UNIVERSITY OF CENTRAL ASIA
GRADUATE SCHOOL OF DEVELOPMENT
Institute of Public Policy and Administration

Impact Evaluation Study Results of Rehabilitation of Irrigation Canals in South Kyrgyzstan

https://ucentralasia.org/media/4a1klhoz/uca-ippa-wp69-irrigation-projectengfinal.pdf

October 2022

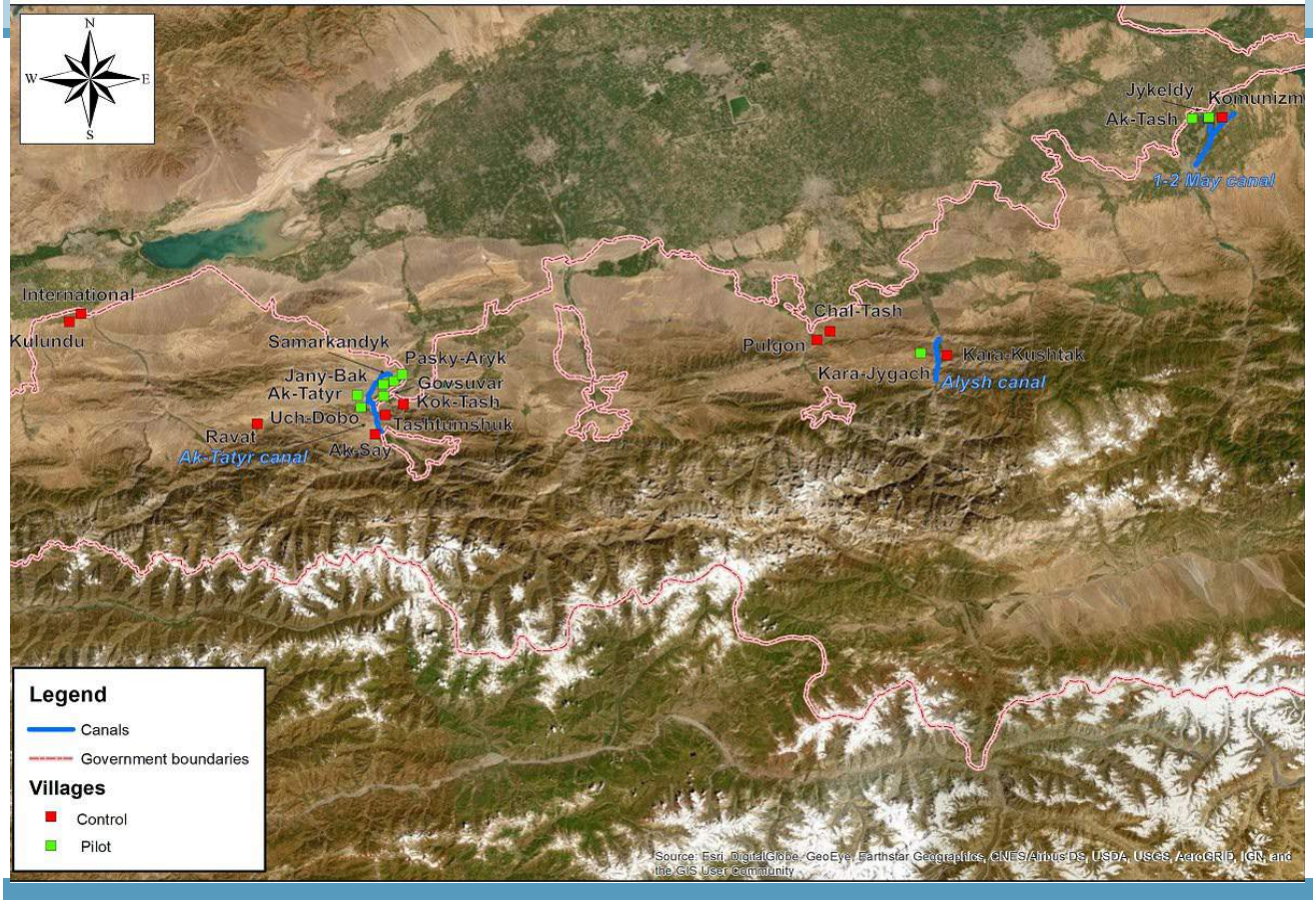
Introduction

- IPPA responsible for impact evaluation of irrigation canals rehabilitation component of "Improving stability and better natural resource management in Tajikistan and Kyrgyzstan" Project
- Project was funded by DFID and AKF KG
- Baseline survey was conducted in 2016 to analyze the condition of the area **before** intervention stage
- Endline survey conducted in 2019 make possible to compare the **post-intervention** stage condition of rural inhabitants in the project intervention stage
- Rehabilitation of canals expected to have a positive impact on crop production and on incomes of farmers

