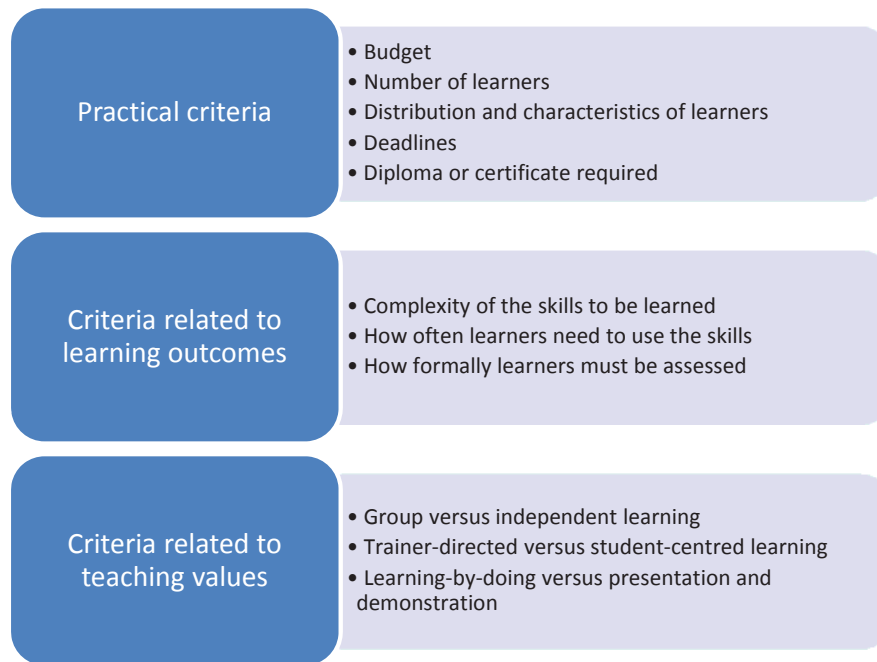
Choosing a learning solution requires consideration of criteria related to practical or logistical constraints, learning outcomes and teaching values (Figure 18):

- Practical criteria are those factors that relate to the training context;
- Criteria related to learning outcomes state what is required in order to achieve the proper outcomes;
- Criteria related to teaching values concern our beliefs and values about learning. These can cause us to wrongly reject potential solutions.

A general process for creating learning solutions might include the following steps:

1. Consider the practical criteria that appear fixed and non-negotiable. These will likely be imposed by stakeholders and managers. Eliminate or question solutions that do not fit the practical criteria and highlight those that fit.
2. Consider criteria related to learning outcomes. You may decide that some of these might rise in importance above the practical criteria, suggesting that you should alter your list of initial choices.
3. Reflect on whether learning values are being considered. How important are these for the learners and trainers involved, and can they accept approaches that might not match their preferences?
4. Justify your decision about the learning solution (or better, blend of solutions) to stakeholders, stating which criteria led you to the decision.
5. Include in your statement whether the technical and human resources to effectively implement the selected training solutions are already in place or need to be developed.





**Figure 18. Examples of criteria to be considered in the design of learning solutions**

In most cases, blended learning solutions — those that combine learning solutions in complementary ways — will offer the best option. For example, a complete training programme might call for self-directed online learning, an instructor-led workshop, and on-the-job follow-on training.

### 3.4 **Designing and developing a training programme**

This section focuses on some key training design decisions required for competency-based training. The development steps can vary widely depending on the learning solutions chosen, design decisions and the technologies used, so they are not covered here.

To develop competency, trainers need to focus on active learning, or learning that includes significant practice opportunities for developing skills. Seminar and lecture approaches may be useful for building background knowledge, but developing competency requires practice in realistic tasks that involve analysis, problem solving and decision-making, as well as feedback on performance. The development of competency-based learning activities may identify the need for documented work practices or processes, or updating of existing documentation from the operational service area.

Four of the most common strategies for active learning are described below, with a summary of their general characteristics (Figure 19). They overlap and can be combined in any situation.

#### 3.4.1 **Discussion strategies**

Learners learn more thoroughly when they articulate what they know in their own words. Learning discussions are centred on questions or issues, and encourage learners to think deeply about difficult aspects of the topics or the challenges of applying the skills they are learning.

