

THE IMPACT OF MUNDA DAM ON THE FARM SECTOR IN THE DAM COMMAND AREA (NWFP - PAKISTAN)

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ABSTRACT

This paper attempts at preliminary assessment of the expected impact of the canals planned to be taken out of the Munda dam on the farm sector in the command area of these canals. The Munda dam is proposed to be built on river Swat, near Shabqadar Town in District Charsadda. Besides producing 600 MW electricity, the Dam is designed to irrigate 29,380 acres of land in the command area of the canal to be taken out of the Dam. Perennial irrigation from the proposed canals would enable crop cultivation throughout the year do away with the costly tubewell based irrigation, lead to higher cropping intensity higher yields etc. Based on a sample survey of the farm households in the command area, it is concluded that the cropping intensity would rise to 180 percent as against the existing 83 percent. The number of crops in the area would increase to 12 as against 8 at present and the yields would rise in the case of all crops resulting in at least 18-folds increase in total farm production. The average annual total incremental farm production is projected to be 414602 metric tonnes (MT), cereals 20,628 MT; sugarcane 291180 MT; vegetables 82,011 MT; fruit 11,250 MT and fodder 9,533 MT. The chain of primary and secondary positive impacts would radically transform the command area's economy and pave the way for sustained development of the Dam command area.

INTRODUCTION

Building of dams for irrigation and power generation is a pressing necessity to cope with the mounting demand for food and energy in Pakistan. The country needs to build several big dams within the next two decades to attain autarky in food and fiber for meeting its growing needs. No development project can ensure wholly positive impacts as some displacement is always involved before the development takes place. The dams involve both of these impacts, but are built only if the benefits far outweigh the costs. Therefore, it is necessary to make an assessment of their likely impacts so as to ward off the adverse impacts and maximize the beneficial outcomes. The dam is proposed to be built on the Swat River; about 6 km upstream of the existing Munda Head Works which is located near the Shabqadar Town. Its gross storage capacity would be 0.755 MAF, with the live storage of 0.505 MAF. It would produce 600 MW electricity, and is designed to take out two canals to irrigate a total area of 29,380 acres in Mohmand Agency, the Tangi Tehsil and the Malakand Agency. The present paper attempts at impact assessment in the context of the farm sector of the command area of the canals to be taken out of the Munda dam.

Objective and Scope

The proposed Munda Dam is designed to produce hydel power and provide irrigation through its two planned canals. The main focus of the present paper is to assess the expected impact of the proposed canals on the farm sector with a view to estimate change in:

- i. Cultivated area and cropping intensity
- ii. Cropping patterns
- iii. Crop yields
- iv. Existing and prospective crop production on an average farm
- v. Total expected incremental production-crop wise in the command area upon full maturity of the impact of irrigation resulting from the Dam
- vi. Secondary impacts of the enhanced farm production.

MATERIALS AND METHODS

The proposed Dam will have two canals viz the Right Bank Canal (RBC) and the Left Bank Canal (LBC) designed to irrigate 8,100 acres and 21,280 acres, respectively, totaling 29,380 acres. The RBC is wholly in the Mohmand Agency. The command area of LBC has wider coverage. It is designed for irrigating land in Mohmand Agency, the Tangi tehsil of Charsadda District and Malakand Agency.

The study is based mainly on primary data. For the existing situation analysis of the farm sector, sample survey was conducted in the command area of the two canals proposed to be taken out of the Munda Dam. The sample comprised one hundred farm households, 30 in Right Bank Canal command area and 70 in Left Bank Canal command area. The sample was distributed as follows:

S.No.	Area	Canal	No. of farms surveyed
1	Mohmand Agency	RBC	30
2	Pranghar	LBC	20
3	Tangi	LBC	25
4	Malakand Agency	LBC	25
5	Total		100

The sample villages were selected by the purposive method in the light of location of the villages and their representativeness. The farmers were selected randomly. Assessment of post dam scenario of the farm sector with reference to the dam's impact on cultivated land, cropping pattern, yield, total incremental production, etc is based on the primary data collected through the aforesaid survey. The cropping pattern and crop yields in the neighboring district of Charsadda is used as proxy for post-dam scenario alongwith sample farmers perceptions and consultation with agricultural experts.

RESULTS AND DISCUSSION

Pre-Dam Profile of Farmers and the Farms

The profile includes some introductory information about the sample farmers and detailed characteristics which are expected to experience change due to commissioning of the two proposed canals. As is a customary practice in such studies, we will begin with the study of the family organization.

Family Organization/Sizes

The joint family system is dominant in the project area. In the Right Bank Command (RBC) area 70% and in the Lift Bank command area 57% of the sample households are so organized. The household size is 19 and 12 members on average, respectively. The RBC covers the Mohmand

Agency and the tribal character is clearly reflected in family system as well as the household size.

