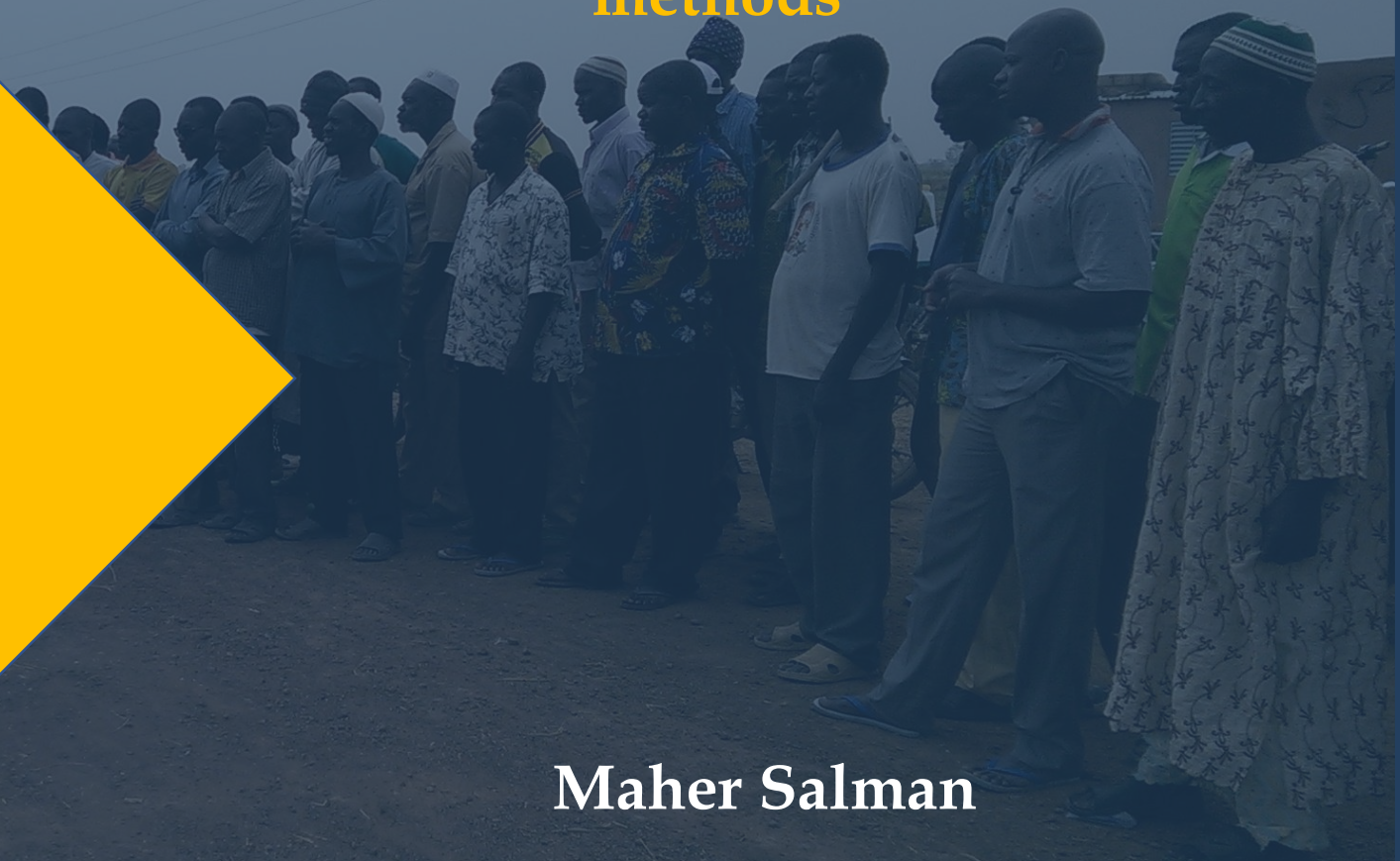
SESSION II.

Encouraging small-scale farmers to embrace participatory water-management for applying technology and new irrigation methods



Improving water-efficient irrigation: Prospects and difficulties of innovative technologies and practices in agricultural water management

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OUTLINE

Definition of Participatory Irrigation Management

Pilot area and sampling

Farmers Participation Index and the factors determining participatory approach

Effect of participatory approach on farmers' productivity and profitability

Are farmers able to influence their socio-economic conditions through improving their agricultural water use?