#### 3.4.2 **Inquiry strategies**

In any profession, people responsible for complex tasks have to be able to solve the problems they encounter and find the information they need to make decisions. Using inquiry strategies,

trainers pose problems, open-ended questions or hypotheses whose answers require gathering data and information, analysing them and then developing conclusions. For example, asking learners to investigate what observation platforms should be in place to help forecast the formation and propagation of a tropical cyclone can elicit critical thinking, whereas simple provision of the information does not.

### 3.4.3 **Case-based strategies**

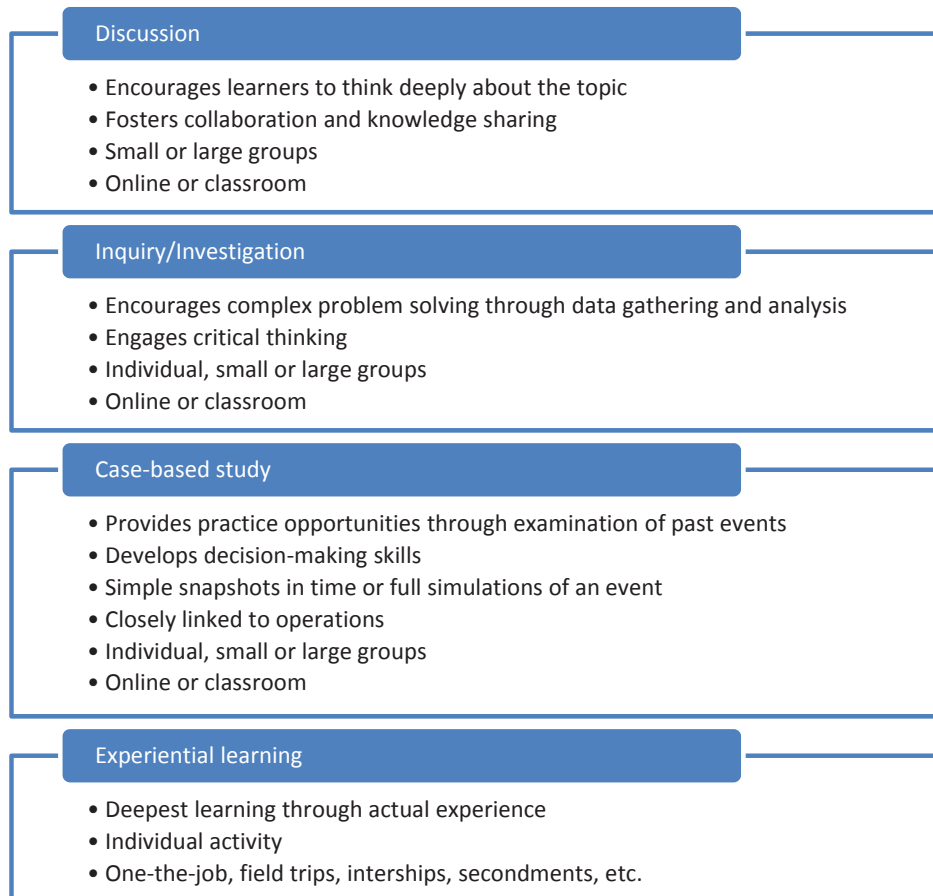
One way people gain competence is by remembering cases that guide future actions. Decision-making, particularly rapid decision-making, is frequently done by comparing current situations to past ones, taking action and then judging the results. In case-based learning strategies, people work through real-world cases to apply what they are learning.

### 3.4.4 **Experiential learning strategies**

The deepest learning results from experience. By trying things out and working to improve our results, we can see a significant increase in competence. The more realistic the experiences, the more applicable the learning will be.

### 3.4.5 **Training methods**

Training methods are the finer details of how training is carried out, and can be applied within any strategy. Training methods can include lectures, group discussions, structured tutorials, collaborative learning, demonstrations, sharing stories of practice, practice exercises, self-



**Figure 19. Summary of the four common strategies for active learning**

directed learning resources, sharing case studies, running simulations or role plays, and completing individual or collaborative projects. These can be combined to achieve the best outcomes for any set of learning goals.

### 3.5 **Designing learning assessments**

Good learning assessment practices for competency-based training can look very much like competency assessment, as discussed in Part III, section 2. Both assess competency or skill, but at different stages in their development and perhaps with different scopes. For example, even though learning assessment is done during or immediately after training, it should, to the extent possible, assess tasks that need to be performed on-the-job.

