Measuring System Performance

"Improving Irrigation Service Delivery in India"
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Dr Martin Burton,
Consultant, Irrigation Management

WORLD BANK GROUP
Water

Outline of this presentation

1. Introduction
2. Defining service delivery
3. The irrigation “system”
4. Performance indicators & data
5. Examples of performance assessment
4. Summary and conclusions
5. Questions for discussion

Introduction

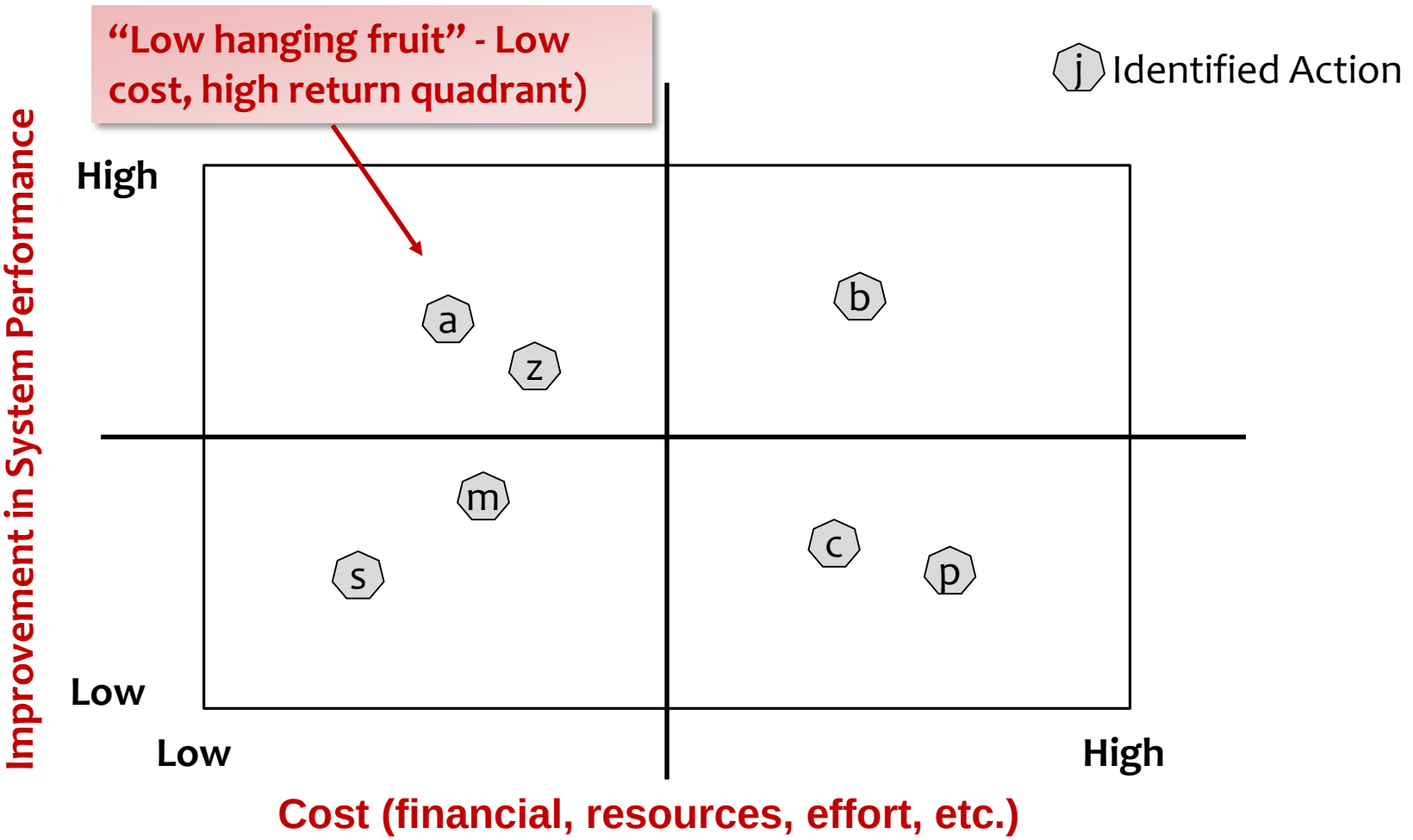
Objective

Identify feasible options for improving efficiency of water management & systems operation in India

Purpose of presentation: To initiate discussion and seek advice on:

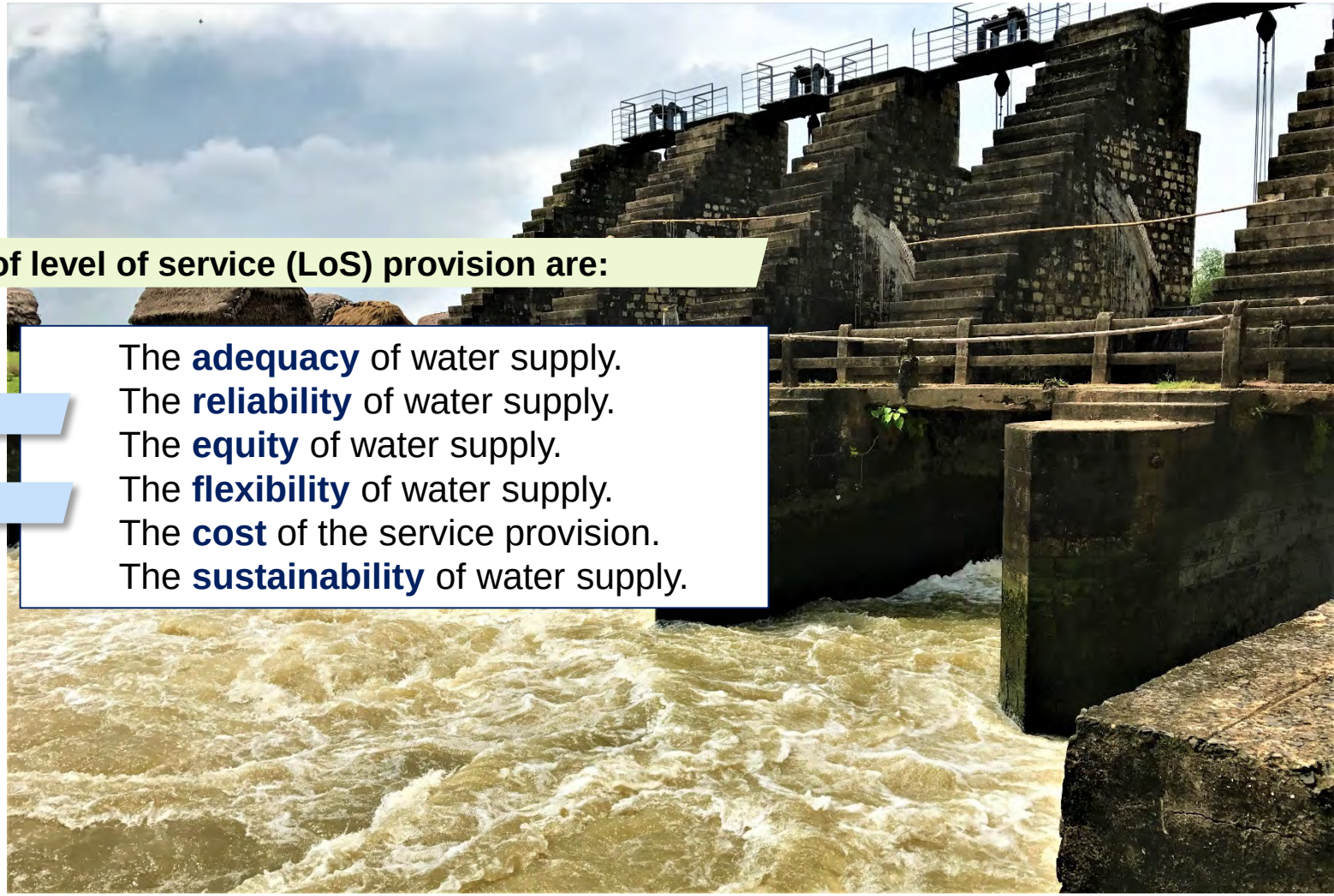
- Measures of system performance by scheme/ state.
- Identification of suitable performance indicators.