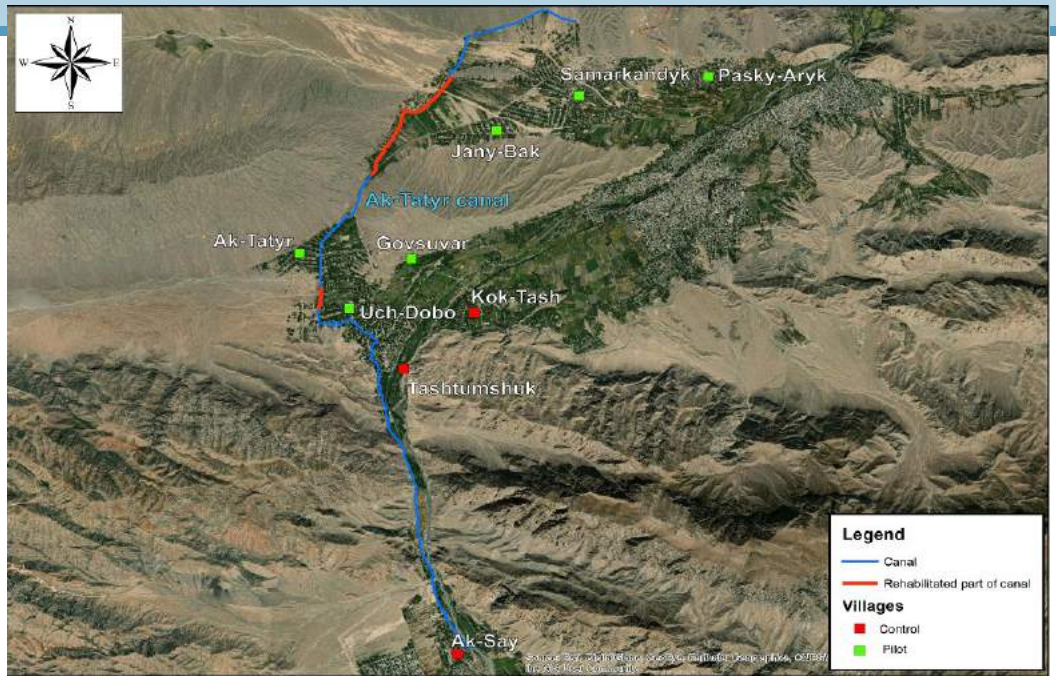
Endline survey

- MSDSP KG is an implementation agency of the project and irrigation canals rehabilitation component
- List of 5 irrigation canals were provided (Ak-Tatyr, 1-2 Maya, Alysh, Nurgaziev and the Kulundu pumping station), in 3 canals the rehabilitation was implemented (Ak-Tatyr, 1-2 Maya, Alysh)
- Endline survey was conducted in November-December, 2019
- Main instrument - Households face-to-face interviews
- Survey company – Rebicon

Research area (Batken and Osh sites)