Working Member

There are five working members per household including one female working for wage on farm or family enterprise. The RBC and LBC regions are almost identical in this respect but the dependency rate is higher in RBC (3.8) as compared with LBC (2.4) due to similar difference in household size.

Land Holding

The farm households operate 2.77 hectares of land on average; 2.64 hectares in the command area and 0.13 hectares outside.

Land Use Pattern

96% farm land is used for crop production. woodland three percent and uncultivable land accounts for the remaining one percent farm area. The RBC and LBC zones are almost identical in this respect. Due to non-availability of water, the frequency of crop cultivation is low and so is the cropping intensity.

Irrigation

About 42% of the sample farm area was found irrigated through tube wells (installed on dug-wells) and lift pumps. They are all electricity operated. The farmers in Mohmand Agency do not pay for electricity, while those in settled parts of the command area have to pay for it. Power break downs however, are, frequent and long duration that results in low irrigation and consequently low yields.

Crops

In the un-irrigated zones, crops are grown only in the rabi session. In the irrigated zones, cultivation is done in rabi as well as kharif, however, the rabi season is the major cropping season. The major rabi crops are wheat and off-season tomato. In kharif, sugarcane is the major crop. The cropping pattern is given in Table I.

Table I Existing cropping pattern of sample farms

Crops	% Area		
	Irrigated	Un-irrigated	Total
Wheat	42.92	91.48	73.24
Barley	-	8.52	5.32
Fodder	1.37	-	0.51
Vegetables	38.36	-	14.41
Maize	7.76	-	2.92
Sugarcane	9.59	-	3.60
All crops	100.00	100.00	100.00

The sample farmer's perception of their possible cropping pattern after availability of canal irrigation is given in Table II.

Table II Cropping pattern when canal irrigation available (as perceived by sample farmers)

Crops	% Farm Area
Cereal crops	35
Cash Crops (Sugarcane/ Sugar beet, etc)	32
Vegetables	25
Fodder	4
Fruit Orchards	4
All Crops	100

Farmer's perception of their post-canal cropping patterns appears to be influenced mainly by the profitability of their existing cropping patterns. Vegetable and sugarcane are at present relatively more profitable than other crops, and the farmers hope this to continue in the future. Cereal crops are produced largely for domestic consumption but in the prospective cropping pattern their weight age will be less than now as sugarcane, sugar beet, and vegetables would fetch more cash than cereals.

Currently, crop yields are low as compared with the bordering district of Charsadda for the reason that adequate irrigation is not available. The existing yields are given in Table III.

Table III Crop yields on sample farms (kg/hectare)

Crop	Yield on:		
	Irrigated land	Un-irrigated land	Overall Average
Wheat	2417	927	1257
Barley	-	752	752
Fodder	3380	-	3380
Onion	6567	-	6567
Tomato	6627	-	6627
Cucumber	6400	-	6400
Chilies	1400	-	1400
Maize	777	-	777
Sugarcane in terms of Gur	3364	-	3364

Livestock

Almost all sample farmers reported ownership of livestock of one kind or the other, and 70% of them reported owning poultry birds. Goats and cows are the most prominent ones with average of 7.38 and 4.03 per sample household, respectively (Table IV).

Table IV Live stock owned by sample farmers

Livestock	Number Owned		
	Total	Average per household of:	
		Owners	Sample farmers in general
Buffalo	13	0.14	0.13
Cows	403	4.20	4.03
Goats	738	7.70	7.38
Sheep	87	0.90	0.87
Draft animals	70	0.73	0.70
Total all kinds	1311	13.67	13.11
Poultry	1188	17.00	12.00

The sample farmers were asked about the possible impact of the proposed canals on their livestock holdings. That is, whether there will be no change, the number will fall or will increase. Their response is given below in Table V.

Table V *Sample farmer's perception about livestock and poultry after the canals operations*

Livestock	Percentage of respondents stating that after commissioning of canal the number will:		
	No change	Fall	Increase
Sheep	45	39	16
Goat	20	54	26
Buffalo	13	12	75
Cow	12	11	77
Draft animals	29	20	51
Poultry	34	15	51

Expected Impact of Proposed Canal on Farm Sector

In the previous section the existing situation of the farm sector in the dam's command area was described. The present section focuses the expected post canal period scenario. This assessment or projection is made selectively restricting it to impact on cropping intensity, cropping pattern, yield, livestock economy, etc. Needless to emphasize, the projected impact analysis is of a crude nature as complete and final design of the canals is not yet available. However, the broad nature and magnitude of the impacts would not be materially different than presently visualized.

Cropping Intensity

The most visible and immediate impact of the proposed canal would be increased in cropping intensity.