Performance assessment & benchmarking



Service delivery: Key measures

Assessing the performance of the service provider



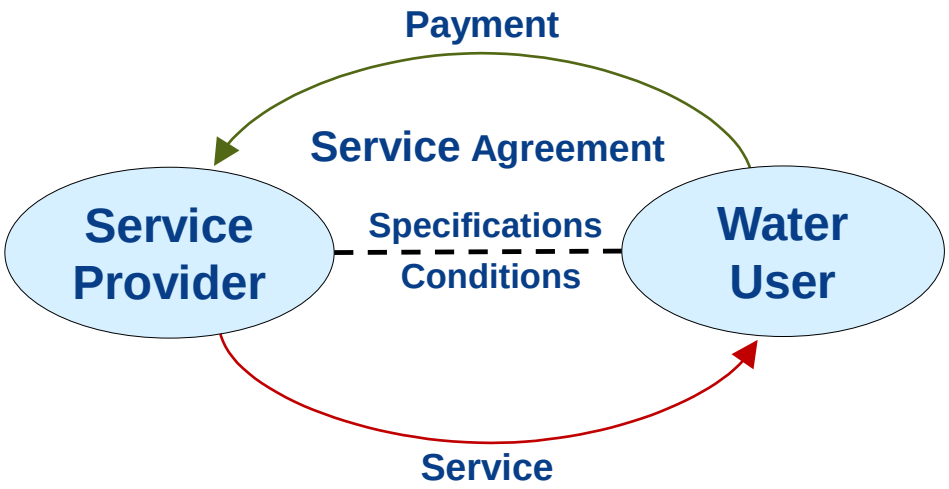
Key measures of level of service (LoS) provision are:

Quality

Efficiency

The **adequacy** of water supply.
The **reliability** of water supply.
The **equity** of water supply.
The **flexibility** of water supply.
The **cost** of the service provision.
The **sustainability** of water supply.

Service delivery: Key elements



Source: Huppert and Urban, 1998

Measurement ↔ **Management** ↔ **Scheduling**

Operational specifications & conditions

Core criteria

"Detailed description of the criteria for service"

Specifications

- Rate, duration and frequency of supply
- Height (or command) of supply
- Pressure of supply
- Security of supply
- Delivery performance
- Measurement & monitoring arrangements

"Something required or limiting in an agreement"