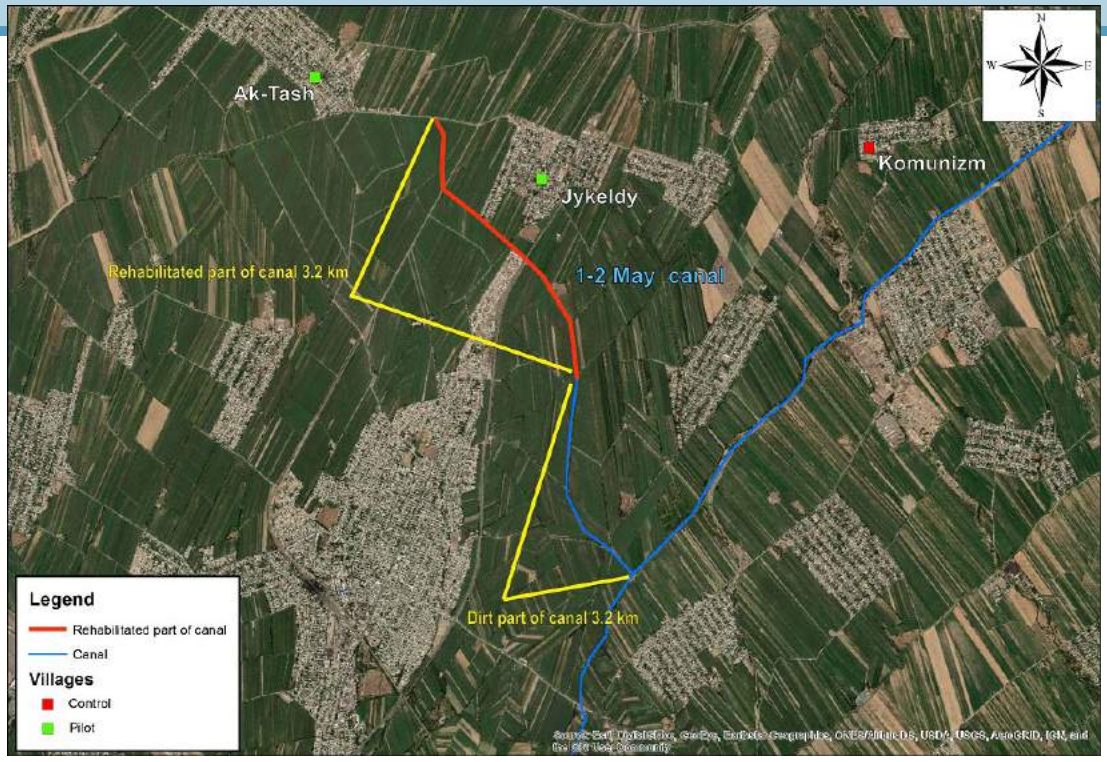
Ak-Tatyr canal



The total cost 102 735 GBP, project contributed 32 300 GBP

- Mechanized cleaning the canal (8 km)
- Concreting the part of the canal
- Partial replacement of the most destroyed sections of the canal network

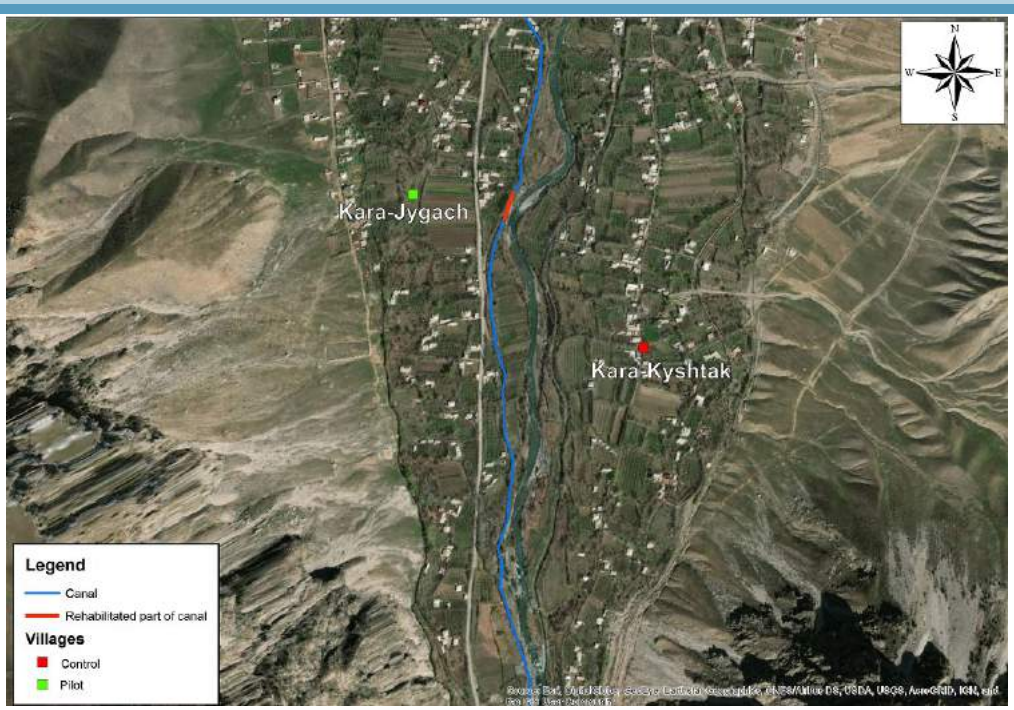
1-2 Maya canal



The total cost 103 178 GBP, project contributed 76 529 GBP

- Reinforced concrete trays were installed at 3100 m

Alysh canal



The total cost 10 132 GBP, project contributed 5 090 GBP

- Emergency section of the canal at a length of 60 meters was strengthened

Theory of Change

Inputs

Three canals were selected for irrigation rehabilitation	Nine intervention villages located near intervention zones	10 villages located far from intervention zones