However, the primary purposes of learning and competency assessment differ. Competency assessment is first and foremost meant to document competency achievement, even though learning is a natural outcome. Learning assessment, on the other hand, has two possible goals:

- It can be summative, or designed to measure learning achievements and to document them (as potential evidence for competency assessment, for example);
- It can also be formative, aiding the learning process through practice and, more importantly, the feedback provided to the learner. Formative assessment is sometimes underutilized, but it is an important part of competency-based training. Without practice in the application of what is learned, and without constructive feedback during that practice, learners might not make sufficient progress in developing their skills.

As mentioned previously, what is assessed in competency-based training should be driven by the defined learning outcomes, and these in turn should be driven by the competencies. For competency-based training, job tasks should be the targets of assessment, even when enabling skills and background knowledge are also assessed. Job tasks are composed of many smaller skills and require background knowledge, so assessment of the whole job task also demonstrates that the enabling skills and knowledge have been attained.

It can be difficult to assess job tasks in a training environment, away from the workplace. Creating realistic conditions may not be easy. However, job tasks can be approximated through simulations and case studies that use standard work equipment and real data.

The building blocks of performance can be assessed in less complex ways. For example, we can assess the ability to analyse a single data product more easily than we can assess the entire forecast process. With even more ease, we can assess knowledge of the formation mechanisms of weather phenomena. Many forms of assessment can be used to discover if learning has occurred. Even well-constructed quiz questions can go a long way to gauge learning before, during and immediately after a course. But discussions that probe how decisions would be made and simulations that test decision-making can more deeply diagnose what learners know.

Recall Bloom's Taxonomy of educational objectives (Part II, subsection 1.1.3 and Figure 7). The same framework can be used to assess learning. At the lower three levels (Recall, Understand and Apply), background knowledge is being assessed by asking people what they can recall or what they can explain. This can be accomplished through objective or open-ended questions that are relatively easy to judge. At the higher three levels (Analyse, Evaluate and Create), complex skills are being assessed that require observation of performance or reviewing the outcomes of complex decisions. These are much more difficult to judge and often require probing to determine if learners are applying the newly learned skills correctly. Implicitly, assessment at this level also checks on recall and understanding because these skills form the basis of the higher-order skills.

Competencies describe complex skills. Therefore, competency-based training will likely require assessment through case studies, simulations or multiple-step problems. These may require protocols to guide a trainer in making a fair and consistent learning assessment.

### 3.6 **Delivering training activities**

There are numerous considerations when planning and promoting training activities. Many of these are compiled in *Organizing and Managing Training Events*, in the [WMO Trainer Resources Portal](#). This section will focus on the unique aspects of delivering competency-based training, namely how to take a student-centred approach to facilitate learning of skills.

Many traditional education practices focus on the lecture and the role of the teacher as a source of information and assessment, with a limited amount of interaction unless prompted by the learner. Competency-based training practices stress another role for the trainer, one of facilitator in support of learning.

All teachers and trainers support learning by providing clear information, answering questions or providing feedback, but those who emphasize student-centred approaches for developing competency add facilitation to this list. Facilitation is a subtle skill, requiring that a trainer (a) provide opportunities for learners to practice using their growing knowledge and new skills, (b) observe and probe to determine good performance and mastery of background knowledge, and (c) coach to guide the learner to improved understanding and performance. In particular, (b) and (c) require close attention to the learner's individual needs, including matters of emotion and feelings of self-worth.

Practicing a new skill is difficult, and the subtleties of good performance can be hard for learners to identify. A good facilitator is observant and inquisitive, and knows how to diagnose issues in performance and misunderstandings that can get in the way of achieving competency, as well as how to avoid the emotional pitfalls that come with failures that can occur along the way. For this reason, good trainers for competency-based training should be:

- Approachable, friendly and eager to provide support. They should know how to establish a pleasant working atmosphere for learning, and should be able to facilitate positive group interactions;
- Able to listen constructively, helping to clarify concerns without dominating the conversation, and yet to know when to summarize clearly and draw conclusions;
- Flexible, patient, empathic and attuned to the sources of learning challenges, allowing learners to learn in their own ways and at their own pace;
- Able to ask questions that stimulate thought, and not simply provide information;
- Able to provide carefully constructed feedback—feedback that emphasizes the positive factors, the successes and the effort that has been made, before it identifies mistakes and misunderstandings;
- Self-aware, able to identify their own biases and sources of frustration before they affect learners;
- Knowledgeable and able to gauge the level of learners.