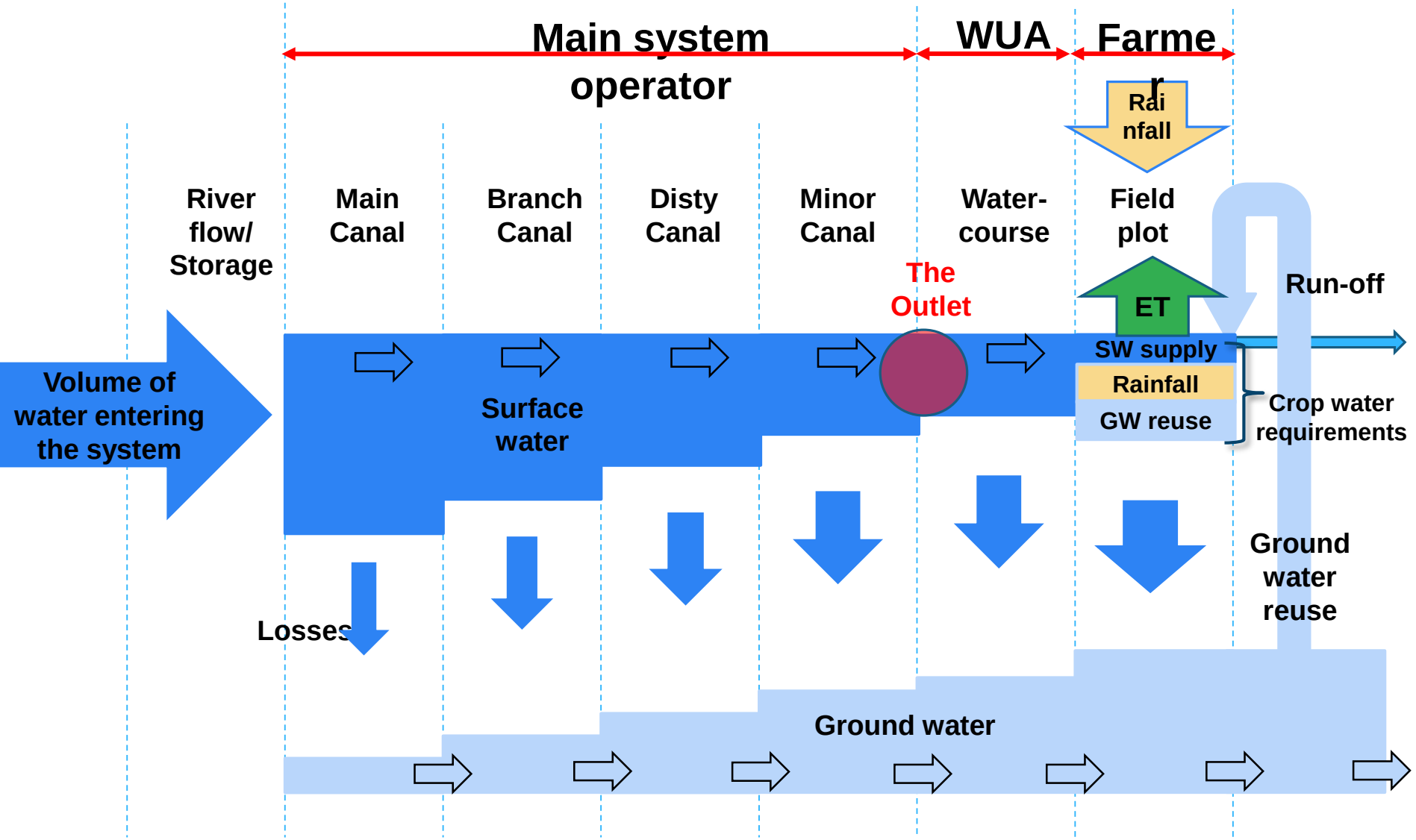
Conditions

- Payment for water supply
- Water ordering
- Location and nature of delivery point
- Supply restrictions
- Allocation priority
- Interruptions of supply

Source: Malano and van Hofwegen, 1999

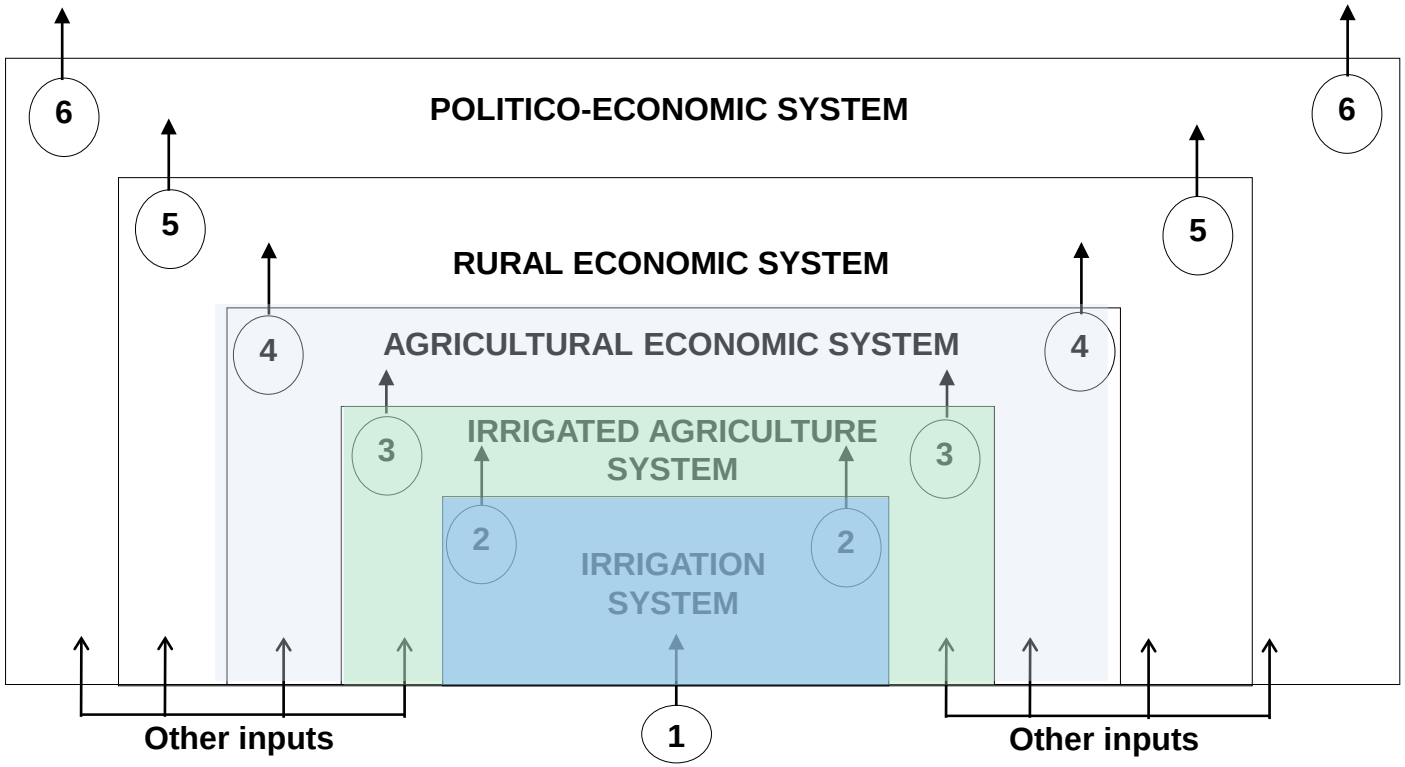
The physical irrigation system

Water use and management



The irrigation "system"

Setting the boundaries



Inputs/outputs to each system

1. Operation of irrigation facilities
2. Supply of water to crops
3. Agricultural production
4. Incomes in rural sector
5. Rural economic development
6. National development

Source: Small and Svendsen, 1992

“System” inputs and outputs

Core criteria

	Input	Output
I&D System	• Water abstracted • O&M of the physical system	Water delivered: • at the outlet (WRD) • to the farm plot (WUA) • to the crop root zone (farmer)
Irrigated ag system	• Water • Labour, land, energy, seed, etc.	Agricultural produce
Ag – eco system	• Agricultural produce • Markets	• Income to farmers and labour • Ability to pay the ISF

Where to select the boundaries?

Main system service provider

Where should we set the boundaries for measuring the main system service provider's performance?

- To the head of the minor or distributary (for flow measurement)?
- To the final delivery point (the outlet to the chak)?
- To measuring the crop type and area in the chak (as a proxy for water delivery to the outlet)?
- To measuring the crop yield, crop production and crop value in the chak (and thus the scheme overall)?