Intervention

Irrigation canals rehabilitation activities	Supporting activities - improved water management, training for farmers

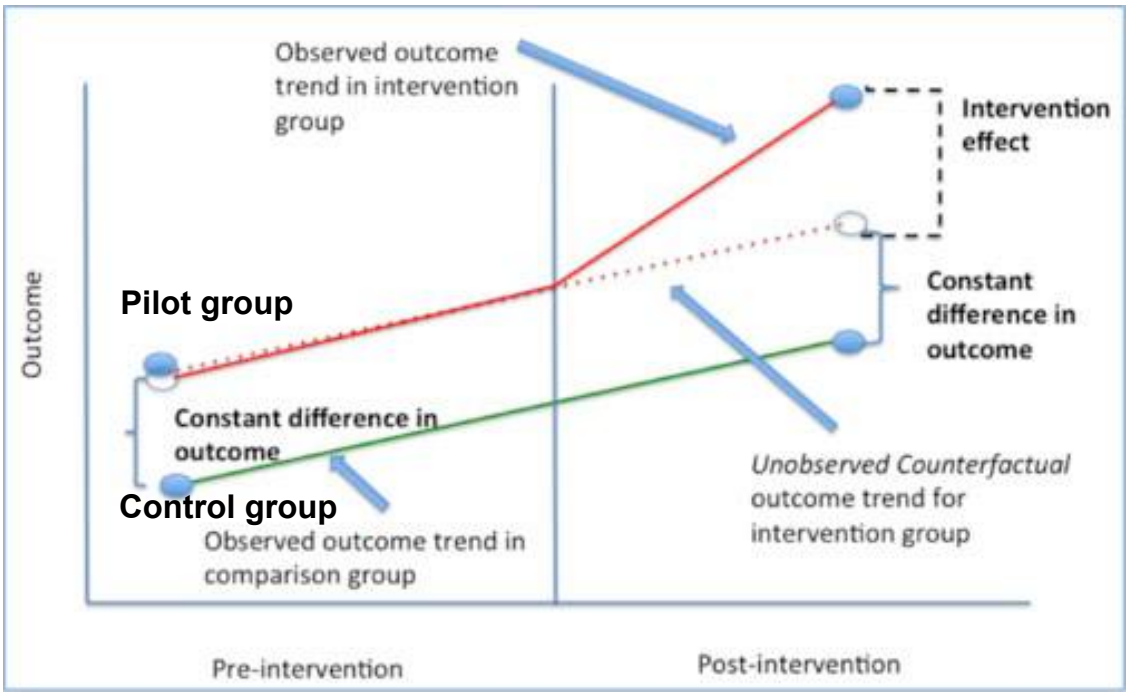
Outputs

Investments in infrastructure - canal rehabilitation – (increase water volume and stability supply)	Investments in institutional development - (water management practices, water use by farmers)

Outcomes

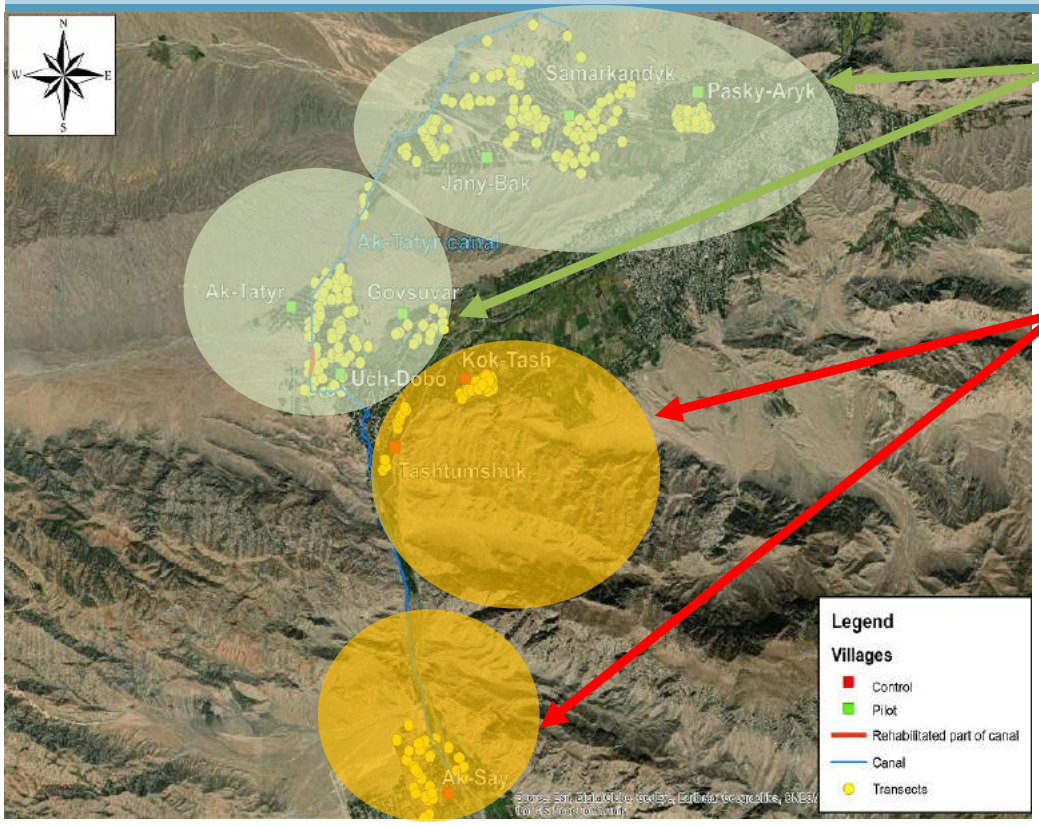
Increase of the crop production volume	Increase of the crop diversity	Increase of the agricultural income

