

**COMPARATIVE MANAGEMENT
PERFORMANCE OF
GOVERNMENT AND FARMER
MANAGED IRRIGATION
SYSTEMS IN KASHMIR:**

**CASE STUDIES OF TWENTY ONE
IRRIGATION SCHEMES**

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1. INTRODUCTION

Throughout the world, irrigation is considered as a vehicle for agricultural and economic development. Irrigation plays a pivotal role in food security, income generation, employment creation, improved nutrition and raising of the standard of living of farmers. With increase in the population and growing demand for food, sustainable production increases from irrigated agriculture must be achieved. With limited freshwater and land resources and increasing competition for these resources, irrigation system must improve utilization of these resources. An irrigation system is nested within an irrigated agricultural system, which in turn can be considered part of an agricultural economic system (Molden *et al*, 1998).

How best an irrigation system performs its designated function may depend on various variables such as infrastructure design, climatic conditions, price and availability of inputs, socio-economic settings and more important the management of the irrigation system. The conventional typology for the administration of irrigation systems is state and self management. There are also examples of the irrigation schemes through out world which are jointly managed by the government and farmers but the locus of authority lies in the former in majority of the cases (Vicqueira, 2001). The institutional setup of any system plays an important role in its proper functioning. The present trend of management transfer of irrigation systems from government/state to farmers is taking place world over. The review of literature shows success of turnover schemes in most of the cases.

On the other side, the Kashmir region of Indian country which was famous for its lively hydraulic society with large and ancient network of *Zamindari Kuhls* (farmer managed irrigation canals) lies now in a decrepit state. In this part of the world, trend is reverse. The area irrigated by the farmer managed irrigation canals (Zamindari Kuhls) was more than 85 per cent during fifties (1950s) whose command has now reduced to about 53 Per cent of the total irrigated area. The proportionate irrigated area under government managed irrigation schemes (GMIS) increased over the period due to commissioning of new irrigation schemes, particularly the lift irrigation schemes and also takeover of some *Zamindari Kuhls* (FMIS) by the state irrigation department. Every year few *Zamindari Kuhls* are handed over to irrigation department on the behest of the farmers.

The present study is aimed to examine the management of the existing two typological institutions (FMIS and GMIS) and see the reasons for the turnover.

2. BACKGROUND INFORMATION

The state of Jammu and Kashmir (J&K) with geographical area of 101387 sq.km. (excluding area under occupation of Pakistan and China), extending over 32°-17' and 37°-5' and 73°-26' and 80°-30' E with an altitudinal variation of 300-5400 metres above sea level, constitutes about 67.5 per cent of North-Western Himalayan region. The entire territory is a mass of mountain ranges which yield only a fraction of total geographical area, located in outer plains at the southern extremity and plain areas of Himalayan valleys, for cultivation of crops. The state resources of agriculture have a high potential, not only for having a higher rate of growth *per se*, but also for helping other sectors of economy which are directly and indirectly dependant on agriculture.

Endowed with unique advantage of environmental resources and wide range of agro-ecological setting, agriculture in Jammu and Kashmir State is faced with great diversity of needs, opportunities and prospects. Being a core sector of the economy, about 33.4 per cent of the net State Domestic Product is contributed by agriculture. Nearly two third of the work force is employed in agriculture and about 80 per cent of the population of the state is directly or indirectly dependant on this sector.

The J&K state is located almost in the middle of three climatic regions of Asia. With this geographical position, coupled with varied physiography, the state lays claim to a variety of climatic conditions within a comparatively narrow latitudinal expanse and geographical spread. Besides, the major climatic zones, the changing aspects of the contrasting relief give rise to a host of microclimates within each macro climatic zone. However, broadly four macro climatic zones have been identified in the state.

Table 1: Meteorological Features Of Four Macro Climatic Zones

Zone	Mean rainfall (mm)	Mean Temp °C	Thermal Index	Hydric Index
I Low altitude sub-tropical zone	1069	24.2	Mild	Humid
II Mid to high altitude intermediate zone	1478	23.5	Mild	Humid
III Mid to high altitude temperate zone	660	13.3	Cold	Humid
IV Cold arid zone	83	5.8	Very cold	Arid

(Source: adapted from Masoodi, 2000 pp.7)

Zone I is characterized by definite but not severe winters, rare occurrence of frosts, and a hot spell of summer with concentration of precipitation in summer months. It comprises whole of Jammu district and lower parts of Kathua, Udhampur and Rajouri districts.

The Zone II comprises the mid and high altitude areas on the outer aspect of the Panjal-trap. It encompasses all the areas above the outer hills including the districts of Doda, Poonch, parts of Rajouri, Udhampur and Kathua. River Chenab and its tributaries constitute the major drainage base. However, upper parts of Kathua district drain into Ravi.

The Zone III forms the valley of Kashmir with 6 districts, viz., Anantnag, Pulwama, Srinagar, Budgam, Baramulla and Kupwara. The region is characterized by a sub-microthermic regime with marked winter and spring concentration of precipitation. Snowfall is important form of precipitation that helps to maintain moisture supply during summer when scanty rainfall is less than the evapo-transpirational requirements. Whole of the Kashmir valley is drained by river Jhelum and its tributaries.

Zone IV consisting of Ladakh region with Leh and Kargil districts, lies in the high altitude range of North West Himalayas. More than 75 per cent of the geographical area of the state falls in this zone. This zone has highest average elevation dotted with deep gorges, deserts and plateaus. Climate is characterized by extremes of heat and cold. Zone receives about 80-

90 mm rainfall in Leh to about 300 mm in Kargil. The growing season is restricted to summer months. The region requires water and the agricultural output will be directly proportional to this input. It is irony that the waters of Indus that flow through this cold arid zone leaves this territory dry and parched while making the deserts of Sind (Pakistan) to flourish.

3. STATUS OF IRRIGATION DEVELOPMENT

Despite huge watershed and surface system, only about 35 per cent of the 31.75 million acres crop land is irrigated.

Table 2: Status of Irrigation Development in Kashmir (Source: Masoodi, 2000)

Zone	Percent area irrigated
I Low altitude sub-tropical zone	36
II Mid to high altitude intermediate zone	10
III Mid to high altitude temperate zone	62
IV Cold arid zone	100

Comparatively higher percentage of irrigated area in temperate zone is more as a result of ease with which the lay of the land permits the use of gravity system. One great advantage of the development of irrigation system in Kashmir valley is that most of the water is used for rice production which has forced the development of terraced paddy, thus saving a vast area from erosion. Similarly, the very low percentage of irrigated area in the intermediate zone is the result of very difficult terrain of agricultural land in this zone which does not permit the gravity system to operate. But higher moisture supply through rain, compared to other zones, helps a higher output from rainfed agriculture in this zone.