How does this affect the performance indicators we use & the data we collect?

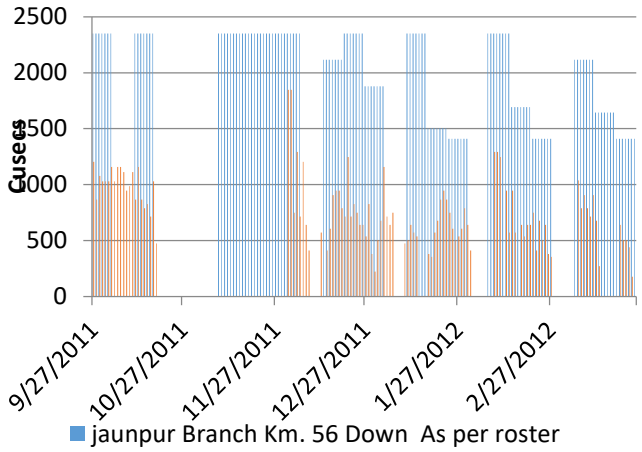
Possible performance indicators

Main system service provider

	Performance indicators
Adequacy	• Ratio IPU/IPC • Crop type and area • Cropping intensity • Fee recovery ratio • Delivery Performance Ratio (at disty/minor)
Reliability	• User satisfaction survey
Equity	• Crop type and area • Cropping intensity • Fee recovery ratio • Delivery Performance Ratio (at disty/minor)
Flexibility	• User satisfaction survey
Cost	• Irrigation service fee • Total MOM expenditure • ISF collected/MOM expenditure ratio • Abstraction/river flow ratio • Groundwater levels

Data collection

What to collect	Discharges, crop areas / types, fee, management, O&M expenditure, etc.
Where to collect	For the whole system/ different locations within the system?
When to collect	During the season/ at the end of the season or year
Who collects	WRD/ other parties?



Examples of Performance Assessment

Nagarjuna Sagar Right Canal, AP, 2008-09

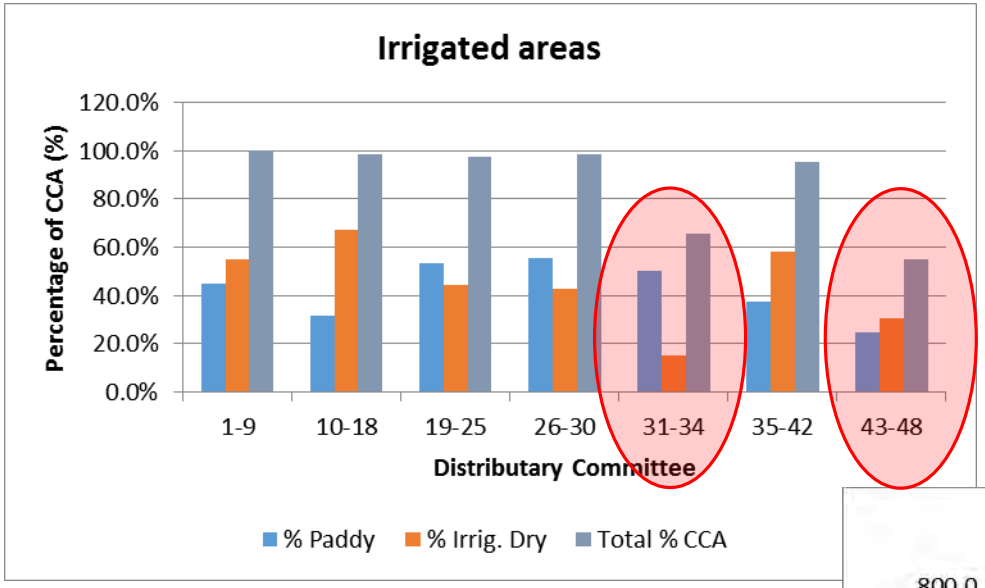
Base Data (10 data items)

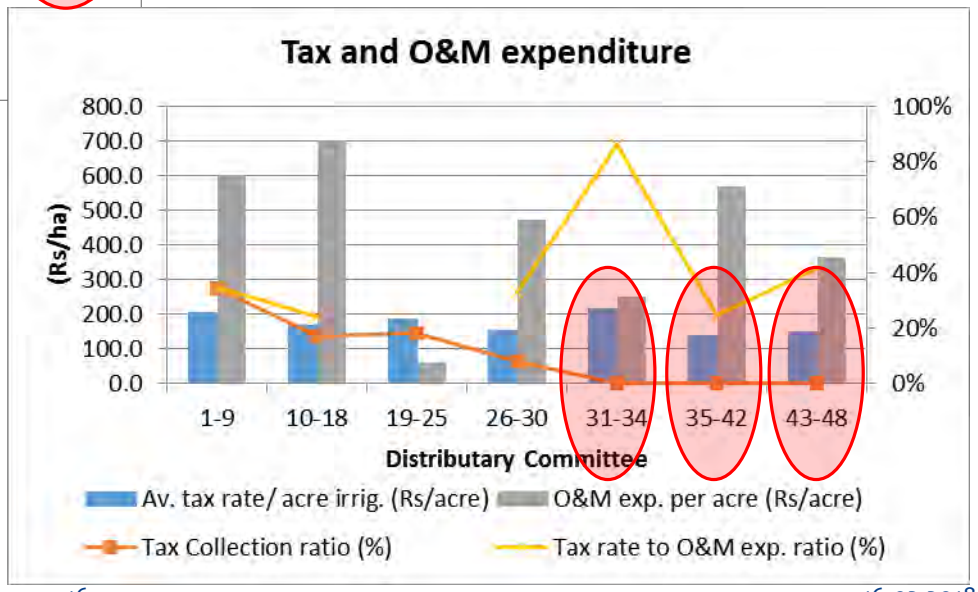
- Distributary Committee name
- Localized Ayacut (acres)
- Paddy Irrigated Area (acres)
- ID Irrigated Area (acres)
- Total Area Irrigated (acres)
- Tax Demand (INR)
- Tax Collection (INR)
- Total O&M Expenditure (INR)
- Water Supplied (Mcft)
- Total Crop Value (INR)

Analysis (8 Indicators)