Definition of Participatory Irrigation Management – translations

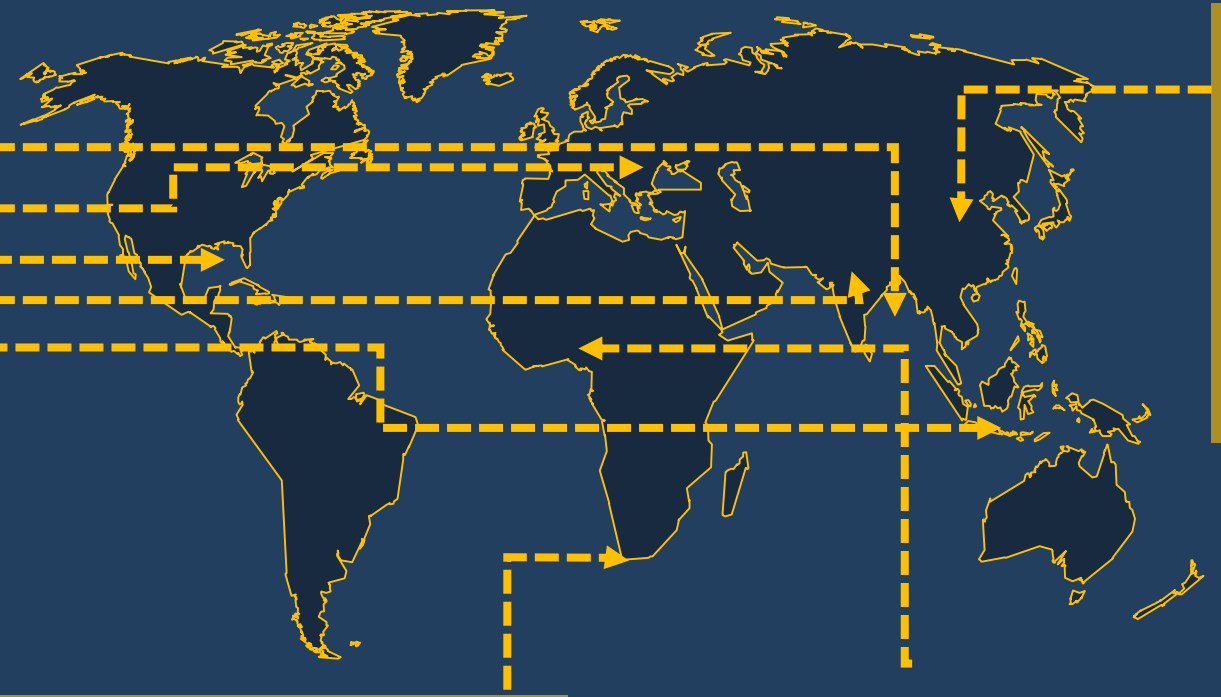
Participatory Irrigation Management → Farmers-led irrigation development

- management by irrigation users at all levels of the system and in all aspects of management
- participation of irrigation users - the farmers - in the management of the irrigation system
- not only tertiary-level management, nor merely consulting with farmers

- farmers' motivations and ideas about how to face a water challenges or respond to opportunities to improve water-management
- voluntary activities to improve agricultural water-management on farm level

Definition of Participatory Irrigation Management – translations

PIM as part of national agricultural policies:
Sri Lanka
Turkey
Mexico
India
Indonesia



Yellow River Basin (Wang et al.)
Four indicators of PIM:
- Establishing WUA
- Selecting managers
- Regular meeting
- Other activity in WUA

South Africa (Muchara et al)
Indicators of PIM:
- financial and in-kind contribution to maintenance
- attendance on trainings and knowledge-sharing,
- engagement in WUA,
- reporting on disturbances and non-compliance

Ghana (Barimah et al.)
PIM: responsibility to monitor and control the management

Definition of Participatory Irrigation Management

Why PIM ?