During pre independence period and even upto mid of the 19th century, most of the irrigated area of the state was commanded by the *Zamindari Kuhls* (FMIS) and meager area by government canals. With the formation of state irrigation department in 1949, a large number of irrigation schemes were commissioned and also emphasis was given to lift irrigation schemes. Lift irrigation schemes was resorted to in 1953/54. Greater emphasis was given to minor irrigation schemes which could be executed quickly, at relatively lesser cost as compared to large projects.

The area under farmer managed irrigation schemes had reduced to 13.96 per cent when compared at two different vintages. On the other hand, there is seen a marvelous increase of 364.62 per cent in the irrigated area under government managed irrigation schemes, which most probably had come due to coming of new irrigation schemes as well as transfer of farmer managed irrigation schemes to state irrigation department.

Table 3: Comparison of Irrigation Development in FMIS and GMIS in Kashmir

(Area in million acres)

Irrigated Area	Zamindari (FMIS)	Kuhls	Government irrigation schemes	Total
1956/57	4.01 (86.05)		0.65 (13.95)	4.66 (100)
2002/03	3.45 (53.32)		3.02 (46.68)	6.47 (100)
Absolute Change	- 0.56		2.37	1.81
Percentage Change	- 13.96		364.62	38.84

(Source: Khan, 1961 and J&K Statistical Digest, 2003)

Note: Figures in the parentheses are percentage to total irrigated area.

After the formation of State irrigation department, greater emphasis was given to minor irrigation schemes which could be executed at lesser costs and for which no hydraulic and other necessary data was required for their commissioning as was required in case of major and medium irrigation schemes. The river Jhelum, which is known as the life line of Kashmir, plays an important role in shaping the economy of valley. Since the river flows below the level of agricultural field along its course, so the river water was flowing almost in waste as far as the irrigating lands were concerned. But this changed after the lift irrigation system was introduced in Kashmir valley about four decades ago. The system opened new vistas for the agriculture. Irrigation canals fed with water lifted from the Jhelum were constructed across the valley. There are about more than 114 lift irrigation stations on the

Table 4: Government Managed Minor Irrigation Schemes In Kashmir 2003/04

Districts	Gravity Schemes	Annual Potential Utilization (in acres)			Lift Schemes	Annual Potential Utilization (in acres)		
		Kharif	Rabi	Total		Kharif	Rabi	Total
1. Srinagar	14	25820	5222	31042	0	0	0	0
2. Budgam	32	27813	1504	29317	1	283	0	283
3. Anantnag	11	11997	1362	13359	3	250	57	307
4. Pulwama	38	32112	3225	35337	19	6951	0	6951
5. Baramulla	49	37300	10708	48008	91	14864	197	15061
6. Kupwara	29	20684	-	20684	140*	2935	0	2935
TOTAL	173			177747	114			25537

(Source: Department of Irrigation and Flood Control, Srinagar)

Note: 140* irrigation schemes in Kupwara district are storage tanks and not lift schemes.

river Jhelum. The area irrigated under minor irrigation schemes by the lift stations is about 22,602 acres and through gravity system about 1.17million acres in 2003/04, whereas, an estimated area of about 99,355 acres is irrigated under major and medium irrigation schemes which include both gravity as well as lift ones. There are also 140 tank irrigation schemes in the Kupwara district which irrigate about 2,935 acres of land in kharif season (Table 4).

4. PROBLEM STATEMENT

The farmer managed irrigation schemes are presently promoted world over and the transfer of state/government managed irrigation systems to the farmer communities is gaining more credentials due to their better performance. However, the Kashmir case is different from other parts of the globe. The transfer of irrigation schemes is reversible here. Every year state irrigation department takes control of some *Zamindari Kuhls* (FMIS), that too on the demand from the farmers through their local leaders, most probably the MLA of the constituency.

So, it is imperative to study the management and other performance aspects of the two regimes and also to identify the reasons for takeover of the FMIS by irrigation department.

5. OBJECTIVES OF THE STUDY

The broader objective of this study is to evaluate the comparative management performance of Zamindari Kuhls (farmer managed irrigation schemes) and government managed irrigation canals as well as to identify the factors responsible for the transfer of *Zamindari Kuhls* (FMIS) to state irrigation department.

6. STUDY METHODOLOGY

The study looks at the performances of 21 irrigation schemes in one of the irrigation divisions of Baramulla district which has highest number of irrigation schemes in Kashmir province. Out of the total 21 selected schemes, 10 belong to irrigation department and 11 schemes are farmer managed (*Zamindari Kuhls*). The list of the selected schemes, and a summary of their details are given in Table 5.

Participatory Rural Appraisal (PRA) techniques were used in collecting data from the schemes. Descriptive statistics were generated to identify factors, which lead to conclusions on scheme performance and other social aspects. The study draws on both primary and secondary data sources. The main emphasis was on the collection of survey data from irrigators of each scheme. The major part of the data was collected from the Irrigation and Flood Control Department, Srinagar and also the Revenue Cell of the irrigation department.

Informal interviews were carried out with some key informants. The objective was to get enough background information on what were the main issues on each individual irrigation scheme.