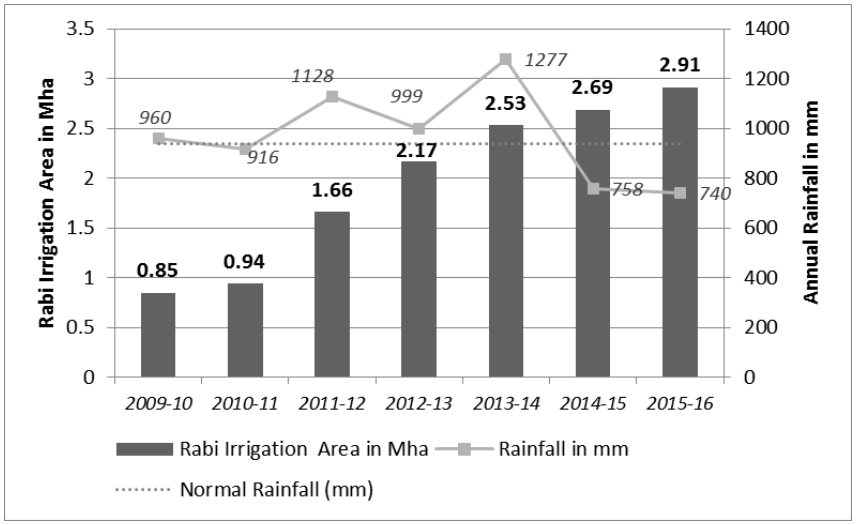
- Distributary Committee name
- Localized Ayacut (acres)
- % Paddy
- % Irrigated Dry
- Total % CCA
- Av. tax rate/acre irrigated (Rs/acre)
- Tax Collection ratio (%)
- O&M expenditure per acre (Rs/acre)
- Tax rate to O&M exp. ratio (%)
- Av. Irrig. area per Mcft (Acres/Mcft)

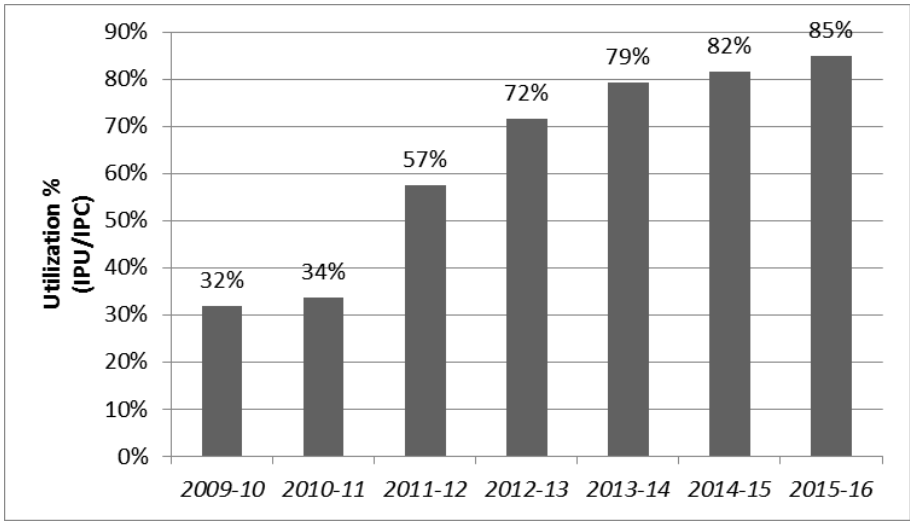
Nagarjuna Sagar Right Canal, AP, 2008-09

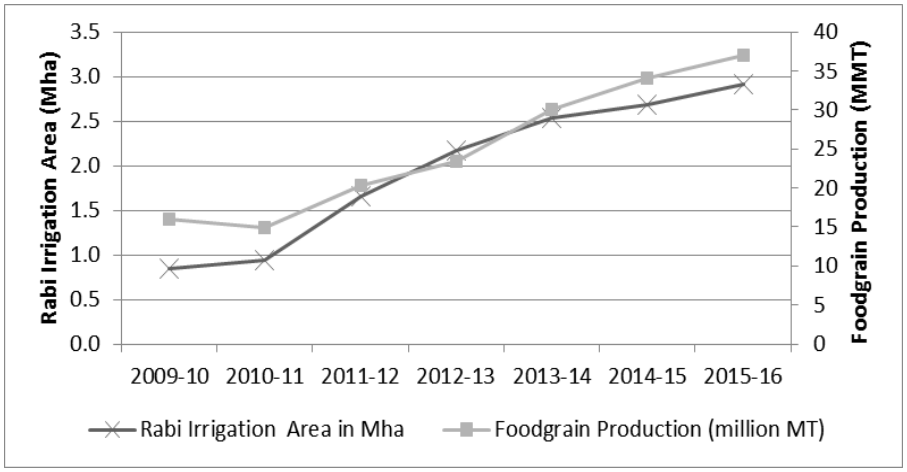


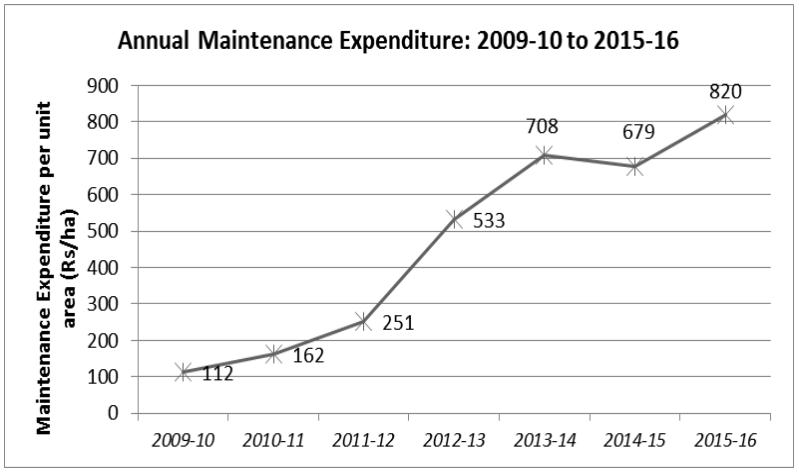


Madhya Pradesh, 2009-10 to 2015-16









Source: Julaniya et al, 2016

Maharashtra benchmarking

Doing performance assessment of schemes since 2001-2

2010-11: 1335 schemes benchmarked

- (86 major, 258 medium & 3108 minor)
- 12 indicators

Indicators in 5 categories:

- System performance (3 indicators)
- Agricultural productivity (2 indicators)
- Financial (5 indicators)
- Environmental (1 indicator)
- Social (1 indicator)

