



Food and Agriculture Organization  
of the United Nations

# PERFORMANCE INDICATORS OF THE WATER SERVICE IN IRRIGATION

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ONLINE ADMINISTERED COURSE – 15 DECEMBER 2020



# OUTLINE



- **Water service and irrigation system performance**
- **Performance indicators:**
  - **Reliability fiabilité**
    - Define – measure - assess
  - **Equity**
    - Define – address - assess
  - **Flexibility**
    - Define – measure - improve
  - **Adequacy**
    - Define - evaluate

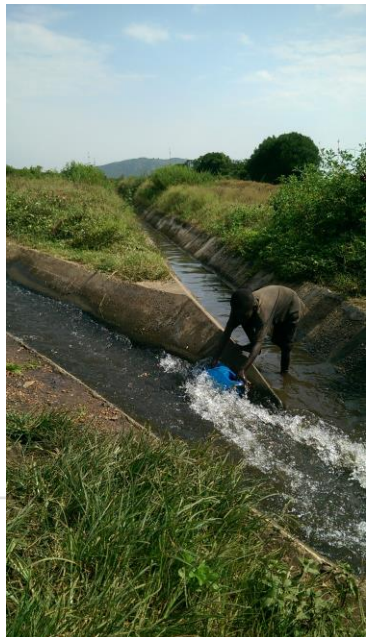
# WATER SERVICE: A DEFINITION



**Water Service:** provision of the **adequate amount** of water, at the **appropriate time**, to satisfy the **crop water requirements** and obtain the **potential yield**

The hydraulic expression of the water service refers to:

**Open-channel irrigation systems:**



1. discharge and duration of water distribution;
2. water level within the canals to guarantee appropriate distribution to farms and crops



**Pressurized irrigation systems:**

1. discharge and duration of water distribution;
2. pressure at hydrant level to guarantee discharge and appropriate functioning of on-farm equipment (drippers, sprinklers, ...)