### 3.7 **Evaluation of training delivery**

The training evaluation step completes the training cycle. As in any quality management process, one needs to gather data on performance to improve the system. In training systems, this means determining if the training has met the intended learning outcomes. Training success can be examined at four levels, as described by Kirkpatrick<sup>4</sup> (see Figure 20).

Most training organizations are very familiar with the Reaction level (response to the training experience) and Learning level (learning assessment), but Behaviour and Results are often

<sup>4</sup> Kirkpatrick, J. and W. Kirkpatrick, 2016: *Kirkpatrick's Four Levels of Training Evaluation*, ATD Press, Virginia

not addressed because levels 3 and 4 require much more effort to evaluate. Level 3 evaluation might be achieved by providing questionnaires, checklists, or rubrics to be used by learners and supervisors to check performance on the job; follow up questionnaires administered 6 months to 1 year after training; refresher training events with practical activities; and formal competency assessment procedures. Level 4 evaluation will require the highest levels of the organization to do concerted data gathering, including validation of performance and customer feedback.

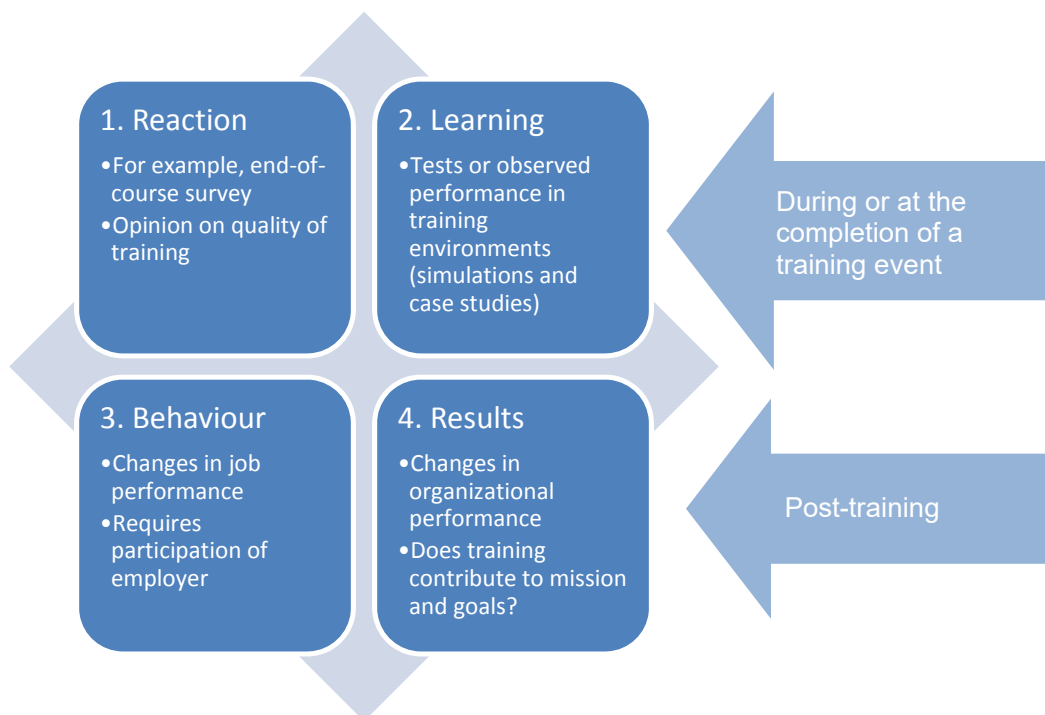
The learners are initially more interested in levels 1 and 2 whilst the managers and supervisors want to see the results of level 3 and 4 evaluations. If insufficient attention is paid to addressing levels 3 and 4, questions are often asked about the long-term benefit or usefulness of the training programme or training interventions. Discussing how the sponsors expect to evaluate the success of the training intervention during the initial planning is very important as it allows appropriate data to be collected along the way and provides the trainers with metrics to track during and after the training intervention.

**3.8 Example of a competency-based training course**

Documentation and announcements of competency-based training requires complete descriptions of competencies to be developed and activities that will aid in their development. Reference to the appropriate framework and competency elements (high-level competency, performance criteria and background knowledge or skill), including their identifying numbers, if available, should be included.

