Assessing canal irrigation performances in Punjab, Pakistan: case studies in contrasted governance systems

by

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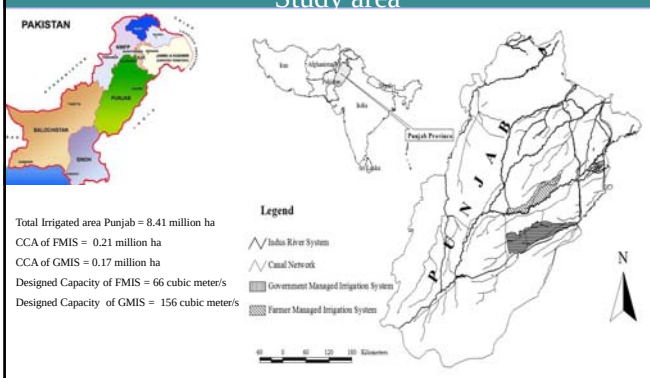
Irrigation network of Punjab province
Study area



Total Irrigated area Punjab = 8.41 million ha
CCA of FMIS = 0.21 million ha
CCA of GMIS = 0.17 million ha
Designed Capacity of FMIS = 66 cubic meter/s
Designed Capacity of GMIS = 156 cubic meter/s

MASSCOTE has been used as a systematic tool to comparatively assess performances and issues at system level

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Internal performance indicators

Delivery service	FMIS	GMIS
Actual Water Delivery Service to Individual Ownership Units (e.g., field or farm)	0.9	0.9
Actual Water Delivery Service at the most downstream point in the system operated by a paid employee	1.9	1.1
Actual Water Delivery Service by the Main Canals to the Second Level Canals	2.6	2.2
Main Canal		
Cross regulator hardware	1.1	0.9
Turnouts	2	1.7
Regulating Reservoirs	0	2
Communications	2.5	2.6
General Conditions	1.8	1.6
Operation	3	2.1

Note: Maximum Value = 4, Minimum Value = 0

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Internal performance indicators (conti…)

Second Level Canal	FMIS	GMIS
Cross regulator hardware	1.3	1.1
Turnouts	1.7	1.5
Regulating Reservoirs	0	0
Communications	2.5	2.1
General Conditions	2.4	1.4
Operation	2.4	2.2
Third Level Canal		
Cross regulator hardware	-	0.9
Turnouts	1	0.7
Regulating Reservoirs	0	0
Communications	1.9	1.5
General Conditions	2.2	1.7
Operation	2.2	1.9

Note: Maximum Value = 4, Minimum Value = 0

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External performance indicators

Financial Indicators	FMIS	GMIS
Cost recovery ratio	0.33	0.67
Maintenance cost to revenue ratio	0.48	0.33
Total MOM cost per unit area (US$/ha)	5	4
Total cost per staff person employed (US$/person)	1,046	1,488
Revenue collection performance	0.62	0.85
Staff persons per unit irrigated area (Persons/ha)	0.0029	0.0013
Number of turnouts per field operator	1.5	2.8
Agricultural Productivity and Economic Indicators		
Output per unit command area (US$/ha)	2,271	4,013
Output per unit irrigated area, including multiple cropping (US$/ha)	2,014	2,643
Output per unit irrigation supply (US$/m3)	0.448	0.481

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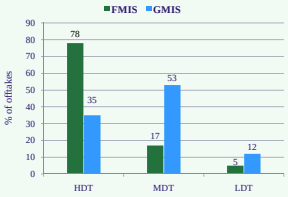
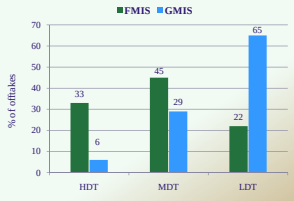
Demand for operation

- Seepage from main canal 20 %; in distributaries, minors 10 % and water courses about 25 %; in field about 20 % and **only 35 % of water is available for crops**
- 78% offtake structures in FMIS and 35% offtake structures in GMIS are found as high demanding targets
- Causes: Perturbation, Service, and sensitivity of offtake structures (Both systems)
- Farmers-induced causes: Un-gated structure (tempering etc), wooden sheets used to control flow (Both systems)

Demand for operation as a function of ±10% allowable variation on water level



Demand for operation as a function of ±20% allowable variation on water level



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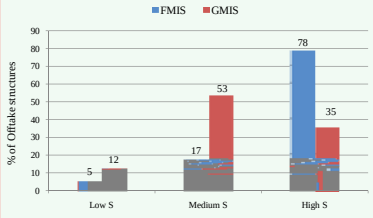
Sensitivity of offtake structure

❖ **Objective**

- To assess the behavior of irrigation structures

- IMT led to remodeling of offtakes so tail enders supply improved
- 78% HS OF structures in FMIS
- 35% HS OF structures in GMIS



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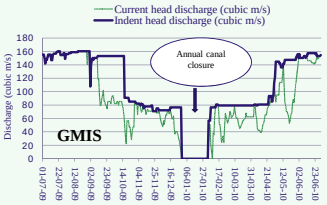
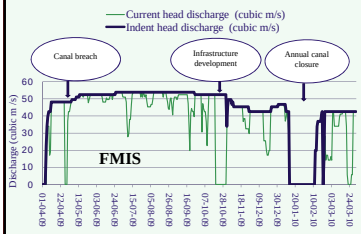
Perturbation

- One major cause of HS
- Wide fluctuations in river water supply
- Water theft at secondary and tertiary canals
- Damage b/c livestock cause perturbation
- Century old irrigation infrastructure
- Designed for 65% C.I, now ~ doubled