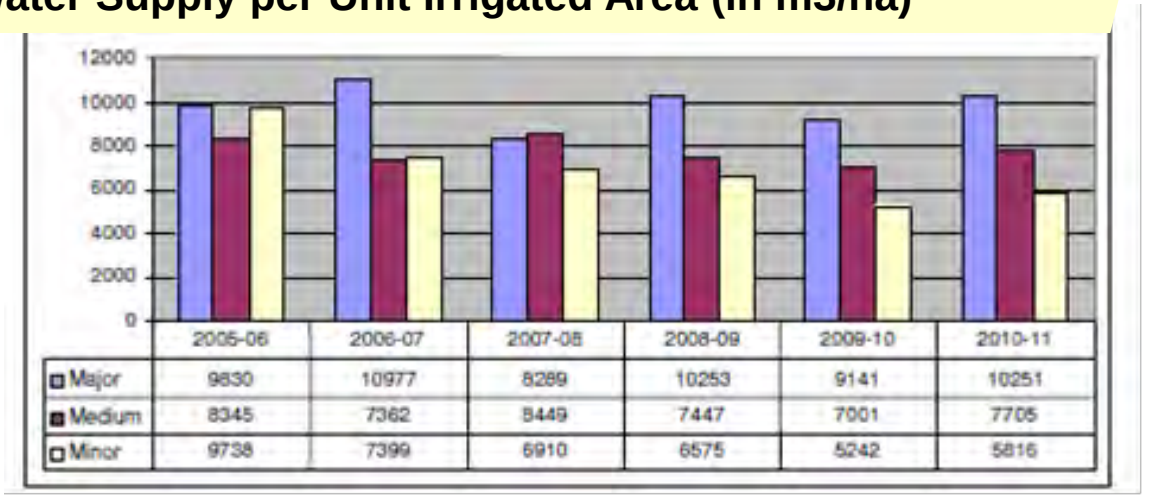
Maharashtra benchmarking

Performance indicators

Sr. No.	Indicator No.	Title of indicator
System Performance		
1	I	Annual Irrigation Water Supply Per Unit Irrigated Area (m^3/ha)
2	Ia	Annual Area Irrigated per Unit of Water Supplied (ha/MCM)
3	II	Potential Created and Utilized (ratio)
Agricultural Productivity		
4	III	Output (Agricultural Production) Per Unit Irrigated Area (Rs/ha)
5	IV	Output (Agricultural Production) Per Unit Irrigation Water Supply (Rs/m^3)
Financial Aspects		
6	V	Cost Recovery Ratio (ratio)
7	VI	Total O&M Cost Per Unit Area (Rs/ha)
8	VII	Total O&M Cost Per Unit Volume Of Water Supplied (Rs/m^3)
9	VIII	Revenue Per Unit Volume Of Water Supplied (Rs/m^3)
10	XII(I)	Assessment Recovery Ratio Irrigation (ratio)
	XII (NI)	Assessment Recovery Ratio Non-Irrigation (ratio)
Environmental Aspects		
11	X	Land Damage (%)
Social Aspects		
12	XI	Equity Performance (ratio)

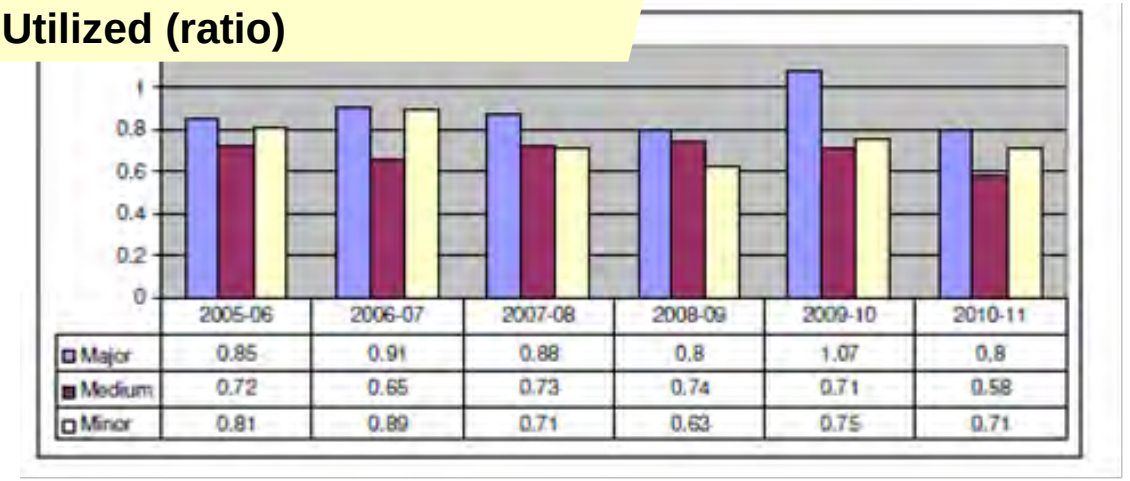
Maharashtra indicators

Indicator I - Annual Irrigation Water Supply per Unit Irrigated Area (in m3/ha)



	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Major	9830	10977	8289	10253	9141	10251
Medium	8345	7362	8449	7447	7001	7705
Minor	9738	7399	6910	6575	5242	5816

Indicator II – Potential Created & Utilized (ratio)



	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Major	0.85	0.91	0.88	0.8	1.07	0.8
Medium	0.72	0.65	0.73	0.74	0.71	0.58
Minor	0.81	0.89	0.71	0.63	0.75	0.71

Summary and conclusions

- Performance assessment is a key management process for improving performance of schemes.
- The Level of Service (LoS) defines the performance indicators to be used and thus the data to be collected.
- It is important to define the “system” boundaries
- Three examples from India show a range of indicators used to measure performance.

Questions for discussion

Where should we set the boundaries for assessing performance (delivery only, agricultural production, value of produce)?

What indicators should we use for measuring the performance of major irrigation systems?

What data are required for these indicators and are these data readily available?