The existing level on sample farms is 83% and after the canals it would rise to 189% on the assumption of 5% fallow land, or to 180% if the fallow land in 10%. Even doubling of it from 83% to 166%, which is almost an assured and quite achievable level, would be no small a rise (Table VI).

Table VI *Existing and expected cropping intensity in command area*

Sr.No.	Particulars	Crop
1	Cultivated area of sample farm (ha)	264
2	Annual cropped area (ha)	218
3	Existing cropping intensity	83
4	Expected cropping intensity in post-canal period (%)	
4-a	4-a at 5% fallow land	189
4-b	4-b at 10% fallow land	180
4-c	4-c at 20% fallow land	160

Not only that the cropping intensity would rise in the post-canal period, the level of maturity/survival of crops would also rise and that would be the real difference-making factor. At present, the probability of the crops reaching full maturity is low as tube-well irrigation and rainfall are insufficient. This problem would be largely overcome when canal irrigation becomes available.

Cropping Pattern

It would be possible to grow crops in rabi as well as kharif, and the relative shares of different crops is also likely to undergo a change. The existing and the projected cropping patterns are shown in Table VII by reference to the sample farms, and the assumption is that these would hold valid for the total command area of the proposed canals.

Table VII *Cropping pattern on sample farms: existing and projected*

S.No.	Season/Crop	Existing		Projected	
		Hectare	% of year	Hectare	% of year
I. RABI					
1	Wheat	149	68.35	167	33.40
2	Barley	11	5.05	13	2.60
3	Onion	6	2.75	8	1.60
4	Tomato	30	13.76	40	8.00
5	Other vegetable	3	1.38	5	1.00
6	Fodder	1	0.46	5	1.00
7	Fruit	-	-	12	2.40
	Total Rabi	200	91.74	250	50.00
II. KHARIF					
1	Maize	7	3.21	81	16.20
2	Sugarcane	11	5.05	132	26.40
3	Potato	-	-	5	1.00
4	Other Vegetable	-	-	15	3.00
5	Fruit	-	-	12	2.40
6	Fodder	-	-	-	1.00
	Total Kharif	18	8.26	250	50.00
	Grand total	218	100.00	500	100.00

The cropped area of the sample farms is expected to increase from 200 ha (present) to 250 ha due to greater and regular availability of irrigation due to canal. This is sample farmers estimate, which is taken as given. The projected cropping pattern is also based on farmers perception of post canal scenario, but it is moderated by the cropping pattern in Charsadda district which is taken as a proxy for certain crops. The cropping pattern projections as given in Table-VII may be modified. The relative shares of different crops be different from the projected but their rankings are not likely to change. Wheat in rabi and sugarcane in kharif would continue to be the leading crops. The area is however, likely to grow a larger

variety of vegetables including onion and tomato, the cultivation of fodder and fruit may be more than the projected area at the cost of wheat and sugarcane, but that would not upset these two crop's dominant position.

Projected Total / Incremental Production on Sample Farms

In the preceding para it was noted that following the commissioning of the two planned more area would be under crops as well as with higher crop yields. The incremented production on the sample farm is in Table VIII.

Table VIII *Incremental production of sample farm*

Season	Total Products in per sample farm (MT)		Increase
	Now	Post-Canal	
Rabi	452	1482	3.29 time
Kharif	42	7387	176 time
Both season	492	8869	18 time

These are very guarded projections and in all probability the incremental production would be higher. With even these conservative projections

the post canal scenario on the sample farms looks significantly better. An 18 fold increase or more in production/income would be expected

In Table IX, the existing and projected cropping patterns and crop-wise production of the sample farm are shown. It can be seen that at present only

eight crops are grown. On the other hand in the post-canal period as many as 13 crops would be grown with much higher yields.

Table IX Existing and expected crops and production on sample farms

S. No.	Season/crop	Existing		Post-Canal Projected			Incremental Production	
		Area (Ha)	Product (MT)	Area (Ha)	Yield MT/Ha	Production (MT)	MT	% increase
I. RABI								
1	Wheat	149	187	167	2.940	491	304	162.57
2	Barley	11	8	13	1.813	24	16	200.00
3	Onion	6	39	8	9.000	72	33	84.62
4	Tomato	30	199	40	15.357	614	415	208.54
5	Other veg	3	14	5	9.000	45	31	221.43
6	Fodder	1	3	5	23.936	120	117	3,900.00
7	Fruit	-	-	12	9.681	116	116	11,600.00
8	Fallow	64	-	14	-	-	-	-
	Total	264	450	264	-	1482	1032	229.33
II. KHARIF								
1	Maize	7	5	81	4.714	139	134	2,680.00
2	Sugarcane	11	370	132	51,453	6792	6722	18,356.76
3	Potato	-	-	5	14,200	71	71	7,100.00
4	Vegetable	-	-	15	10,500	158	158	15,800.00
5	Fruit	-	-	12	11,000	132	132	13,200.00
6	Fodder	-	-	5	19,000	95	95	9,500.00
7	Fallow	246	-	14	-	-	-	-
	Total	264	42	264	10,351	10,351	10,351	22,402.38

Assessment of Total Expected Incremental Crop Production in the Total Command Area of the Proposed Canals

The proposed two canals would irrigate 11,855 ha. It is assumed that after allowing for fallow land, 11,290 hectares would be brought under plough in each of the two cropping seasons – Rabi and Kharif.