Table 5: Selected Irrigation Schemes

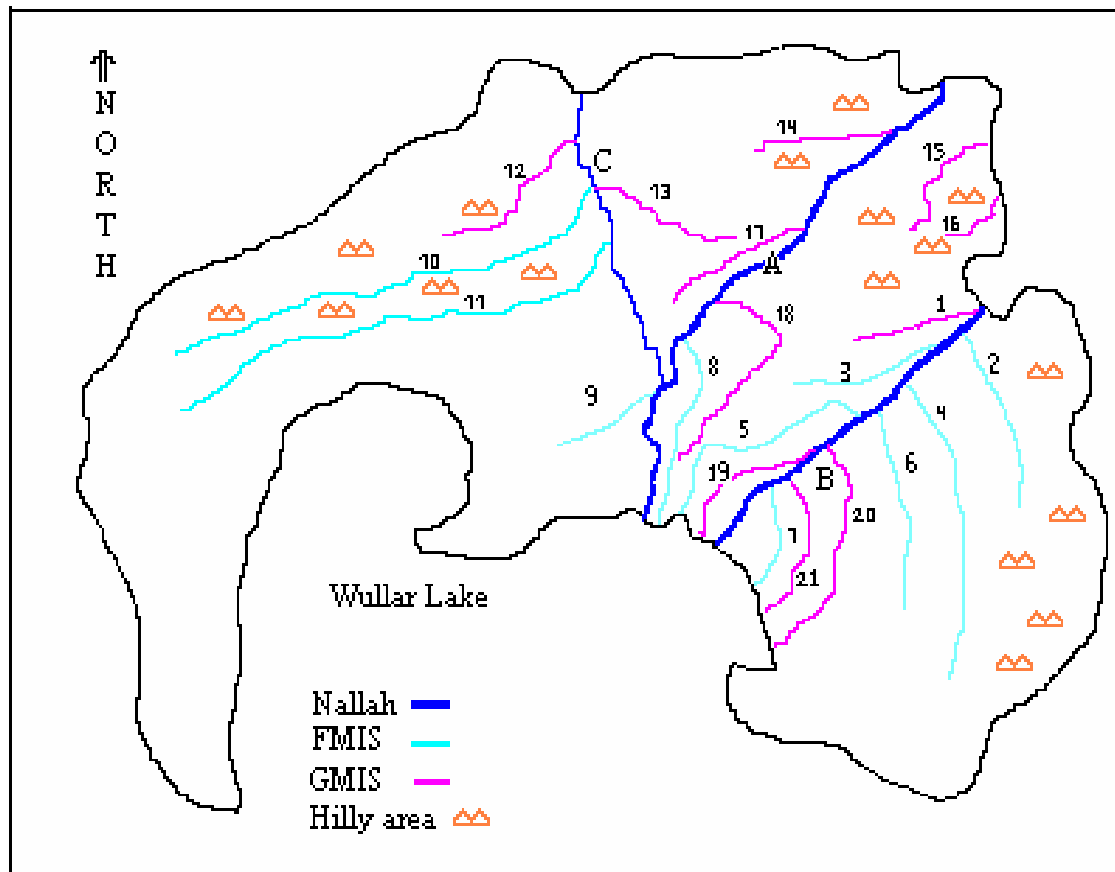
Scheme name	Type of Scheme	Source	Type of management	Performance rating
1. Jinder Kuhl	Gravity	Arin Nallah	Government managed	Excellent
2. Gadder Kuhl	Gravity	Madhumati Nallah	Government managed	Excellent
3. War Kuhl	Gravity	Arin Nallah	Government managed	Excellent
4. Sofi Kuhl	Gravity	Arin Nallah	Government managed	Average
5. Peer Kuhl	Gravity	Arin Nallah	Government managed	Average
6. Aragam Kuhl	Gravity	Arin Nallah	Government managed	Better
7. Garoora Kuhl	Gravity	Arin Nallah	Government managed	Better
8. Reshi Kuhl	Gravity	Boner Nallah	Government managed	Better
9. Dehgam Kuhl	Gravity	Boner Nallah	Government managed	Better
10. Bagh Kuhl	Gravity	Zainager Canal	Government managed	Good
11. chuntimullah Kuhl	Gravity	Arin Nallah	Farmer managed	Average
12. Malik Kuhl	Gravity	Boner Nallah	Farmer managed	Good
13. Thanghat Kuhl	Gravity	Boner Nallah	Farmer managed	Average
14. Kulwan Kuhl	Gravity	Madhumati Nallah	Farmer managed	Average
15. Bohru Kuhl	Gravity	Arin Nallah	Farmer managed	Good
16. Kralpora Kuhl	Gravity	Boner Nallah	Farmer managed	Average
17. Kudhara Kuhl	Gravity	Arin Nallah	Farmer managed	Average
18. Dilawar Kuhl	Gravity	Madhumati Nallah	Farmer managed	Excellent
19. Gamroo Kuhl	Gravity	Arin Nallah	Farmer managed	Excellent
20. Koota Kuhl	Gravity	Shamthan Nallah	Farmer managed	Poor
21. Kawtari Kuhl	Gravity	Shamthan Nallah	Farmer managed	Poor

The following key informants were interviewed.

- ? Executive Engineer, Irrigation and Flood Control Deptt., Bandipore.
- ? Junior Engineer, Irrigation and Flood Control Deptt., Bandipore.
- ? Works Supervisors, Irrigation and Flood Control Deptt., Bandipore.
- ? Canal Daroga / Assistant Collector, Irrigation Revenue, Baramulla.
- ? Ziladar, Irrigation Revenue, Sopore.
- ? Patwaris, Irrigation Revenue, Bandipore.
- ? Heads / Sarpanchs of the *Zamindari Kuhls*.
- ? Assistant Executive Engineer (AEE), Block Development Office, Bandipore.

Location of the irrigation schemes studied

Figure 1: Location Map Of Selected Irrigation Schemes



A – Madhumati Nallah; B – Arin Nallah; C – Bonar Nallah

1 – Chuntimullah Kuhl; 2 – Peer Kuhl; 3 – War Kuhl; 4 – Aragam Kuhl; 5 – Jinder Kuhl;
6 – Garoora Kuhl; 7 – Sofi Kuhl; 8 – Gadder Kuhl; 9 – Bagh Kuhl; 10 – Reshi Kuhl;
11 – Dehgam Kuhl; 12 – Kralpora Kuhl; 13 – Malik Kuhl; 14 – Tanghat Kuhl;
15 – Kooti Kuhl; 16 – Kawtari Kuhl; 17 – Dilawar Kuhl; 18 – Kulwan Kuhl;
19 – Bohru Kuhl; 20 – Gamroo Kuhl; 21 Kudhara Kuhl.

The locations of the 21 irrigation schemes studied are shown on Figure 1. All the selected 21 irrigation schemes come under Bandipore irrigation sub division. The water sources for these schemes are the Madhumati, Arin and Boner Nallah's which in turn are fed by the glaciers. Some of these *Kuhls* are located at higher terrains. All schemes come under gravity system.

7. WATER SOURCES AND IRRIGATION TECHNOLOGY TYPES

Almost all the irrigation schemes get their water from these major three nallah's which are fed by the glaciers and snow, except Bagh Kuhl which draws its water from Zainger canal (kashmir's major irrigation canal) which is in turn fed by the Madhumati nallah / glaciers or

snow. The water sources are secure throughout the year on majority of the Kuhls, however, the winters experienced by low snowfall make these Kuhls almost parched in coming summer. The details of the water sources and water delivery systems along with the discharges at offtake head for all the schemes covered in this study are given in Table 6.