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Service to users

- Distribution from main to secondary canals is uniform
- FMIS has better service to tertiary canals
- Deferred maintenance, less water delivery to canal in monsoon
- Deposition of silt and reduced flow of water to tail enders
- Shortage of canal water and severity of problem increased from head to tail

Indicators of service to users in the Burala Canal Irrigation System (FMIS)

Indicator	Main to secondary	Secondary to tertiary	Tertiary to farm level	Farm level
Flexibility	1	1	0.5	3
Reliability	2.5	2	1.5	1.5
Equity	2	2	1	2.5

Indicators of service to users in the Upper Pakpattan canal Irrigation Scheme (GMIS)

Indicator	Main to secondary	Secondary to tertiary	Tertiary to farm level	Farm level
Flexibility	1	1.5	1.5	2.5
Reliability	2	1	1	1
Equity	2.5	1.5	0.5	1

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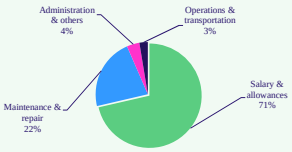
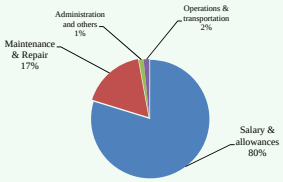
Cost of operation

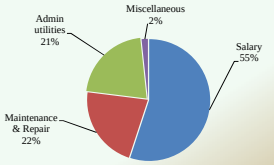


FMIS budget estimate for year 2008-09



Main canal (FMIS) budget estimate for 2008-09

GMIS budget estimate for year 2008-09



Farmers' Organization Budget Distribution for year 2008-09

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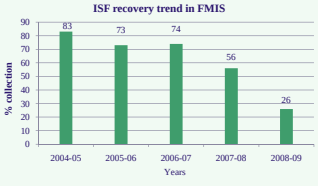
Financial aspects for canal Operation

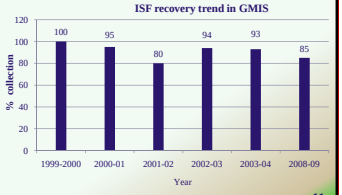
- Water fee charged per ha is 2.8 US$/ha for Kharif and 1.7 US$/ha for Rabi season
- Strict rules and action in GMIS

Financial aspects	FMIS	GMIS
Total budget (US$/ha)	5.65	4.93
Non-salary budget (US$/ha)	1.47	1.41
Salary & allowance (US$/ha)	4.18	3.52
Management, Operation & Maintenance (US$/ha)	5	4
Cost recovery ratio	0.33	0.67

ISF recovery trend in FMIS



ISF recovery trend in GMIS



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Proposed Management Units

Sub-Division	Secondary channels	CCA	Outlets	Proposed management Units: FOs	Proposed management Units: Remarks
Tandlianwala	Chakku	506	3		
	Dulchi	2,391	13	1	New
	Nupewala I	1,628	27		
	Nupewala II	4,629	24	2	New
	Pithrana	2,281	12		
	Hassoki	502	3	3	New
	Naurang	4,493	21		
	Bahlak	13,562	78	4	Same as existing
	Tandlianwala	17,306	85	5	Same as existing
	Jhoke	1,596	8		
	Pervaiz	3,412	17	6	New
	Ranjiana I	1,615	11		
	Ranjiana II	1,074	5[1]	7	New
	Duranwan	1,508	11		
	Ala	2,065	9	8	New
	Arif	2,501	17	9	New

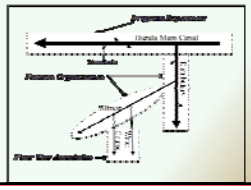
Objective

- To divide area into small management units that are homogeneous and can be separated from one another on some particular point

Based on:

- Cultivable command area
- Number of outlets
- Distance between secondary canals

- Existing Management Units = 24
- Proposed Management Units= 19



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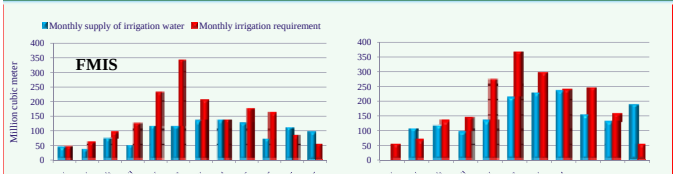
Water Balance



Main findings & Concluding remarks of scheme-level performances

- Deficiency of technical and field staff
- Salaries and allowances in budget
- 78% offtake structures in FMIS and 35% in GMIS with HDT
- Water balance
- FMIS is performing better in terms of monitoring, responsiveness, transparency, provision of moral support and respect to farmers and in taking decisions however conflict resolution is still poor.
- The future of irrigation in Punjab

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Modernization plan

- IMT has already led to some modernization in FMIS (tail enders)
- **Technical aspects**
- 20-30% daily fluctuations have significant implications on offtake sensitivity (discharges)
- Water reservoirs even at small level for persistent water flows
- Remodeling of main canal offtakes (FMIS) should be prioritized to improve canal operation and equitable water deliveries
- **Political and Socio-financial aspects**
- Policy adjustment and strengthening the enforcement systems to improve conflict resolution and flows of money (recovery of ISF)
- Counseling of farmers through intensive and meaningful trainings and capacity-building programs (Current role of Education Cell (PIDA) needs to be improved)

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Field pictures - FMIS

Primary data measurement for MASSCOTE

EC=0.2 dS/m (FMIS)
EC=0.3 dS/m (GMIS)

Physical conditions of canals - FMIS

Main Canal (BCIS) | Secondary Canal (BCIS)

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Physical conditions of canals - GMIS

Main canal (UPCIS)

Secondary canal (UPCIS)

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Farm level conditions - FMIS

Tube well pumping (BCIS)

Farm water channel (BCIS)

Thanks for your attention

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