Potential Effects of Interventions over Time



Source:
https://www.mailman.columbia.edu/

Selected land plots in the control and pilot zone of the Ak-Tatyr canal

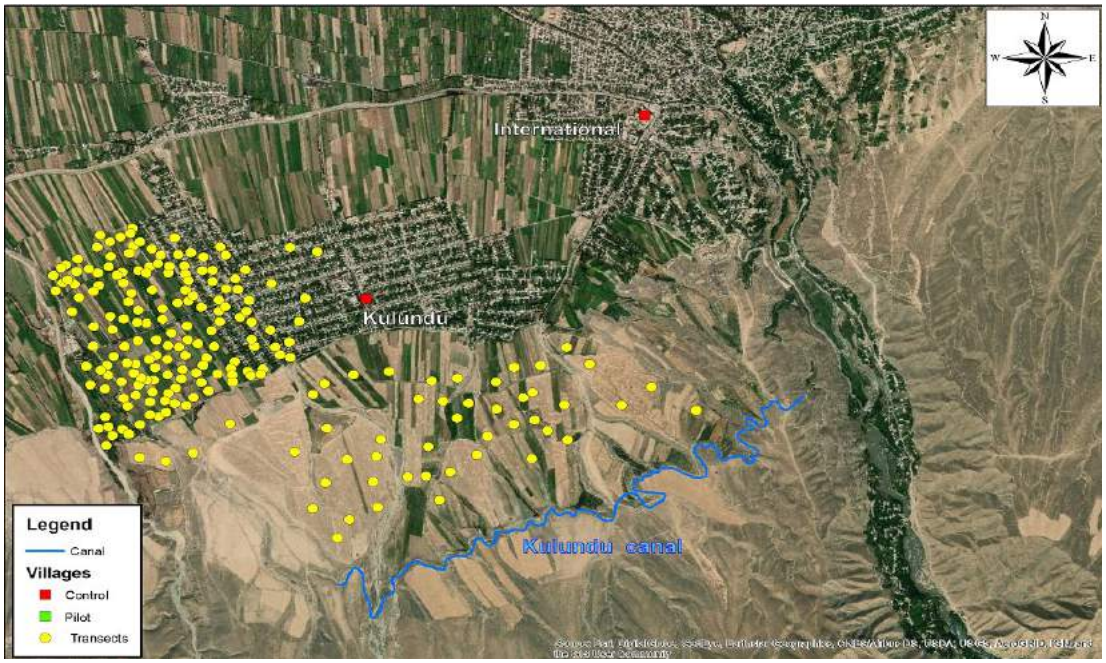


Pilot zone - zone of irrigation canals rehabilitation

Control zone - no intervention zone, comparison group

Transects – land plots near every village where crops cultivated

Selected land plots in the control zone of the Kulundu canal



Sampling methodology:

- List of households from the baseline study whose land plots were selected on the maps

Transects –land plots near village where crops cultivated

Sample

Oblast	Rayon	Territory	Baseline	Endline	Loss of the sample
Treated area					
Batken	Batken	Pasky-Aryk AO Samarkandek	35	34	1
Batken	Batken	Samarkandek AO Samarkandek	71	59	12
Batken	Batken	Jany-Bak AO Samarkandek	22	21	1
Batken	Batken	Uch-Dobo AO Aksai	22	20	2
Batken	Batken	Ak-Tatyr AO Ak-Tatyr	44	39	5
Batken	Batken	Govsuvar AO Ak-Tatyr	13	13	0
Batken	Kadamjai	Kara-Jygach AO Maidan	20	18	2
Osh	Kara-Suu	Ak-Tash AO Ak-Tash	40	36	4
Osh	Kara-Suu	Jylkeldi AO Ak-Tash	41	39	2
Total			308	279	29