Table 6: Water Sources and Irrigation Technology Types on the Selected Schemes (Source: Office of the Assistant Executive Engineer, Department Of Irrigation and Flood Control, Sub-Division, Bandipore)

Scheme	Water source	Water delivery system	Discharge at offtake headwork (cusecs)	Remarks
Jinder Kuhl	Glaciers / Arin Nallah	Canal is 5.5 km long with 1.5 km concrete. Head works concrete provided with gauge. One siphon and 2 falls are on the canal.	42.00	The water source is secure through out the year.
Gadder Kuhl	Glaciers / Madhumati Nallah	Kuhl is 4.3 km in length of which 2 km is concrete. No fall or siphon.	36.00	The water source is secure through out the year.
War Kuhl	Glaciers / Arin Nallah	3 km long with 1 km concrete.	52.00	Secure water supply.
Sofi Kuhl	Glaciers / Arin Nallah	3.5 km long with concrete headworks.	30.00	Water supply is secure.
Peer Kuhl	Glaciers / Arin Nallah	5 km long with 3 km concrete.	52.00	Secure water
Aragam Kuhl	Glaciers / Arin Nallah	The Kuhl is 7.5 km long with 2.5 km concrete as well as 1 aqueduct and super-passage.	42.00	Water remains throughout year.
Garooru Kuhl	Glaciers / Arin Nallah	6 km in length of which 1 km is concrete.	42.00	Water available only for six months from March to October.
Reshi Kuhl	Rain & Snow / Boner nallah	The largest Kuhl in length of about 16.5 km of which 1 km is concrete. There are 5 falls and 7 super-passages and 4 escapes with gauges.	30.00	Water remains for about 7-8 months from March to November.
Dehgam Kuhl	Rain & Snow / Boner nallah	11.25 km long with about 1 km concrete, provided with one aqueduct, 4 falls, 2 super-passages and 1 escape with gauge.	30.00	Water remains for about 7-8 months from March to November.
Bagh Kuhl	Zainger Canal	3.5 km in length with 0.75 km concrete work. One super-passage and flume.	35.00	Water available throughout year.
Chuntimullah	Glaciers /	Kuhl is 6.5 km in length of	55.00	Water remains over

Kuhl	Arin Nallah	which 3 km is concrete.		the year.
Malik Kuhl	Glaciers / Boner Nallah	5.48 km long with 3 km concrete and is having 3 falls.	-	Water available from March to November.
Thanghat Kuhl	Glaciers / Boner Nallah	4.25 km long with 2 km concrete work. It has 5 falls and 2 super-passages.	-	Water available from March to November.
Kulwan Kuhl	Glaciers / Madhumati Nallah	6 km long with no headworks.	-	Water available for whole year.
Bohru Kuhl	Glaciers / Arin Nallah	Kuhl is 2.5 km long. No headworks, fall, flume etc. or concrete work.	-	Water is secure throughout year.
Kralpora Kuhl	Glaciers / Boner Nallah	4.5 km in length with no headworks.	-	Water available from March to November.
Kudhara Kuhl	Glaciers / Arin Nallah	3 km in length with no headworks.	-	Water available from March to November.
Dilawar Kuhl	Glaciers / Madhumati Nallah	4 km long with 1 km concrete work, provided with 2 falls.	-	Water available from March to November.
Gamroo Kuhl	Glaciers / Arin Nallah	5.8 km long with 0.75 km concrete work.	-	Water available throughout year.
Koota Kuhl	Rain and snow	2.5 km long.	-	Water available from March to October.
Kawtari Kuhl	Rain and snow	2 km in length.	-	Water available from March to October.

The Kuhls under the irrigation department had all the necessary required headworks, provided with gauges to control water during the floods. It is here necessary to mention that the valley experiences frequent floods mostly in spring season and wreak havoc to the Kuhls mostly *Zamindari* (farmer managed) ones as none of these are provided with necessary headworks and gauges to operate the excess flood water. Except Gamroo and Dilawar Kuhls, managed by farmers, none of the irrigation schemes have concrete work. The cement work on these two Kuhls was not carried out by the farmers from their own resources but from the Block Development Office under rural development programs. On the other hand, all the schemes managed by the irrigation department have some portion of the canal as concrete work which minimizes the water delivery losses as well as provided with the escape passages through which water is made to flow into nallahs during floods, thereby minimizing the chances of canals breaches. These Kuhls have also aqueducts, flumes, super-passages and falls at necessary required places. The discharge data at the head was not available for the farmer managed irrigation schemes as these are not provided with the headworks, gauges and measuring devices.

The three irrigation schemes namely Malik, Tanghat and Kulwan Kuhls were under irrigation department for some period that is why, these schemes have some concrete work. The Tanghat Kuhl was under irrigation department from 1988 to 1996 and was thereafter handed over to farmers as irrigation department neither was carrying out any works on the

scheme nor was any coolie deputed for its watch and ward. The famers were themselves looking after to the Kuhl and were reluctant to pay *Abiana* (irrigation charges).

8. SCHEME SIZES AND NUMBER OF BENEFICIARIES

The schemes studied vary in size. The smallest scheme is Kawtari Kuhl (FMIS) with an area of 110 acres and the largest scheme is Jinder Kuhl (GMIS) with 583 acres as command area. Among the FMIS, largest schemes are Kulwan Kuhl and Gamroo Kuhl with both having 500 acres of cultivable command area. The number of villages covered by each scheme varies from 1 to 9 with Kawtari and Kooti Kuhls covering single villages whereas, Jinder, Aragam, Reshi and kulwan Kuhls covering 8 to 9 villages. Reshi and Dehgam Kuhls are also big schemes in lengthwise too. The plot sizes vary from 0.53 acre at Sofi Kuhl to 3.6 acre at

Table 7: Scheme Sizes And Number Of Beneficiaries (2003-04)

Scheme	Area / CCA (Acres)	Number of beneficiaries	Number of villages covered	Average plot size (acre)	Total irrigated area (acres)
Jinder Kuhl	583	749	8	0.78	566
Gadder Kuhl	414	531	6	0.78	379
War Kuhl	210	207	2	1.01	190
Sofi Kuhl	133	249	3	0.53	114
Peer Kuhl	173	158	2	1.09	163
Aragam Kuhl	419	690	8	0.61	453
Garooru Kuhl	332	584	7	0.57	344
Reshi Kuhl	214	364	8	0.58	216
Dehgam Kuhl	573	791	9	0.72	583
Bagh Kuhl	300	416	3	0.72	276
Chuntimullah Kuhl	420	517	2	0.81	362
Malik Kuhl	486	530	2	0.92	486
Thanghat Kuhl	158	147	2	1.07	158
Kulwan Kuhl	500	746	9	0.67	700
Bohru Kuhl	160	160	2	1.00	210
Kralpora Kuhl	260	313	2	0.83	285
Kudhara Kuhl	180	280	1	0.64	180
Dilawar Kuhl	300	433	2	0.69	400
Gamroo Kuhl	500	700	5	0.71	650
Koota Kuhl	130	50	1	2.6	130
Kawtari Kuhl	110	30	1	3.6	110

(Source: Office of Assistant Executive Engineer, I&FC Deptt., Bandipore)

Kawtari Kuhl. Jinder Kuhl has the highest number of beneficiaries with 749 farmers while Kawtari Kuhl has the lowest with 110 farmers (Table 7).