In addition to a clear description documenting the competencies addressed, and how they will be achieved, the training course should provide a certificate that indicates which competencies were developed. This “competency transcript” can be very useful for competency management processes.

In the example below, no competency framework could be referenced, but appropriate learning outcomes are referenced just the same as they might appear in a competency framework.



**Figure 20. Methods for determining training success**

**OSCAR/Surface training course****Course title**

The Observing Systems Capability Analysis and Review (OSCAR) tool for the metadata of surface-based observing systems

**General description**

A new online tool, the OSCAR/Surface database, is available for WMO Members to register all metadata regarding their surface observing systems. This tool is a practical implementation of the WIGOS Metadata Standard, which was approved in 2015 by the Seventeenth World Meteorological Congress and entered into force in July 2016. WMO Members need to understand and learn how to use the tool.

**Expected learning outcomes**

After completing the training course, participants will be able to:

- Interact with the Web interface of OSCAR/Surface via Internet to insert, validate, correct and update their observational metadata, as well as to search and extract observational metadata (primary outcome);
- Review and improve the internal processes of their NMHS related to the collection and processing of their observational metadata (secondary outcome).

**Audience(s)**

- Primary audience: National Focal Points for OSCAR/Surface;
- Secondary audience: Observing network managers, as well as observers and other technical staff dealing with meteorological instruments/equipment; other technical staff dealing with analysis and quality control or quality assurance of observations may be considered;
- This is a train-the-trainer course, which takes into account the regional structure of WMO and the number and variety of target audiences. So, after the course, learners are expected to act as trainers on OSCAR/Surface in their countries.

**Topic outlines**

1. Introduction and context
  - 1.1 Brief description of the WMO Integrated Global Observing System (WIGOS) and its regulatory and guidance material
  - 1.2 Importance of metadata and distinction between discovery and observational metadata
  - 1.3 Brief description of the WIGOS Metadata Standard
2. Functional description of OSCAR/Surface
  - 2.1 Functions and competencies
  - 2.2 Contents and structure
3. Practical use of OSCAR/Surface website
  - 3.1 Navigate the website, search for and extract metadata

### 3.2 Correct/update and insert metadata.

#### Course format

Classroom training with lectures and practical exercises on using OSCAR/Surface. Training material will be available online prior to the classroom event and also for use after training.

#### Learning activities

- (a) Learners will discuss the relevance of observational metadata and what, how and when they should be collected;
- (b) Learners will go through a set of practical exercises on searching, inserting and updating observational metadata in OSCAR/Surface;
- (c) A case study will be provided to learners, requiring them to search for incorrect/incomplete metadata and to propose the necessary changes;
- (d) Project: Learners will be challenged to insert and/or update some observational metadata from their own countries in OSCAR/Surface; this includes previous gathering of real metadata.

#### Learning assessment

- Before the training course, the basic knowledge and skills of potential learners for using OSCAR/Surface will be assessed via a self-assessment procedure;
- During the training course, a formative assessment of the learners will be made based on observation of practical exercises, particularly focused on searching and extracting observational metadata;
- At the end of the training course, a summative assessment of the learners will be made, based on a final project consisting in correction/updating of a set of metadata and its insertion into OSCAR/Surface.

#### Course evaluation

- Classroom discussions and practical exercises to determine how well students are learning;
- One end-of-course questionnaire;
- Long-term feedback questionnaires sent to the OSCAR/Surface NFPs, approximately nine months after the course, combined with pre-course feedback to assess what was gained during the training course;
- A dedicated email address to gather feedback on OSCAR/Surface training activities.

#### Learning resources

- The [OSCAR/Surface website](#);
- The [Manual on WMO Integrated Global observing System](#) (WMO-No. 1160);
- The [OSCAR/Surface User Manual](#).

## 4. OTHER CONSIDERATIONS

### 4.1 Reporting implementation progress

Organizations audited by international regulatory bodies may be called upon to report their level of implementation of relevant competency frameworks. The four stages of implementation are depicted in Figure 21.

Implementation through each stage should be documented (see section 5 below), as appropriate, according to the organization's QMS.

Members can self-assess their progress through the various stages of implementation, or monitoring can be done at the international level. For example, the WMO Marine Meteorology and Oceanography Programme conducts a periodic assessment of all Members with MetArea Coordinator responsibilities as part of the Worldwide Met-Ocean Information and Warning Service; whereas implementation of the competencies for Aeronautical Meteorological Personnel is monitored by ICAO.