Reasons of loss - not found, moved to another region / Russia, refusal to answer, etc

Sample (2)

Oblast	Rayon	Territory	Baseline	Endline	Loss of the sample
Control area					
Batken	Batken	Tashtumshuk AO Aksai	10	10	0
Batken	Batken	Aksai AO Aksai	28	27	1
Batken	Batken	Kek-Tash AO Aksai	53	50	3
Batken	Batken	Ravat AO Ak-Tatyr	49	49	0
Batken	Kadamjai	Kara-Kyshtak AO Maidan	22	21	1
Batken	Kadamjai	Chal-Tash Kadamjay	25	23	2
Batken	Kadamjai	Pulgon Kadamjay	13	12	1
Batken	Leilek	Internazionalnoe AO Kulundu	49	47	2
Batken	Leilek	Kulundu AO Kulundu	162	142	20
Osh	Kara-Suu	Communism AO Joosh	21	16	5
Total			432	397	35

Reasons of loss - not found, moved to another region / Russia, refusal to answer, etc

Demography

	Pilot group		Control group		Batken		Osh	
	2016	2019	2016	2019	2016	2019	2016	2019
Average age, years	27	30	27	29	29	33	27	29
The share of male population	52%	49%	53%	52%	52%	51%	54%	50%
The share of female population	48%	51%	47%	48%	48%	49%	46%	50%
Male household heads	88%	83%	91%	86%	84%	85%	91%	80%
Female household heads	12%	17%	9%	14%	16%	15%	9%	20%

Migration

	Pilot group		Control group	
	2016	2019	2016	2019
Number of labor migrants	84	67	51	66
Number of labor migrants per household	1.8	1.5	1.4	1.5
Average annual transfer in USD per migrant	1,447	1,123	1,110	1,001
Average annual transfer in USD per household	2,375	948	1,521	773

Education

	Pilot group		Control group		Batken		Osh	
	2016	2019	2016	2019	2016	2019	2016	2019
People with higher education	9%	8%	8%	6%	7%	7%	18%	6%
People with vocational education	4%	9%	4%	4%	4%	6%	7%	6%
People with secondary education	47%	43%	44%	43%	46%	41%	40%	56%
People with primary education	12%	16%	16%	20%	15%	19%	10%	15%
Uneducated people and people with incomplete primary education	12%	12%	11%	13%	11%	13%	12%	7%
Children under the school age (0-6 years of age)	16%	13%	17%	14%	17%	14%	13%	10%

Labour

	Pilot group		Control group		Batken		Osh	
	2016	2019	2016	2019	2016	2019	2016	2019
Officially employed	15%	28%	18%	28%	17%	25%	14%	33%
Self-employed	29%	26%	22%	19%	17%	20%	64%	32%
Students	5%	7%	5%	6%	6%	7%	2%	3%
Unemployed	36%	28%	37%	29%	44%	31%	5%	16%
Retired	14%	17%	17%	17%	16%	17%	15%	16%

Agricultural land

	2016				2019			
	Pilot group		Control group		Pilot group		Control group	
	Number of land plots	Average size, ha	Number of land plots	Average size, ha	Number of land plots	Average size, ha	Number of land plots	Average size, ha
Own cultivated field	276	0.31	359	0.3	230	0.33	305	0.3
Rented in	15	1.30	16	1.0	15	1.60	9	0.9
Kitchen garden	250	0.09	367	0.1	232	0.11	319	0.1
Fallow land	4	0.24	9	0.3	5	0.21	18	0.5
Rented out	3	0.12	20	0.2	13	0.36	51	0.2
Orchard	33	0.14	37	0.3	38	0.13	30	0.2
Hayfield	13	0.50	55	0.5	16	0.41	19	0.6

Agricultural land – Lost opportunities

Village	Baseline	Endline	Change
Samarkandek	113	119	6
Jany-Back	40	35	-5
Pasky -Aryk	70	63	-7
Uch-Dobo	43	39	-4
Ak-Tatyr	79	63	-16
Govsuvar	27	26	-1
Kara-Jygach	59	58	-1
Ak-Tash	81	82	1
Jylkeldi	82	74	-8
Kek-Tash	102	97	-5
Aksai	55	50	-5
Tashtumshuk	20	16	-4
Ravat	101	98	-3
Kulundu	290	236	-54
Internazionalnoe	96	94	-2
Kara-Kyshtak	68	62	-6
Chal-Tash	66	54	-12
Communism	32	31	-1
Pulgon	33	23	-10
Total	1457	1320	-137