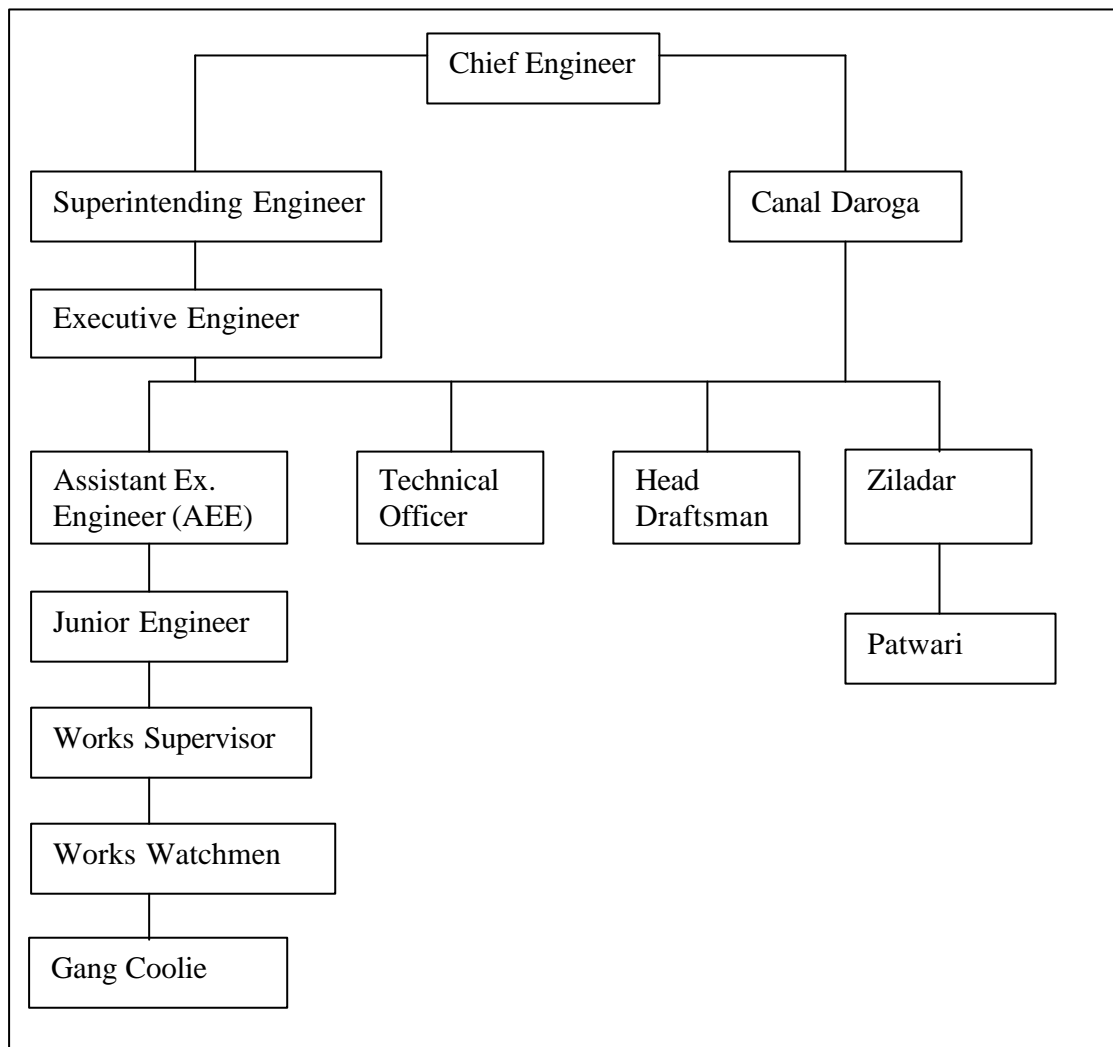
Reasons for the gap between the CCA and the actual irrigation on majority of the schemes is due to drought conditions in the state since last few years which forced the farmers to convert their paddy fields into apple orchards and also residential colonies has come up in the paddy fields which is the main cause of shortfall and the process of conversion of prime irrigated agricultural lands for other purposes is going on.

9. MANAGEMENT OF THE IRRIGATION SCHEMES

Jinder, Gadder, War, Sofi, Peer, Aragam, Garoora, Reshi, Dehgam and Bagh Kuhls /schemes are government managed schemes and the remaining eleven schemes are farmer managed. The Chuntimullah, Tanghat and Malik schemes were for sometime under the irrigation department which were later on again handed over to farmers. All the schemes which are even now under the state irrigation department were actually *Zamindari Kuhls* (FMIS) during fifties.

Aragam, Garoora, reshi and Dehgam schemes were handed over to irrigation department in 1971. Reshi Kuhl was only 9 km long, covering 4 villages before the takeover, which was later on extended by the irrigation department further by a length of 7.5 km and four new villages were brought under its command. Gadder Kuhl, Jinder Kuhl, Sofi Kuhl, Bagh Kuhl and Malik Kuhl were took over by irrigation department in 1987, whereas, War Kuhl in year 1999. More command area was brought almost on all the irrigation schemes after their transfer and were also provided with the necessary headworks, which did not exist previously under the management of farmers.

The government managed irrigation schemes have their own administrative and legislative structure which is shown in Figure 2. The Chief Engineer of Irrigation and Flood Control Department is the top level authority at the apex of the government managed irrigation schemes. Superintending Engineer (SE) remains incharge of the schemes at district level, whereas Canal Daroga which is the rank of Assistant Collector looks after the Revenue Cell of the irrigation department. Canal Daroga enjoys the Sub District Magistrate (SDM) powers. There are also Hydraulic Cells for each irrigation division which is headed by the Divisional Engineer / Executive Engineer. The number of irrigation divisions varies from district to district depending upon the area and geographical and agricultural characteristics. Every irrigation division is provided with a Zildar which is of Tehsildar/Mamlatdar level. He has his own court in which water disputes, encroachments and other related matters are solved in accordance of the State Irrigation Act, 1978. Before the formulation of Act, *Rivaj Abpashi* (customs of irrigation) was working. The *Rivaj Abpashi* which was written in Urdu during the Maharja times was the basis on which all the water disputes were settled by the Tehsildars and the courts before 1978. It had a complete force of law.

Figure 2: Administrative and Legislative Provisions of Irrigation Schemes

Each irrigation sub-division is headed by Assistant Executive Engineer (AEE) which is supported by Junior Engineer and Works Supervisors, Whereas, Works Watchman and Gang Coolies act at canal level.

Table 8 shows the number of people employed on selected irrigation schemes. All the government managed irrigation schemes had coolies for their look after which are headed by works watchman (*Meath*). As per the irrigation engineering rule and also mentioned in the State Irrigation Act, there should be one coolie for each kilometer of the canal. However, less number of coolies is deputed on all the irrigation schemes as against to their requirement. Sofi irrigation scheme has not even a single coolie or works watchman.