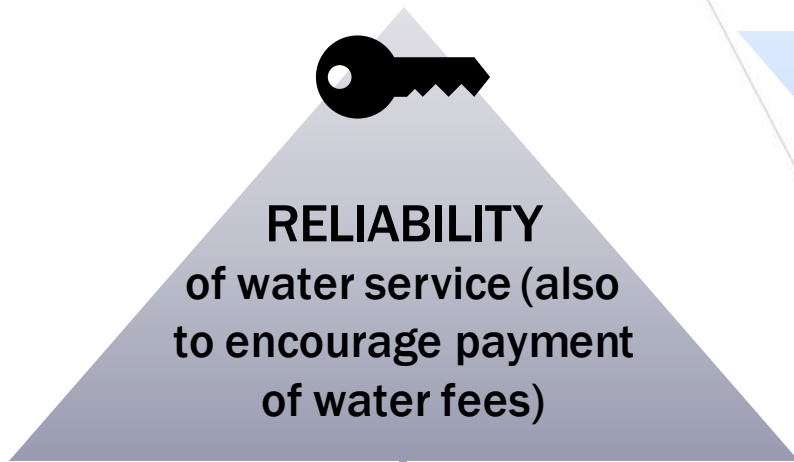


# IRRIGATION SYSTEMS' PERFORMANCE: INDICATORS

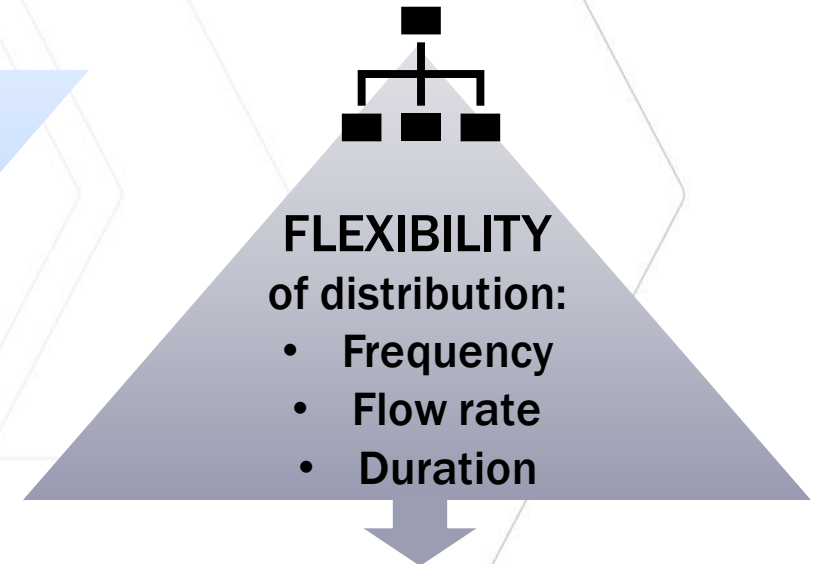
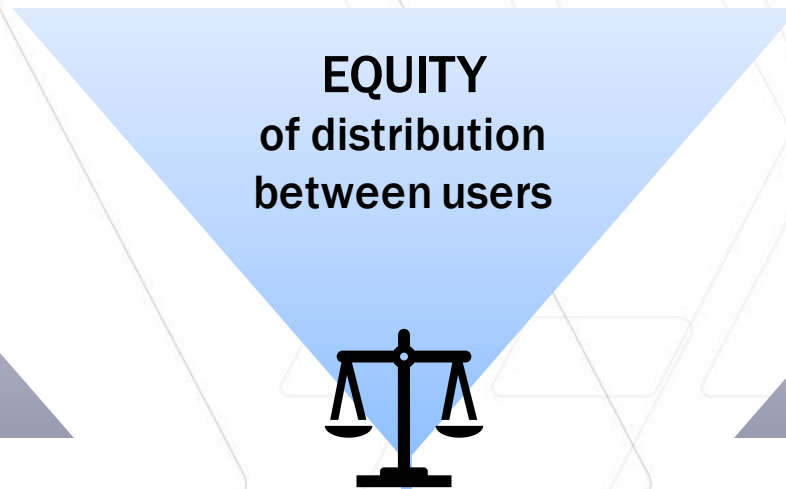


Performances of irrigation systems define the service delivered to users

## MAIN INDICATORS:



*Key to ensure good social order*



*Minimum level required in all cases for efficient field level practices*

# RELIABILITY: HOW TO DEFINE IT?



Indicator to assess the temporal variability of the irrigation system performance and any deviation from the required value



*LACK OF RELIABILITY CAN BE:*

**Temporary:**  
related to conjuncture  
mechanical failure,  
breakdown or breakage of the  
canal and leaks, or of pipes,  
blockage or breakage on  
valves, or hydro mechanical  
equipment on the network



**Systemic:**  
failure to meet the demand  
for water, especially when the  
capacity of the network  
or/and the state of the  
irrigation scheme is exceeded  
by the level of demand

# RELIABILITY: HOW TO MEASURE IT?



**Reliability indicator : number of gates to open simultaneously to satisfy those conditions**

**Case scenario: 70% out of all gates (farmers) are completely satisfied**

*Which farms are satisfied and when?*

*Which farms are **not** satisfied and why?*

**Need to assess:**

- Deficit in pressure or in canal water level
  - Cause and Duration of the failure
  - Impacts on crops

**This will open the door for Rapid Appraisal Procedure and rehabilitation**

# RELIABILITY: HOW TO ASSESS IT?



Irrigation water delivery can be considered reliable under any of these conditions:

- water level exceeds the defined minimum water level in open canal system
- pressure in hydrant exceeds the minimum required pressure in pressurized irrigation system

It applies even if multiple outlets (gates in canal-system, hydrants in pressurized systems) operate simultaneously



# EQUITY: HOW TO DEFINE IT ?



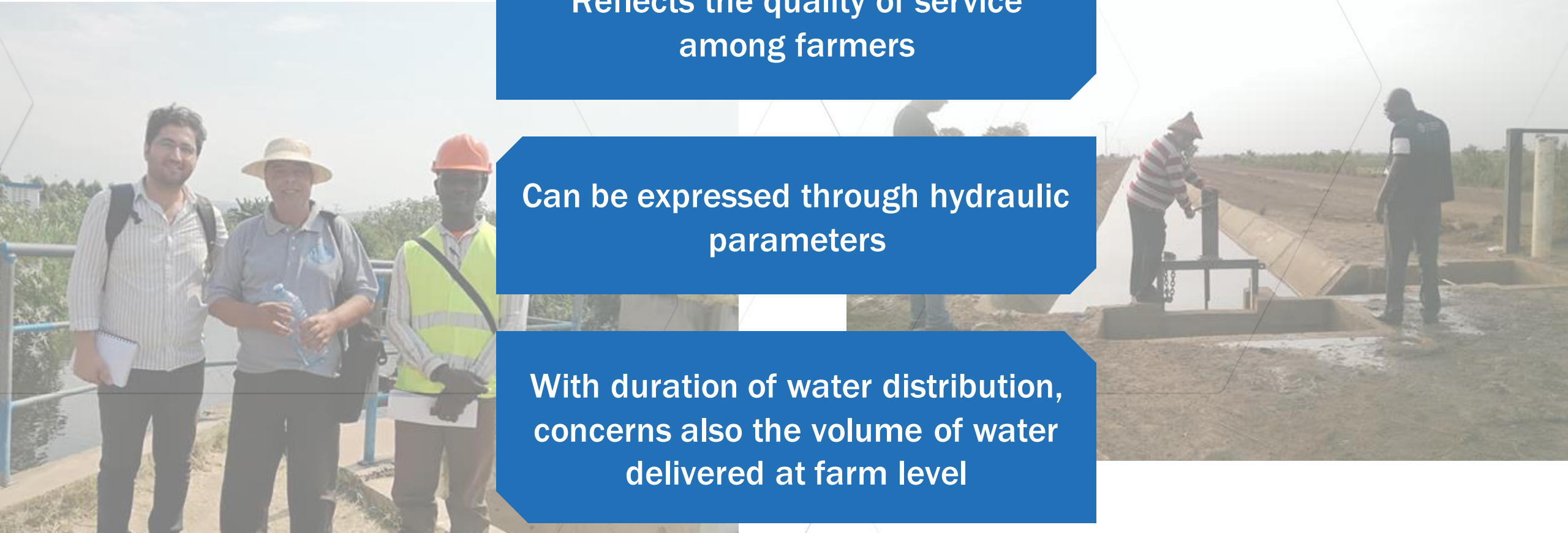
Indicator to assess the spatial variability of the irrigation system performance