In Africa, 80 % of the irrigated area is supplied by surface irrigation method

The surface irrigation has the lowest water application efficiency at 60 %

In countries, annualized 4% of GDP is needed to realize irrigation potential

Improving farmers' capacity could significantly lower the need of investment

Pilot area and sampling

Pilot area

- One and half a year research period in Mubuku irrigation scheme, Phase II
- Research is extended on main canal, secondary canal and tertiary canal level, both on management and farm level
- 17 stakeholders are involved to establish Farmers Participation Index
- Total population: 167 farmers in Phase II, producing on 560 ha
- Cropping pattern: maize, rice, onion, tomato, mango, beans and others

Sampling

- Random sampling of 122 farmers from Phase II, Mubuku
- Considered cropping pattern: maize, rice, onion
- Semi-structured survey: i./ personal characteristic, ii./ pursued water-efficiency activities, iii./ farm economics data
- Supported by the local extension service, control survey was launched to analyse average farm economic per crops in the scheme

Farmers Participation Index and the factors determining participatory approach

14 water-use efficiency activities obtained by MASSCOTE approach

Weighted by an expert pool from local professionals

1. Contribution (in-kind or cash) to canal maintenance - above the regular water fee	0.01
2. Regular payment of water fee	0.01
3. Visiting other schemes to follow good practices	0.02
4. Regular participating in extension services related to irrigation	0.03
5. Consultation with WUA officers for maintenance	0.03
6. Regular participation in irrigation training organized by the WUA or other institutes	0.05
7. Attending meeting in irrigation turn planning	0.05
8. Private investment in water irrigation structure on annual base	0.05
9. Other water-management techniques applied in the scheme (tillage techniques etc.)	0.05
10. Regular manhand work on irrigation structures	0.1
11. Weeding, bushing, reshaping tertiary/quaternary canals on regular base	0.1
12. Measure water discharge	0.1
13. Observe irrigation demand of crop and adjust the water rate to it	0.2
14. Cooperation with other farmers to re-distribute water supply	0.2

Farmers Participation Index and the factors determining participatory approach

Farmers Participation Index

FPI > 0.5 : Participating group (N=60)

FPI < 0.5 : Non-Participating group (N=62)

Participating group performs better at each activity

Most preferred activities of the farmers

I. Cooperation with other farmers to re-distribute water supply

II. Regular payment of water fee

III. Weeding, bushing reshaping tertiary/quaternary canals on regular base

Least preferred activities of the farmers

I. Measure water discharge

II. Observe irrigation demand of crop and adjust the water rate to it

III. Other water-management techniques applied in the scheme (tillage techniques etc.)

	Participating Farmers (%)	Non-participating Farmers (%)	All farmers (%)
Education-level			
primary	68.33	83.87	76.23
secondary	18.33	12.90	15.57
advanced	5.00	3.23	4.10
university	8.33	0.00	4.10
Gender			
female	26.67	27.42	27.05
male	73.33	72.58	72.95
Age			
below 15	0.00	0.00	0.00
15-25	0.00	0.00	0.00
25-35	1.67	1.61	1.64
35-45	10.00	8.06	9.02
45-55	18.33	19.35	18.85
above 55	70.00	70.97	70.49
Membership of cooperative/WUA/extension service provider	100.00	100.00	100.00
Attended in irrigation training/course	75.00	54.84	64.75
Frequent experience of water shortage or waterlogging	35.00	43.55	39.34
Frequent experience of failing production	46.67	50.00	48.36
Access to information system on production and water use	83.33	79.03	81.15

Farmers Participation Index and the factors determining participatory approach

Particulars	Coefficient	Standard error	Z	P-value
Constant	−4.40957	2.01477	−2.189	0.0286**
Education-level	1.28368	0.437230	2.936	0.0033***
Gender	−0.111123	0.448654	−0.2477	0.8044
Age	0.455489	0.349543	1.303	0.1925
Attended in irrigation training/course	1.10828	0.456853	2.426	0.0153**
Frequent experience of water shortage or waterlogging	−0.819034	0.454442	−1.802	0.0715 *
Frequent experience of failing production	−0.0100089	0.451504	−0.02217	0.9823
Number of household	0.110971	0.0607431	1.827	0.0677*
Access to information system on production and water use	−0.770498	0.592398	−1.301	0.1934