Table 8: Number of Employees on Each Scheme (Source: Author's Personal Communication with I&FC Officials and Schemes Members)

Scheme	Coolies	Works Watchman	Works Supervisor	Miraab (water man)
Jinder Kuhl	4	-	1	
Gadder Kuhl	3	1	3	
War Kuhl	2	-	1	
Sofi Kuhl	-	-	-	
Peer Kuhl	1	-	1	
Aragam Kuhl	4	1	1	
Garooru Kuhl	2	1	1	
Reshi Kuhl	4	1	2	
Dehgam Kuhl	2	-	1	
Bagh Kuhl	1	-	1	
Chuntimullah Kuhl	-	-	-	1
Malik Kuhl	-	-	-	2
Thanghat Kuhl	-	-	-	2
Kulwan Kuhl	-	-	-	5
Bohru Kuhl	-	-	-	2
Kralpora Kuhl	-	-	-	2
Kudhara Kuhl	-	-	-	1
Dilawar Kuhl	-	-	-	2
Gamroo Kuhl	-	-	-	5
Koota Kuhl	-	-	-	1
Kawtari Kuhl	-	-	-	1

The farmers appoint *miraabs* (water man) for the look after of the *Zamindari Kuhl*s. For every village, there is one *miraab*. The *miraab* is kept generally a localite of that area, who may not have his own land (non-farmer). The *miraab* takes 2 *khirwar* of paddy (27 kgs of rice) per acre and Rs 20 per beneficiary irrespective of their holding size in a year. The main work of *miraab* is to keep watch and ward of the Kuhl and to make water available to farmers at their fields and also keep farmers well informed in advance about some eventuality or default. Gamar Kuhl is provided with highest number of *miraabs*, whereas, most of the other farmer managed irrigation schemes had either one or two *miraabs*.

10. FORMATION OF WATER COMMITTEES, FUNCTION AND DISSOLUTION

There is a provision in the State Irrigation Act, 1978 to form water committees whenever there may be any crisis or dispute at peak season for sharing of water between the villages

under the supervision, guidance and control of Canal Officer. Reshi and Dehgam irrigation schemes have water committees which were formed in year 1999, when there was water crisis at peak irrigation season. The conflict arose among the farmers of villages irrigated by these two schemes. Both the schemes have same villages under their command, the only difference is that Reshi Kuhl moves at higher altitude, whereas, Dehgam Kuhl traverses at lower altitude.

The procedure for the formation of irrigation committees is that the Ziladar of the irrigation department summons the particular elders of the conflict villages which may in most cases include the Numberdar and sarpanch. There are five members in water committee which are elected mutually by the farmers. Members are elected for tenure of three years.

The main functions and responsibilities entrusted to water committees are;

- (a) Committee meets from time to time and lay down such rules and regulations as it deems fit for its functioning. The main functions entrusted to water committees are,
 - (i) to make arrangements for irrigation of the land coming under the scheme and rational/ equi-distribution of water.
 - (ii) decide about the crops to be sown during a particular period / periods according to the directions of the officers of the scheme.
 - (iii) day to day look after of the irrigation works and repairs and desiltation etc.
 - (iv) ensure and arrange regular supply of water from the point of source of the canal / Kuhl to onwards.
 - (v) cooperate and help to the canal officer in connection with the running of canal / Kuhl.
 - (vi) collect information about unauthorized occupation of the canal land and take necessary preventive measures.
 - (vii) preventive and safety measures for loss of irrigation water.
 - (viii) repairs and damaged irrigation works.
- (b) Water Committee shall have powers for making punishments for unfair use of water (out of turn) and sowing seeds (crops) against the directions of authorities concerned.
- (c) Water Committee shall maintain proper and fair accounts of the amounts received by it and their utilization.
- (d) Water Committee can also make fine upto an amount of Rs 200 to farmers who violate the rules.

If the officials feel at any time that the committee has neglected its duties under the act or such conditions have been created under which it becomes necessary, it can dissolve the committee through an announcement/ or passing an official order. This will, however, be subjected to the condition that water committee may be given an opportunity to hear the arguments / reasons of the committee if any, they may have in their connection. After announcement of dissolution of water committee by the government, the members give resignation.

11. PERFORMANCE OF THE IRRIGATION SCHEMES

The performance of selected irrigation schemes with related to repairs and maintenance as well as desiltation work is shown in Table 9. Irrigation department carry out the desiltation work on majority of the canals under their control, however, there are some GMIS schemes on which farmers do desiltation work. This was in response to the government request to farmers for carrying out desiltation work of the canals due to financial problems.

Table 9: Performance of the Irrigation Schemes

Scheme	Overall performance
Jinder Kuhl	Very effective. O&M is done well and on time. Desiltation work carried out by the irrigation department.
Gadder Kuhl	Good, desiltation done by the department.
War Kuhl	Very good, the desiltation is done by the farmers once in a year.
Sofi Kuhl	Average, desiltation work is carried out by the farmers as well as department once in 2-3 years.
Peer Kuhl	This scheme/ Kuhl get more silted up and also subsequent breaches, so O&M and desiltation work is done every year by the department.
Aragam Kuhl	O&M is done yearly by the department; however, desiltation is done by the farmers.
Garooru Kuhl	O&M is done yearly by the department; however, desiltation is done by the farmers.
Reshi Kuhl	Every year desiltation is done by farmers and the irrigation department through cooperation.
Dehgam Kuhl	Desiltation and O&M done by irrigation department, however, farmers also help sometimes in desiltation work.
Bagh Kuhl	No O&M is done.
Chuntimullah Kuhl	Yearly breaches. O&M done by department, whereas, desiltation done by farmers.
Malik Kuhl	Gets silted up. O&M done by department, whereas, desiltation done by farmers.
Thanghat Kuhl	No major damages or siltation. Minor desiltation done by the farmers.
Kulwan Kuhl	Gets silted up which is desilted by farmers. Major work is done by the Block Development Office.
Bohru Kuhl	Minor desiltation done by farmers.
Kralpora Kuhl	Desiltation done by farmers.
Kudhara Kuhl	No major damage. Minor works carried out by farmers.
Dilawar Kuhl	Very good. Farmers are very much cooperative and responsible. O&M carried well in time. Desiltation work is done every year.
Gamroo Kuhl	Good, desiltation work is done by farmers.
Koota Kuhl	Minor damages repaired by farmers them selves.
Kawtari Kuhl	Minor damages repaired by farmers them selves.