Competency frameworks which are not regulated are recommended practices only, and reporting against these stages may not be required. However, the stages are still a useful measure of the level of intended implementation within an organization.

### 4.2 Promoting implementation of competency frameworks

Implementation will require ongoing attention from WMO technical commissions and the use of a variety of strategies to engage and motivate Members to take action.

The following are useful strategies that technical commissions can employ to promote implementation of competency frameworks amongst Members:

- Raise awareness and educate Members about the competency framework(s) through regular newsletters;
- Conduct regional training workshops to develop awareness of the frameworks and strategies for implementation;

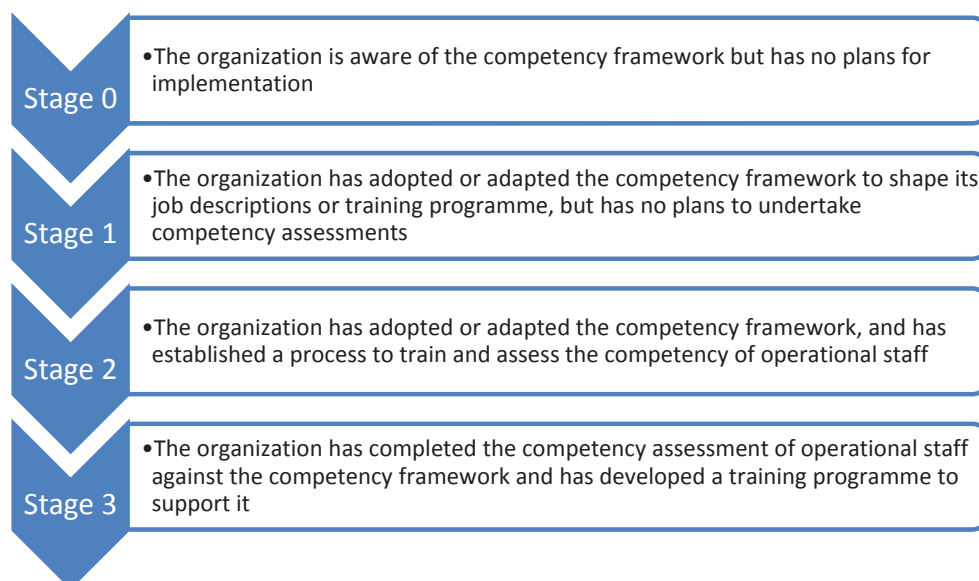


Figure 21. Four stages of implementing a competency framework



- Develop an online library of useful implementation resources, including examples;
- Facilitate discussion between Members and relevant expert teams, through the use of online forums;
- Establish points of contact for competency-related queries from Members;
- Establish a regular reporting cycle with key personnel (Permanent Representatives, Regional Training Centres (RTCs)) within the Members' services against the implementation stages described in 4.1 above;
- Include competency implementation as a standing agenda item at commission meetings;
- Assist in the setting up of a pilot project to be used as a test case and model (useful for newly developed competency frameworks).

### 4.3 **Equity**

Trainers and assessors need to ensure that access and equity principles are applied in training and assessment, in accordance with the requirements set out by the national regulator.

### 4.4 **Work health and safety**

Work health and safety needs to be considered when planning and conducting a training and/or assessment programme. In particular, assessors and supervisors need to be mindful of:

- Allowing adequate time for candidates to complete training and assessment tasks, including taking regular breaks during activities;
- The environment in which the training event and/or the assessment will occur, and of any pre-existing hazards and measures to manage them;
- Hazards created as a result of the training and/or assessment process, for which a risk assessment will need to be applied;
- Monitoring risk and the effectiveness of risk control measures;
- The psychological impact of an assessment outcome.

Health and safety policies can change over time as new practices are developed. Therefore, it is recommended that the organization's policies are regularly checked to ensure the most up-to-date information is being used when planning and conducting an assessment. Policies relevant to the assessment process may include, but are not limited to:

- Driving;
- Ergonomics;
- Personal protective equipment;
- Working shifts or long hours (fatigue management);
- Domestic and international travel.

Trainers and assessors must be aware of any health and safety representatives for the workspace they are entering, and must consult with them about any known hazards and the control procedures in place.

## 5. COMPETENCY DOCUMENTATION

Good documentation serves many purposes (Figure 22) and is the heart of a QMS, covering aspects such as a competency management system. It documents the process employed by organizations implementing competency requirements, and provides a tool to demonstrate to stakeholders what measures the organization is taking to ensure the delivery of quality services.