Education-level and Attendance on irrigation training/course are significant determinants encouraging farmers to adopt participatory approach (at 1 and 5 percent confidence interval)

Effect of participatory approach on farmers' productivity and profitability

Profitability indicator

Farm profit (UGDX per acre)

Calculation: (yield * crop price) – total cost

Strength: residual income for consumption indicating farmers' budget for social issues

Weakness: complexity and dependency on many other production condition such as fluctuating market prices

N=122

Average farm size: 8 acre

Productivity indicator

Farm yield of maize (tons per acre)

Healed and dried maize seeds for direct consumption

Strength: guaranteed input supply and trigger price for maize

Weakness: poor post-harvest and measuring methods (yield calculated by bags)

N=95

Average farm size: 8 acre

Effect of participatory approach on farmers' productivity and profitability

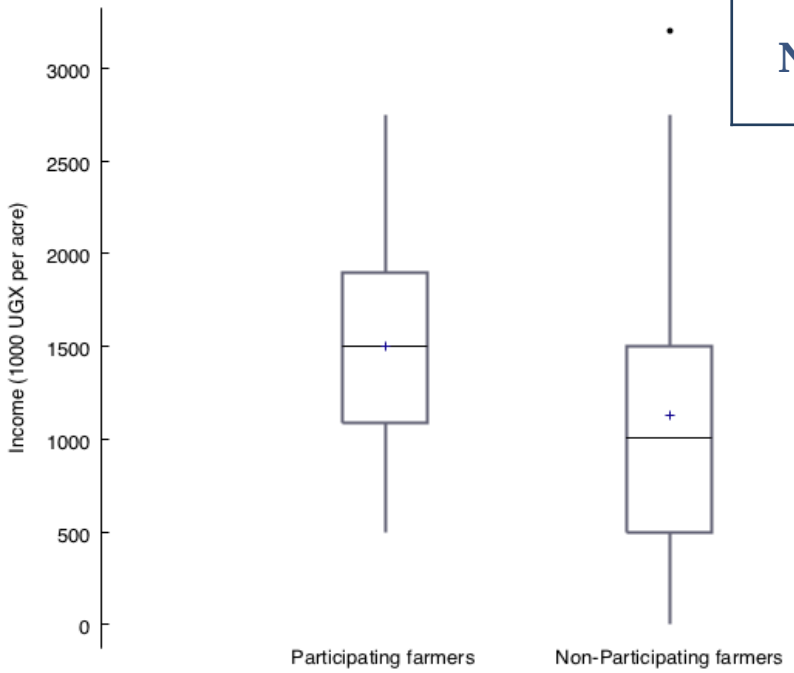
Market conditions of the main crops – according to established good agricultural practices

		Rice	Maize	Onion
Total cost	UGX/ha	4 934 500	3 826 500	6 980 500
Total revenue - poor market conditions	UGX/ha	6 500 000	7 650 000	14 000 000
Total revenue - favourable market conditions	UGX/ha	7 800 000		1 000 000
Profit - poor market conditions	UGX/ha	1 565 500	3 823 500	7 019 500
Profit - favourable market conditions	UGX/ha	2 865 500		-5 980 500
Profit - poor market conditions	USD/ha	414,9	1 013	1 860
Profit - favourable market conditions	USD/ha	759,4		-1 585

Effect of participatory approach on farmers' productivity and profitability

Summary statistics of profitability per groups

(1000 UGX per acre)	Mean	Median	Min	Max	Standard deviation
Participating group	1501	1500	500	2750	580.41
Non-Participating group	1128	1005	0	3200	648.73