It is further assumed that the post-canal cropping pattern and incremental yield would be an opportunity as shown in Table X pertaining the sample farms. Based on these data, the total incremental production for each crop in a season is worked out in table IX to assess the gross incremental crop production due to the proposed canal.

Table X *Expected total incremental crop production in munda dams canal's command area.*

S. No.	Crops	Projected Cropped area after canals (Hectare)	Incremental Production per hectare (Tones)	Total Incremental Production (Tones)
I RABI				
1	Wheat	7742	1820	14090
2	Barley	388	1231	478
3	Onion	360	4330	1559
4	Tomato	1806	10375	18737
5	Other veg	226	6200	1401
6	Fruit	542	23400	5288
7	Fodder	226	9666	5239
	Total	11290	-	-
II. KHARIF				
1	Maize	3658	1654	6050
2	Sugarcane	5690	51174	291180
3	Potato	226	14135	3195
4	Vegetable	678	10500	7119
5	Fruit	542	11000	5962
6	Fodder	226	19000	4294
	Total	11290	-	331616

For a more meaningful assessment, the incremental production is shown in Table-XI in terms of types of products:

Table XI *Incremental production by type of products*

Crops	Production (MI)
Cereals	20618
Sugarcane	291180
Vegetables	32011
Fruit	11250
Fodder	9533

Incremental farm production of the order visualized in Table X, is expected to make a massive direct contribution to the welfare of the farm households concerned. Its indirect beneficial impacts would be immense too.

Some Other Expected Impacts of the Proposed Canals

Besides a manifold increase in area and production of crops the farm sector is expected to experience several other positive impacts due to the proposed canals from the Munda Dam. Some of these are briefly indicated as follows:

Farming efficiency will improve in terms of physical productivity as well as farming cost per unit of investment. This will be enabled by higher cropping intensity, higher level of crop maturity, saving in electricity cost, improvement in factors allocative efficiency, better time utilization of hired and family labor, etc. More land under plough and higher crop maturity rate would result in increase in farm employment. It is expected that the productivity of the man-days on the farm will be doubled.

The livestock sector will flourish a good deal due to the incremental production of fodder crops and residual of other crops that can be used as fodder e.g. sugarcane tops, wheat husk and maize stalks, etc. The impacts will emerge in the form of steep rise in livestock based production i.e. milk and meat etc.

Many other secondary impacts of the canals would not only radically transform the farm sector but also the non-farm sector. Not only the farmers but also the non-farming community would be benefited by these improvements. The most immediate impact can be visualized on the area's business sector, transport and service sector.

Therefore, a massive uplift of the command areas farm as well as non-farm sector is expected to take place after commissioning of the proposed canals. The displacement impacts of the Munda Dam canals are likely to be negligible. There is absolutely no risk of water logging and salinity because of the slope of the area and no productive land is to come under the dam. Yet some displacement effects cannot be ruled out, but these would be far out-weighted by developmental impact.

CONCLUSION AND RECOMMENDATIONS

The two canals planned to be taken out of the proposed Munda Dam would bring about radical improvement in their command area sprawling over 29,380 acre. The cropping intensity would increase from the existing level of 83% to 160-190%, due to perennial irrigation from canals. The number of crops grown in the area is expected to increase to thirteen as against only eight crops at present. Crop productivity per acre would experience a steep rise. The overall farm production is projected to increase 18-fold due to the planned canal. This will have revolutionary favorable impacts on the farming sector which would also spill over to the non-farm sector in the form of expansion in commercial activity, expansive of transport sector, a possible increase in industrial activity, and more off-farm employment due to the aforesaid and other improvement in off-farm sector. In order to facilitate the above stated positive development and to fully capture the development potentials in the farm sector, the public sector need to make

some preparation before the canals are commissioned.

The land owners would need machinery to develop the farm land, and that would be needed on a large scale. The government would have to come forward to help the farmers in this task. Bulldozers, tractors etc would need to be provided at affordable cost, in the required number and without much waiting.

The need for providing agricultural extension services is equally important. These already exist in the area, but are inadequate. The farmers should be provided information on a larger scale about scientific farming, farm management, efficient marketing etc. There is already over flows, a wealth of information on these subjects, but the need is to pass it on to the farmer regularly and rapidly.

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