Documentation that supports implementation of a competency requirement may include, but is not limited to:

- Relevant competency framework(s);
- Training plans;
- Assessment plans;
- Competency maintenance plans;
- Customized competency requirements;
- Assessment tools;
- Communication plans;
- Records of user results and feedback;
- Governance/oversight of the competency programme.

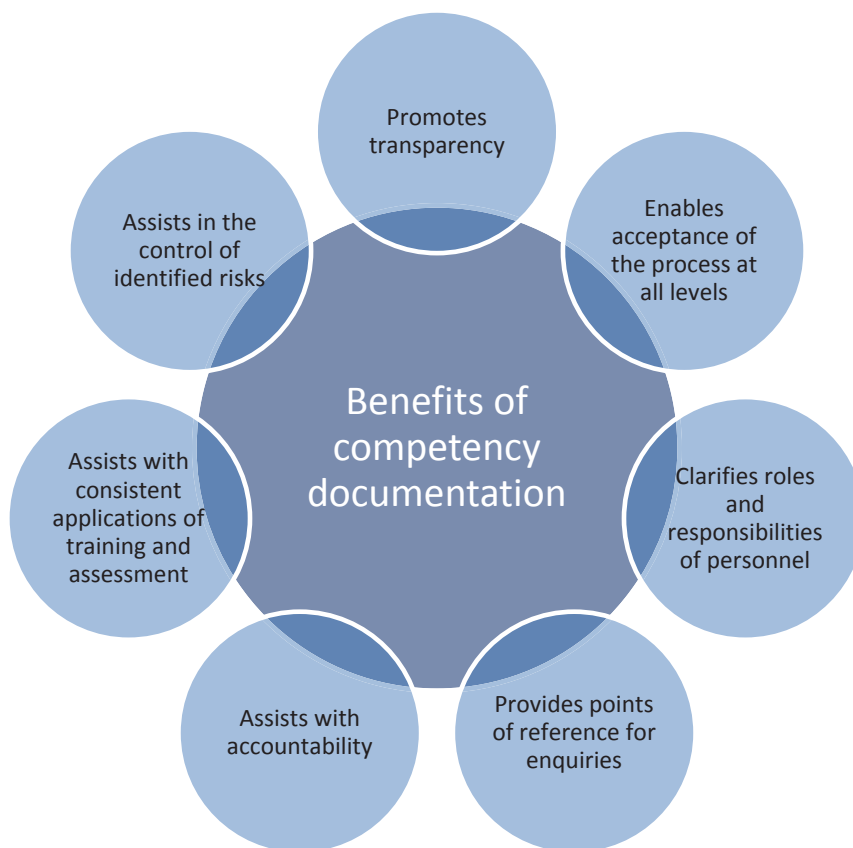


Figure 22. Benefits of competency documentation

The documents themselves should be written in such a way as to provide practical, realistic and usable information for personnel involved in the competency process. Finally, the documents should be reviewed periodically to ensure they are kept up to date, and reflect current practice.

### 5.1 **Training plan**

The purpose of a training plan is to document the decisions that will inform the training development and delivery processes. The training plan will include the results of a training needs analysis, targeted audiences, intended outcomes (competencies to be addressed), an overview of training content, how the training will be delivered and how often, resources, time, personnel, communication strategies involved in the training programme, and how the effectiveness of the training will be assessed. For more details on these elements refer to section 3 above.

### 5.2 **Competency assessment plan**

Similar to a training plan, the assessment plan should document who will be assessed, what unit(s) of competency will be assessed, what tools will be used to assess, when the assessment will take place, over what period and how long it will be valid for, any logistical considerations (such as rostering or relief of duties), who the assessor is, what the communication strategies are, what the instructions for the assessment are, what reasonable adjustments may be applied for relevant staff, what the feedback and reporting mechanisms are, and what actions to take in the event of a “not yet competent” result. Section 2 above will assist organizations in planning and documenting a competency assessment programme.

### 5.3 **Competency management plan**

Recall that a competency requirement outlines the minimum skills, knowledge and behaviours personnel need to demonstrate to perform the job function. Once competency has been demonstrated, it needs to be maintained over time and, ideally, organizations should implement strategies to enhance performance once the minimum requirement is met.