Thank you

References

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- **Small, L.E.; and M. Svendsen. 1992.** A framework for assessing irrigation performance. IFPRI Working Papers on Irrigation Performance No. 1. Washington, D. C.: IFPRI.
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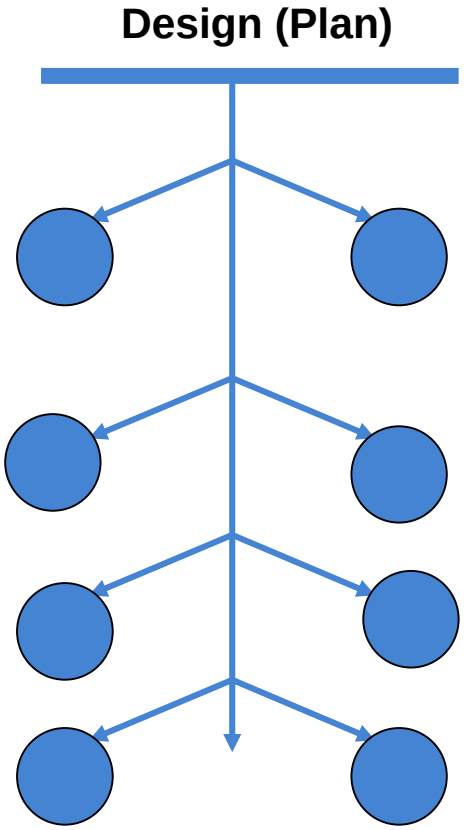
Annexures

Service Delivery
Defining key measures

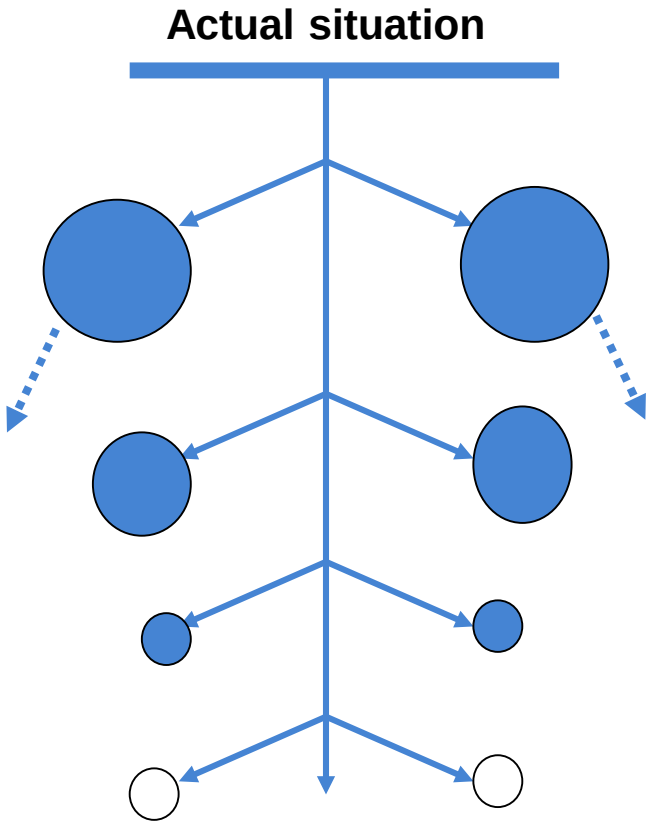
Service quality	Irrigation	Drainage
Adequacy	Ability to meet water demand for optimum plant growth	Ability to dispose of excess water in minimal time to prevent crop damage
Reliability	Confidence in supply of water	Confidence in the ability to dispose of excess water
Equity	Fair share of available water and water shortage risks (e.g. Warabandi system)	Fair distribution of inundation risks
Flexibility	Ability to choose the frequency, rate and duration of supply	Ability to choose the time, rate and duration of disposal
Cost	Cost of the irrigation service provision	Cost of the drainage service provision
Sustainability	Ability to continue to provide water in the future	Ability to cope with extreme events

Service delivery

Plan and reality



Adequate & equitable supply

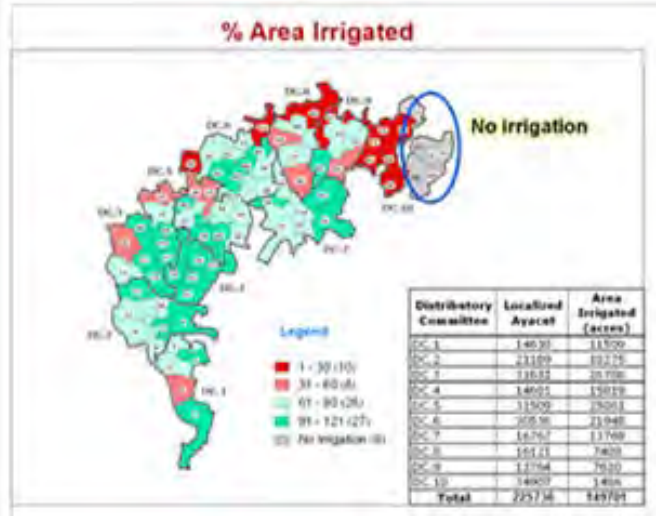


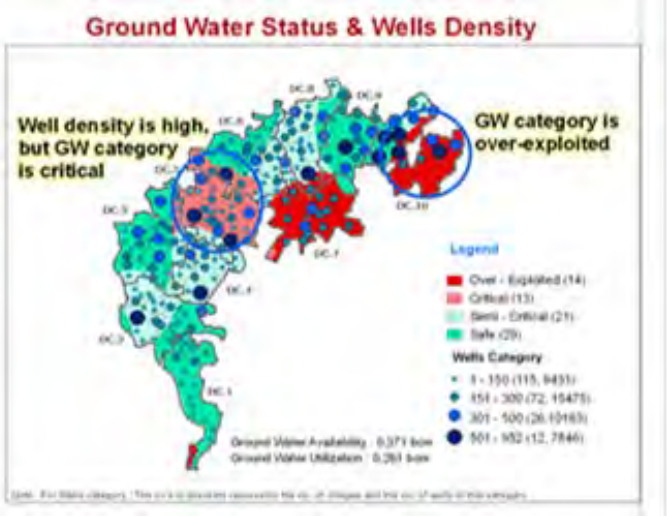
Inadequate & inequitable supply

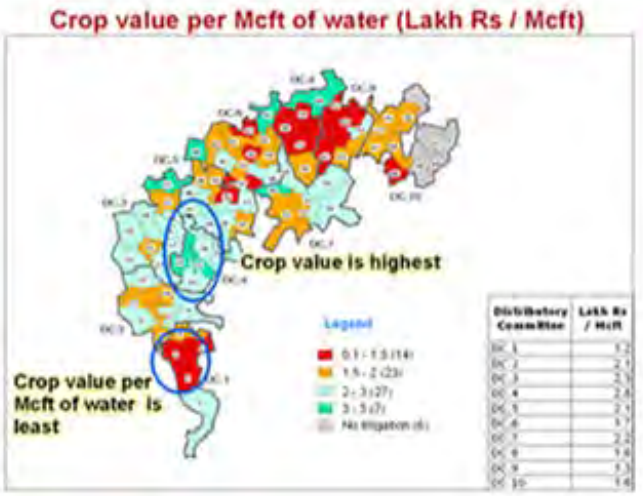
Descriptors of I&D systems

- Irrigable area
- Annual irrigated area
- Climate
- Water source
- Average annual rainfall
- Average annual ETo
- Method of abstraction (gravity, pumped)
- Water delivery infrastructure
- Type of water distribution
- Predominant on-farm irrigation method
- Major crops (type & percentage)
- Average farm size
- Type of management (Govt./farmer)