(Source: Author's personal communication with scheme members, December, 2004)

The FMIS schemes are desilted and necessary repair and maintenance work done by the farmers. In case of some major breach or fault, which is out of reach to rectify by the farmers from their own resources, is done by the Block Development Office, on request from the farmers. Kulwan Kuhl (FMIS) is one such case where Block Development Office (which comes under Rural Development Department) repaired some major breaches.

11.1 Agricultural Performance

More than 80 per cent of the total cultivated area is covered by paddy crop on majority of the selected irrigation schemes. Paddy is the principal crop of whole of the Kashmir valley and is grown extensively. However, due to frequent droughts in the subsequent past years, a large area was converted to apple orchards. Vegetables are grown by the farmers /

Table 10: Crops Grown At the Different Irrigation Schemes (Acres)

Scheme	Kharif					Rabi		Cropping Intensity (%)
	Paddy	Vegetables	Maize	Pulses	Orchards	Mustard	Barseem / Oats	
Jinder Kuhl	446	10	-	36	47	13	14	109
Gadder Kuhl	338	6	-	27	-	4	4	102
War Kuhl	135	-	-	45	-	6	4	105
Sofi Kuhl	110	-	-	13	-	-	-	100
Peer Kuhl	77	-	-	86	-	-	-	100
Aragam Kuhl	377	-	16	10	-	30	20	124
Garoorra Kuhl	314	3	-	7	-	15	5	106
Reshi Kuhl	114	20	28	35	13	2	-	100
Dehgam Kuhl	458	20	28	35	32	10	-	102
Bagh Kuhl	246	7	-	23	-	-	-	100
Chuntimullah Kuhl	124	7	231	-	-	-	-	100
Malik Kuhl	277	8	140	55	6	-	-	100
Thanghat Kuhl	-	-	158	-	-	-	-	100
Kulwan Kuhl	430	25	12	20	13	17	12	106
Bohru Kuhl	150	10	-	-	-	18	8	116
Kralpora Kuhl	60	10	-	-	30	13	7	120
Kudhara Kuhl	30	-	95	25	30	-	-	100
Dilawar Kuhl	230	10	12	18	30	25	17	114
Gamar Kuhl	490	10	-	-	-	70	15	117
Koota Kuhl	-	-	90	40	-	-	-	100
Kawtari Kuhl	-	-	76	34	-	-	-	100

(Source: Irrigation Revenue Division of I&FC Deptt., Bandipore, 2004)

households generally for home consumption and very less number of farmers do vegetable cultivation for commercial purpose. Maize crop is grown on marginal, less productive, high terrain and non-secured irrigated areas. The Maize and Pulse crop are only the options for the people coming under Kooti and kawtari irrigation schemes which command less productive higher altitude lands. Moreover, these two irrigation schemes, which are farmer managed, had no secure water source. Orchards mainly include the apples which require hardly one to two irrigations during summer season only.

The rabi crops include mustard and barseem or oats. Cropping intensity varied from 100 to 124 per cent (Table 10). Under most of the irrigation schemes, no rabi crop is taken. The reason is not the lack of water but due to the severe winter and chilling temperatures which makes farmer lazy and lethargic and thereby reluctant to work on the fields.

Table 11: Average Yields in Qtls/Acre for Selected Crops at the Different Irrigation Schemes during the 2003/2004 Season

Scheme	Paddy	Maize	Pulses	Mustard
Jinder Kuhl	35	-	11.5	12
Gadder Kuhl	35	-	11	12
War Kuhl	32	-	10.5	11
Sofi Kuhl	32	-	9	-
Peer Kuhl	28	-	10	-
Aragam Kuhl	32	20	11	8
Garooru Kuhl	32	-	9.5	7
Reshi Kuhl	30	19.5	10	8
Dehgam Kuhl	31	19	10	8
Bagh Kuhl	35	-	10.5	-
Chuntimullah Kuhl	28	18	-	-
Malik Kuhl	32	20	11	-
Tanghat Kuhl	-	15	-	-
Kulwan Kuhl	35	19	10	11
Bohru Kuhl	35	-	-	11
Kralpora Kuhl	30	-	-	10
Kudhara Kuhl	27	16	8	-
Dilawar Kuhl	33	17	9.5	10.5
Gamroo Kuhl	33	-	-	11
Koota Kuhl	-	10	8.5	-
Kawtari Kuhl	-	9	7	-

(Source: Author's personal correspondence with scheme beneficiaries)

The average yield as perceived by the farmers under different irrigation schemes was found maximum at Jinder, Gadder, Bagh, Kulwan and Bohru irrigation schemes for paddy crop and least for Kudhara and Peer Kuhls (Table 11). The higher productivity of paddy crop on some schemes may not be wise to attribute to the irrigation factor solely but there may also be other factors affecting the yield. The mustard crop shows more or less same trend with regard to productivity on various irrigation schemes as this crop is grown on the same land in rabi season after harvesting of paddy crop.

The paddy crop gets severely affected when there is drought like situation as was experienced in past few years. In year 1999, all irrigation schemes faced severe water shortages in the peak summer season and even some paddy fields got parched after transplantation due to complete non-availability of water in the canals.

Maize and pulses which are generally grown on the marginal lands need lesser water. Fields at higher altitudes and uneven slopes are generally sown maize and pulse as a mixed crop. The highest productivity of maize was recorded at Aragam and Malik Kuhl and lowest at Kawtari Kuhl. The pulses were having more or less same yield on all the irrigation schemes except kawtari Kuhl, which had relatively lesser yield.

11.2 Water Charges

The water fee charged by the State Irrigation department for different crops is given in Table 12. Paddy crop is charged at relatively higher rate as compared to other crops because of more volume of water consumed by this crop. The maize, wheat and oilseeds are charged at the rate of Rs 10 per acre under gravity schemes. The irrigation fee under lift irrigation schemes are placed at higher rates mainly because these schemes are operated at higher costs.

Table 12: Water Charge Rates For Different Crops Under Government Managed Irrigation Canals

Name of Crop	Water charge (Rs per acre)	
	Gravity system	Lift Irrigation
Paddy	20	100
Sugarcane	20	290
Vegetables	15	60
Wheat	10	50
Maize	10	25
Oilseeds	10	30
Barseem / Oats	15	50
Orchards	15	60

(Source: Irrigation Revenue Division of I&FC Deptt., Bandipore, 2004)

The water fee is collected by the Revenue Division of the Irrigation Department through their Patwari's and also Numberdars of the villages. The water fee is generally collected from November to January months as this period remains out of irrigation.

12. PROBLEMS FACING THE IRRIGATION SCHEMES

The major problem facing both GMIS as well as *Zamindari Kuhls* (FMIS) is with related to encroachment. Farmers which have their lands by the side of canals had encroached the respective parts of the canal land / bund which lie on their land side. Some have made plantations particularly willows and Salix and also some of the canal encroached land is under construction. The Gadder Kuhl is encroached more as compared to other Kuhls.