Crop structure

2016

Crop	Pilot	Control	Batken	Osh	Total
Maize	37%	13%	12%	49%	22%
Apricots	19%	7%	17%	0%	12%
Winter wheat	8%	13%	11%	11%	11%
Burley	0%	17%	14%		10%
Sainfoin (Esparcet)	1%	15%	13%	1%	10%
Cotton	19%	0%		28%	8%
Apples	3%	8%	8%	1%	6%
Hay	3%	8%	9%		6%
Other crops	10%	18%	17%	10%	15%
Total	100%	100%	100%	100%	100%

2019

Crop	Pilot	Control	Batken	Osh	Total
Clover	13%	24%	19%	19%	19%
Cotton	34%	2%		51%	16%
Maize	19%	10%	11%	19%	14%
Apples	5%	15%	14%	2%	11%
Apricots	17%	3%	13%	0%	9%
Burley	0%	12%	9%	1%	7%
Sainfoin (Esparcet)	2%	12%	10%	1%	7%
Winter wheat		8%	6%	1%	4%
Other crops	11%	15%	16%	5%	13%
Total	100%	100%	100%	100%	100%

Yield

Crops	Pilot		Growth rate	Control		Growth rate
	2016	2019		2016	2019	
Maize	5.1	5.9	16%	4.1	5.6	38%
Apricots	2.2	1.4	-37%	1.6	2.3	41%
Winter wheat	3.6			2.9	2.4	-16%
Burley	3.0			2.1	1.2	-41%
Cotton	3.1	4.0	28%	3.0	1.3	-57%
Apples	12.7	7.3	-42%	3.2	2.2	-30%
Tomatoes	26.0	13.7	-47%	15.4	7.7	-50%
Cherries	3.1	2.0	-36%	1.9	1.2	-36%

Crop Income

Average income received reported by households from the sales of selected agricultural products

	Pilot group		Growth rate	Control group		Growth rate
	2016	2019		2016	2019	
Peaches	77	305	296%	953	516	-46%
Maize	343	595	73%	295	121	-59%
Tomatoes	131	181	38%	116	98	-16%
Apples	380	378	0%	518	879	70%
Apricots	367	222	-40%	255	496	95%

Livestock

The average amount of livestock per household, heads

Type of livestock	Pilot group		Growth rate	Control group		Growth rate
	2016	2019		2016	2019	
Goatings<1 year	4.36	9.63	121%	8.31	9.7	17%
Lambs < 1 year	4.33	7.17	66%	5.81	7.98	37%
Bulls > 1 year	1.26	1.89	50%	1.29	1.44	12%
Chickens	11.89	17.56	48%	14.82	10.6	-28%
Heifers > 1 year	1.16	1.59	37%	1.3	1.5	15%
Goats > 1 year	13.61	15.86	17%	13.2	13.97	6%
Sheep > 1 year	8.53	9.11	7%	10.35	10.04	-3%
Cows	1.78	1.72	-3%	2.15	1.95	-9%
Calves < 1 year	1.31	1.26	-4%	1.64	1.49	-9%

Water Management Institutions and Project Perception

Aiyl Okmotu and Water Users Associations increase their importance water management issues between 2016 and 2019:

- Water fees collection
- Water distribution
- Water disputes resolving
- Irrigation infrastructure repair

Project perception:

- 35% of households in the pilot zone were aware of the project
- 42% of households in the pilot zone indicated that they were aware of work on improving irrigation canals
- 53% of those who were aware of canal rehabilitation (23% of all households in the pilot zone) noted an improvement in water distribution and canal throughput

Outcome Indicator – Crop Production Index

- Change in crop production caused by improved irrigation;
- Change in the crop production structure;
- Change in agricultural income.

$$\boldsymbol{CPI_i = Crop\ 1_i \times Crop\ 1\ price_{2019} + \cdots + Crop\ 41_i \times Crop\ 41\ price_{2019}}$$