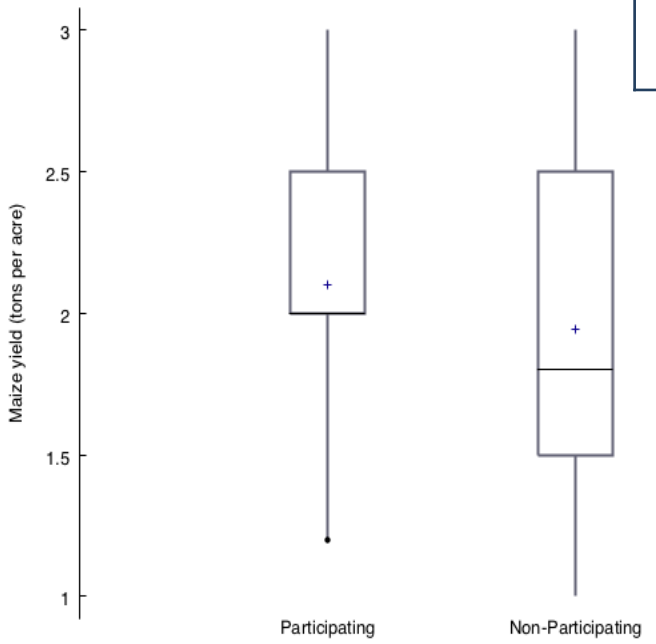


Displaying the distribution of the incomes per group, Participating group has higher income in average

Effect of participatory approach on farmers' productivity and profitability

Summary statistics of productivity per groups

(tons per acre)	Mean	Median	Min	Max	Standard deviation
Participating group	2.101	2	1.2	3	0.421
Non-Participating group	1.945	1	1	3	0.680



Displaying the distribution of the maize yield per group, Participating group has higher yield in average

Effect of participatory approach on farmers' productivity and profitability

to find out:

What would have happened to the Non-Participating farmers if they had participated in water-efficiency activities?

- Methodology: Average Treatment Effect (ATE) estimated by Propensity Score Matching
- The evaluations based on the comparison between one group of units received certain "treatment" (Treated) and the other group of units not received such "treatment" (Not Treated)
- Treated and Not Treated groups correspond to Participating and Non-Participating groups
- Estimating ATE of binary treatment (Participating and Non-Participating) on the proxy of farm productivity (tons per acre) and profitability (UGX per acre)
- Eliminated perfect predictors as independent variables

Effect of participatory approach on farmers' productivity and profitability

Treatment independents of **profitability**: gender, age, attended in irrigation course, frequent experience of water shortage or waterlogging, frequent experience of failing production, access to information system on production and water use, number of households

Income	Number of matches (m)	Coefficient	AI Robust Std. Error	(95 % Conf. Interval)	
ATE Participation (1 vs 0)	1	393 750	113 025.1	172 224.9	615 275.1
ATE Participation (1 vs 0)	2	367 677	105904	160 109.2	575 246
ATE Participation (1 vs 0)	3	375 181	100125	178 939.3	571 424.1

Statistically significant positive coefficient: Non-Participating farmers would earn more with an average 375 181 – 393 750 UGX per acre through participatory

Each farmers cultivating 8 acre in 2 seasons per year would result 6 300 000 UGX more income through participatory approach

Effect of participatory approach on farmers' productivity and profitability

Treatment independents of **productivity**: education, gender, age, attended in irrigation course, frequent experience of water shortage or waterlogging, access to information system on production and water use, number of household as independent variables

yield	Number of matches (m)	Coefficient	AI Robust Std. Error	(95 % Conf. Interval)	
ATE Participation (1 vs 0)	1	.04015	.09396	0.43	0.669
ATE Participation (1 vs 0)	2	.09085	.08185	1.11	0.267
ATE Participation (1 vs 0)	3	.09319	.07461	1.25	0.212

Positive coefficient: Non-Participating farmers would have higher maize yields by 0.4-0.9 t/ha through participatory approach

Each farmers cultivating 8 acre in 2 seasons per year could result 1.6 tons more maize for sale

Conclusions

Definition of Participatory Irrigation Management should be broaden on farmers' individual activities to improve their production

Farmers can be encouraged to engage themselves into water use efficiency activities by capacity-building

Negative effects (such as failing production) do not determine farmers to adopt new methods and technologies

Despite their importance, some water use efficiency activities are not practiced due to lack of knowledge and infrastructure (discharge measurement, irrigation responding on crop demand)

Factors decreasing productivity and profitability (such as market failures) does not disturb the effect of participatory approach

Improving water use efficiency has direct effect both on productivity and profitability

Our job worth doing