Reflects the quality of service among farmers

Can be expressed through hydraulic parameters

With duration of water distribution, concerns also the volume of water delivered at farm level





# EQUITY: HOW TO ADDRESS IT?



**Lack of equity is a cause of conflicts:**

- between operator and users, and
- between users themselves.

**Objective:**

**delivering almost the same water service everywhere in the irrigation system**

**If equity is low (some farmers have more water than others), measurement devices should be installed at least between main and secondary canals, to arbitrate the conflicts by looking for better water distribution rule (arranged on demand, efficient rotation, water saving action,...)**

# EQUITY: HOW TO ASSESS IT?



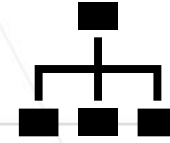
Good equity can be reached when:

**All farmers have a water level in their canals or a pressure head at their hydrant that satisfies the minimum requirement of hydraulic parameters**

**The duration of the water service is enough to deliver the amount of water required by hydraulic parameters**



# FLEXIBILITY: HOW TO DEFINE IT?



## Indicator to:

- assess the degree of freedom for farmers to operate irrigation at his farm
- arrange the delivery planned upon request or not

Flexibility is connected to the state of the irrigation network:  
the higher is water use efficiency, the better is the possibility to arrange irrigation with flexibility.

Discharge available at hydrant level is higher and time to satisfy the demand is lower  
(for the same crops)



**Result:** time saved to improve the flexibility and all through WUE improvement

- the perfect flexibility is guaranteed by on-demand irrigation system. It is a very comfortable situation

# FLEXIBILITY: HOW TO MEASURE IT?



Defined through three parameters:

Duration of the water service

Frequency of water distribution to each farmer

Discharge delivered at on farm level

On-demand irrigation systems ensure perfect flexibility, without constraints on the availability of water resource and the irrigation network capacity



# FLEXIBILITY: HOW TO IMPROVE IT?



Selection of new cash crops with less water requirements can improve the flexibility and the productivity of agricultural water

## The case of Morocco and Uganda

Rehabilitation of secondary, tertiary and quaternary canals



Irrigation scheme more efficient, with reduced losses, and higher discharge and water level in the canals



Duration of irrigation for farmers is lower



The same time allocated to irrigation before rehabilitation is currently enough to save 6 hours free for the farmers in one rotation, to allow to plan other actions, and to adapt the irrigation frequency to the optimal conditions of plant and soil reservoir management.

# ADEQUACY: HOW TO DEFINE IT ?



Indicator to assess if the planned or the desired water use is aligned to actual use

## SCOPE:

To quantify and assess efficient planned irrigation and current irrigation process

The assessment guides the solution to address unsolved issues in the current situation



# ADEQUACY: HOW TO EVALUATE IT ?



## According to stakeholders:

### Farmers

Adequacy of water delivery to the farms is evaluated through the satisfaction or not of the crop water requirements

Adequacy is expressed in this case by a Water Use Ratio, which is Water use over crop water requirements

### Agricultural decision makers

Adequacy may concern the alignment between the planned or projected water amount and use, with the actual water delivered and its use

Adequacy is expressed in this case by the ratio between actual irrigated area and the projected or planned irrigation area.

### Water Resource Managers

Adequacy may concern the ratio between the actual water delivered and the quantity of water planned or allocated to an irrigated area, for the campaign or for a time period.



***Thank you***

***Merci***

***شكرا لكم***