Some useful tools
GIS





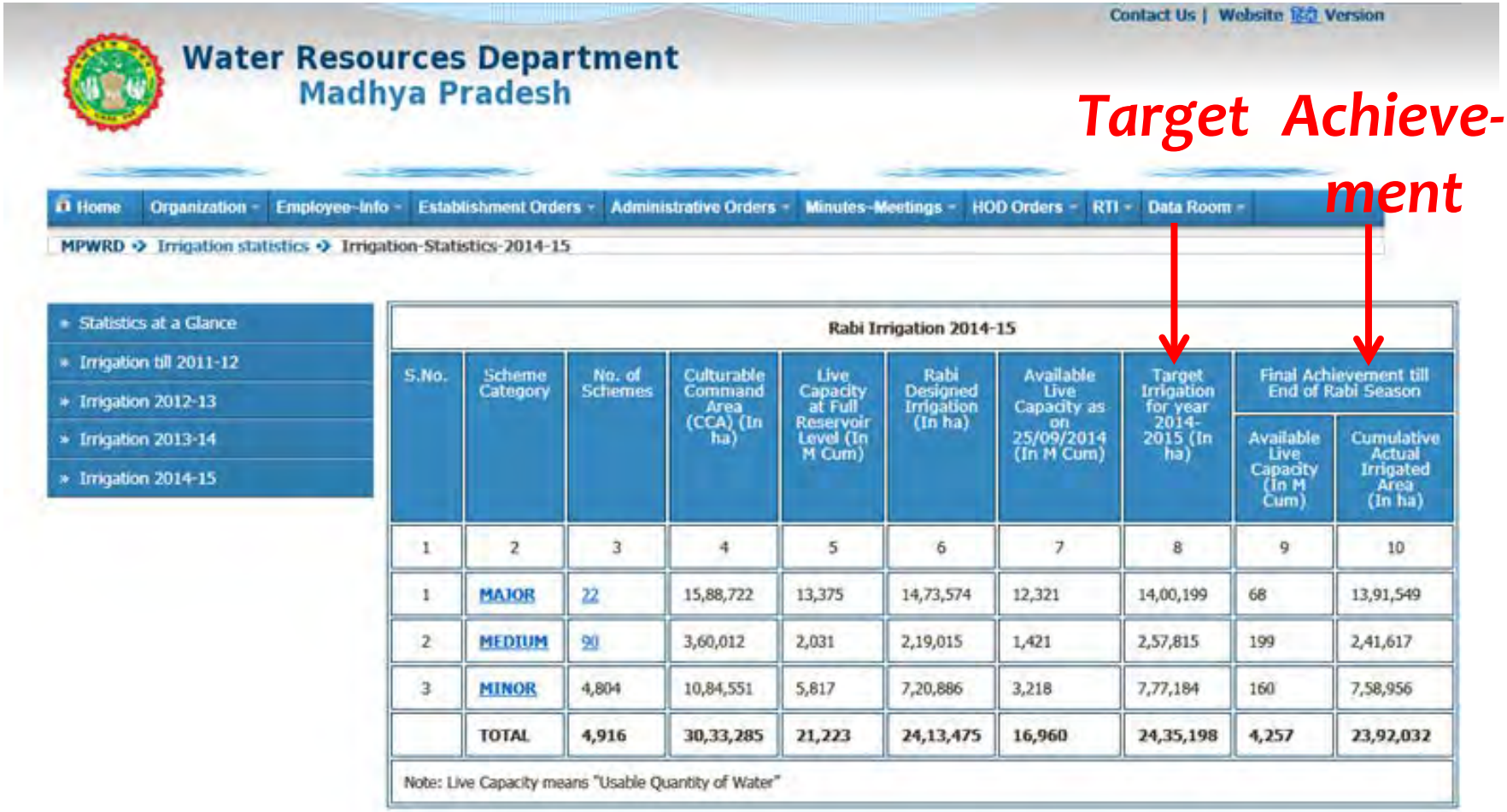


Source: ADB, 2015

Web-based MIS

Source: www.mpwrd.gov.in

Web-based MIS & performance management



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Water Resources Department
Madhya Pradesh

Target Achieve-ment

Home | Organization | Employee-Info | Establishment Orders | Administrative Orders | Minutes-Meetings | HOD Orders | RTI | Data Room

MPWRD → Irrigation statistics → Irrigation-Statistics-2014-15

- Statistics at a Glance
- Irrigation till 2011-12
- Irrigation 2012-13
- Irrigation 2013-14
- Irrigation 2014-15

Rabi Irrigation 2014-15

S.No.	Scheme Category	No. of Schemes	Culturable Command Area (CCA) (In ha)	Live Capacity at Full Reservoir Level (In M Cum)	Rabi Designed Irrigation (In ha)	Available Live Capacity as on 25/09/2014 (In M Cum)	Target Irrigation for year 2014-2015 (In ha)	Final Achievement till End of Rabi Season	
								Available Live Capacity (In M Cum)	Cumulative Actual Irrigated Area (In ha)
1	2	3	4	5	6	7	8	9	10
1	MAJOR	22	15,88,722	13,375	14,73,574	12,321	14,00,199	68	13,91,549
2	MEDIUM	90	3,60,012	2,031	2,19,015	1,421	2,57,815	199	2,41,617
3	MINOR	4,804	10,84,551	5,817	7,20,886	3,218	7,77,184	160	7,58,956
	TOTAL	4,916	30,33,285	21,223	24,13,475	16,960	24,35,198	4,257	23,92,032

Note: Live Capacity means "Usable Quantity of Water"

Source: www.mpwra.gov.in