The process of maintaining and developing competency should be documented. For example, how often competency reassessment will occur, what assessment tools will be used, how they will vary from the initial assessment, how and when the organization will provide training to develop skills and knowledge and how this will be monitored. For organizations that need to consider competency requirements across multiple service areas (for example, marine, public weather services and aviation), a competency management plan will be instrumental in creating an efficient competency maintenance cycle which minimizes the burden of training and assessment on personnel and resources.

### 5.4 **Reporting and recording results**

It is the responsibility of each organization to keep a record of the evidence presented by candidates, which enables assessment decisions to be made.

For services implementing a QMS, such as those producing aeronautical meteorological forecasts, qualification and competency records are required for auditing purposes and should be continually kept up to date and retained with appropriate privacy systems in place. This is good practice for all services.

### 5.5 **Governance**

High-level documents outlining the governance of the assessment programme should be reviewed and endorsed by key stakeholders. Once approved, documentation should be retained according to the organization's QMS.

## 5.6 **Continuous improvement and review**

Documentation should be evaluated regularly to ensure it is up to date, continues to meet the requirements of the service area and is appropriate for the organizational context. This will generally involve a periodic review with key stakeholders to ensure the competency programme continues to meet user requirements. The review cycle should be linked to the organization's QMS.

## 5.7 **Successes and challenges of competency implementation**

In 2016, CAeM requested feedback from Members on the implementation guidance for AMP Competency Standards, including information on the successes and challenges Members faced.

Successes included:

### **Programme**

- Greater ability to select staff for training on the basis of needs identified during assessment;
- Standardized learning pathway from initial training through on-the-job training to job readiness;
- Implementation generated new national and international contacts;
- Tighter control of risks associated with staffing operational rosters;
- Greater transparency and accountability with industry in regard to the quality of service provision;
- Improved responsiveness in providing training and assessment when procedures change;
- Coordination of processes nationwide, across several offices;
- Recognition by meteorological personnel of the professional development benefits of being assessed;
- Improved overall performance of staff;
- Staff rotation now takes competency into consideration to ensure quality services;
- Improved collaboration, communication and planning among different levels of staff and teams;
- Sharing of knowledge and skills;
- Enabling organizations to understand the knowledge and skill status of staff.

### **Staff ownership**

- Facilitated self-directed learning;
- Greater ownership by meteorological personnel of their professional development;
- Staff are more committed to the quality management process.

### **Training**

- Maintaining competent staff provided the opportunity to create more training resources, regularly train staff, and keep in touch with new concepts;

- The mandatory Competency Standard raised the profile of training in the organization;
- Improved overall quality of training programmes.

As is evidenced, many of the benefits cited at the beginning of this Guide have been realized by organizations implementing the AMP Competency Standards.

Further to the list in Part II, section 2, challenges included:

### **Programme**

- Keeping up with the ongoing schedule of assessments;
- Time and energy required to conduct assessments;
- Finding the best tool(s) to assess competency in the most objective way possible;
- Constructing assessment tools to suit a range of different forecast offices that are dispersed geographically, and perform different tasks;
- Rapid turnover of staff in some locations;
- Transferring competency from one location to another;
- Managing the assessment workload for personnel who needed to demonstrate competence over multiple service areas (aviation, marine and public weather services);
- Managing operational rosters to accommodate training and/or assessment, and the availability of staff;
- Staffing rosters in emergency situations or during staff shortages with competent staff;
- Increased communications with operational and non-operational managers;
- Budgeting for assessments;
- Reconciling national regulations with those of WMO;
- Overcoming suspicion and fear of assessment among employees;
- Gaining buy-in or acceptance of the need to carry out assessments;
- Removing subjectivity from assessments;
- Maintaining quality, consistency and rigour of the assessment process;
- Maintaining and resourcing good governance and oversight of the process.

### **Staff**

- Misunderstandings about the difference between a competency assessment and a performance appraisal;
- Reducing the burden of assessments on staff and the disruption of normal duties;
- Perception that individual performance was being challenged;
- Understanding how competence should be demonstrated, and how to collect evidence.

**Training**

- Changing the culture of learning, and development required to support the competency system;
- Lack of adequate training for assessors;
- Lack of human and financial resources to plan, develop or conduct the assessments;
- Determining the level of detail in documentation, what needs to be documented and how often.

It is useful for organizations embarking on a competency process to consider the list of challenges and plan for ways to mitigate them during implementation.

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