CPI_i- Crop Production Index for the by farmer *i*,

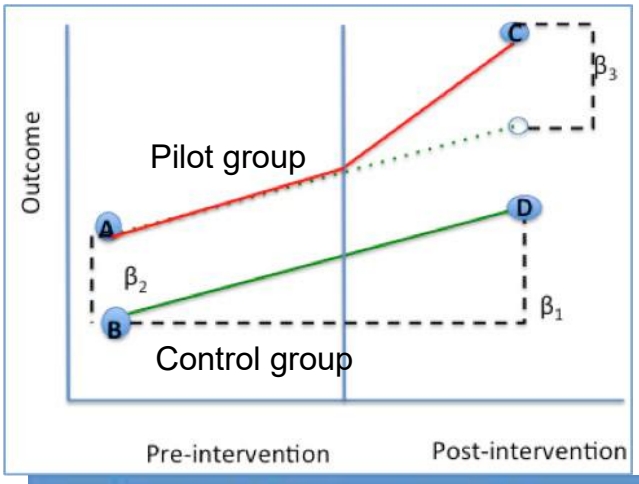
$Crop\ 1_i$– the production of the crop 1 produced by farmer *i*,

$Crop\ 1\ price_{2019}$- price for the crop 1 in 2019.

Crop Production Index- Mean Values

Communities/groups	Baseline (2016)	Endline (2019)	Change, %
Pilot			
Samarkandek	1022.7	620.3	-39%
Jany-Back	816.9	587.8	-28%
Pasky -Aryk	785.5	421.1	-46%
Uch-Dobo	826.3	783.0	-5%
Ak-Tatyr	831.0	408.2	-51%
Govsuvar	764.1	659.8	-14%
Kara-Jygach	1625.7	1509.5	-7%
Ak-Tash	1010.5	1384.1	37%
Jylkeldi	699.2	644.9	-8%
Total pilot	47467	46373	-2%
Control			
Kek-Tash	915.5	632.2	-31%
Aksai	617.9	307.5	-50%
Tashtumshuk	645.6	312.73	-52%
Ravat	236.6	72.1	-70%
Kulundu	722.3	509.2	-29%
Internazionalnoe	538.0	355.6	-34%
Kara-Kyshtak	1046.6	1284.0	23%
Chal-Tash	374.6	309.9	-17%
Communism	646.5	313.0	-52%
Pulgon	727.8	500.6	-31%
Total control	33974	19857	-42%
Sample Total	39543	30800	-22%

Difference-in-Differences Approach



Model Specification

Y= β0 + β1*[Time] + β2*[Intervention] + β3*[Time*Intervention] + β4*[Covariates]+ε

Source: https://www.mailman.columbia.edu/

Coefficient	Calculation	Interpretation
β_0	B	Baseline average
β_1	D-B	Time trend in control group
β_2	A-B	Difference between two groups pre-intervention
β_3	(C-A)-(D-B)	Difference in changes over time

Difference-in-Differences Analysis

$$CPI = \beta_0 + \beta_1 * Wave + \beta_2 * Pilot_{Control} + \beta_3 * (Wave * Pilot_{Control}) + \varepsilon$$

CPI- Crop Production Index,

$Wave$ - dummy variable for the different periods (Baseline - 0, Endline -1),

$Pilot_{Control}$ - dummy variable for indicating households from pilot areas (Pilot area-1, Control area -0),

$(Wave * Pilot_{Control})$ - composite dummy variable indicating when $wave = pilot_{control} = 1$

Outcome Indicator	DiD coefficient	SE	t-statistics	Sample
Crop Production Index – 2019 prices	13 023.4	7 803.2	1.67	1352

Results:

- Positive impact in pilot zone
- Error term bigger than expected

Difference-in-Differences Analysis (cont.)

Alternative Outcome Indicator - Biomass Indicator (BMI) = sum of weight of all crops grown, kg

Difference-in-difference analysis results – Biomass index

Outcome Indicator	DiD coefficient	SE	t-statistics	Sample
Biomass index	1059.3	439.5	2.41	1352

Results:

- Positive impact in pilot zone- supporting main indicator
- Error term is on the lower rates

Concluding remarks

- Crop production declines in project zone
- Crop prices are volatile - decision making is complicated
- Livestock herds are grown
- Problems in the Kyrgyz – Tajik border – land cultivation declines
- Non-agricultural activity increases
- **DiD analysis support the results - HHs in the pilot zone demonstrate 'better' performance compare to control zone**
  - Changes in the project plans lead to reframing sample composition - Sample becomes skewed towards control group
  - Batken and Osh samples are different (agriculture and subsample sizes)
- Role of water management institutions transformed - more important roles were taken on by local authorities and WUAs
- Respondents aware of the project intervention and report on improvement
- Future exploration of the data and analysis is needed in the project zones

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Thank you for the attention!

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