Table 17: Problems Facing the Irrigation Schemes

Scheme	Problems
Jinder Kuhl	No any major problem.
Gadder Kuhl	Encroachment at some places.
War Kuhl	Newly formed scheme in year 1999, no problem.
Sofi Kuhl	Tail portion has got heavy silted up about 1 km, no coolies deputed on the scheme for watch and ward.
Peer Kuhl	Prone to flood damages which causes breaches as well as damage to headworks. It is hilly canal.
Aragam Kuhl	Gets silted up during spring season (March to April).
Garoora Kuhl	Major siltation problem.
Reshi Kuhl	There are social tensions between the villages during water scarce periods for sharing of water and some times police is made to indulge in the matter. The distribution of water is done by the department with the help of water committee.
Dehgam Kuhl	Social tensions arise between the villages during water scarce periods for sharing of water. The distribution of water between the villages is done by the department in consultation with the water committee.
Bagh Kuhl	The actual headwork got damaged during 1996 flood. Now water is drawn from the Zainager canal for this scheme.
Chuntimullah Kuhl	Faces more breaches during floods as compared to other schemes. There was also a major technical problem during scheme commissioning in 1996. The water flows back from tail to head which forced the authorities to cut off the scheme upto half of its proposed length. It irrigates now only 3 villages as against of 7 proposed villages under scheme.
Malik Kuhl	No major problem.
Thanghat Kuhl	Headworks had got damaged from last several years. Tail portion doesn't get water.
Kulwan Kuhl	No problem.
Bohru Kuhl	No problem, headworks were damaged in 1996 flood, which was later on repaired by Block Development Office.
Kralpora Kuhl	No problem.
Kudhara Kuhl	No problem.

Dilawar Kuhl	No problem.
Gamroo Kuhl	No problem.
Koota Kuhl	The scheme is situated at a high altitude on which mainly the <i>Gujjar</i> ¹ community depend for irrigation as well as for cattle tending. The water source is not so much secure and there are frequent damages to the canal.
Kawtari Kuhl	The scheme is situated at a high altitude on which mainly the <i>Gujjar</i> community depend for irrigation as well as for cattle tending.

(Source: Personal conversation with farmers and officials)

The overall general problem with the canals is breaching and heavy siltation due to slight floods mostly in spring season (March-April). The flood of even mild degree wreaks havoc to these Kuhls which requires huge sums to make the schemes functional. On the other hand, some of the schemes (Reshi and Dehgam Kuhls) are famous for quarrels / fight between the farmers of different villages sharing the same canal, during water scarce periods (July-August). But the fights are seen only in those years experienced by low rain / snowfall. One of the major reasons for the formation of water committees on these two irrigation schemes is because of this problem.

13. TRANSFER PROCESS AND FACTORS RESPONSIBLE

All the selected GMIS schemes were actually *Zamindari Kuhls* (FMIS) during fifties. These schemes were extended after transfer and were provided with necessary headworks and other permanent structures which did not existed previously.

The State government formed an Irrigation Advisory Board under the Chairmanship of the Development Minister in January, 1957. The Board came up with lot of recommendations among which the *Kuhls* of the following categories were suggested to be transferred at once to the Irrigation Department for complete management :-

- 1) Where the command area is over 5000 acres.
- 2) Where there are possibilities of saving water.
- 3) Where there are possibilities of extension of irrigation.
- 4) Where there are frequent complaints about shortage of water.
- 5) Where there are disputes between the various interests.
- 6) Where technical works are involved.

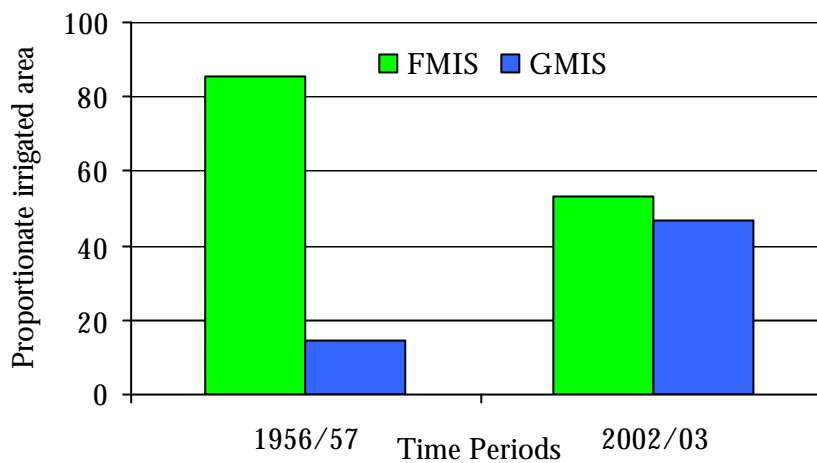


Figure 3 Proportionate irrigated area at two different periods under FMIS and GMIS

At present, there is demand of people to take over of Dilawar, kooti, Kralpora and Kulwan irrigation Kuhls in the study area. During the board meeting, local MLA makes the presentation on the behest of farmers for take over of the *Zaminadri Kuhls* (FMIS) by the state irrigation department. The main reasons for the transfer of FMIS to GMIS and better performance of the latter systems area as under:

- 1) Financial constraint is the major factor responsible for the under performance of FMIS.
- 2) The farmers are not able to irrigate the actual command area, whereas, with the takeover, irrigation department is able to increase its command area.
- 3) The actual water need of the command area is worked out/determined in case of GMIS schemes and accordingly same required quantity of water is made available/put off at the discharge head of canal.
- 4) GMIS schemes are provided with necessary headworks, gauges, aqueducts, flumes, super-passages, passes with gauges, key locks and other permanent structures and also some portion forms of concrete work which lacks in case of FMIS.
- 5) Farmers are able to do irrigation at a time without *warabandi* and equidistribution of water is achieved in GMIS while as, in case of *Zamindari Kuhls* (FMIS), the head reaches are better off than tail ones in some of the cases.
- 6) During floods, FMIS get silted up, breached and defunct as there are no headworks and gauges to divert the excess water into nallah's.
- 7) The farmers are not able to repair the major damages and also due to heavy siltation, they are not able to maintain the structure.
- 8) The farmers are mostly marginal with small land holdings and thereby less concerned about the repairs and maintenance of the irrigation systems.

14. CONCLUSIONS AND RECOMMENDATIONS

Kashmir was once a lively hydraulic society with elaborate irrigation systems owned and managed by farmers (*Zamindari Kuhl*s). These *Zamindari Kuhl*s (FMIS) used to be maintained by the beneficiaries voluntarily (locally called as “*Halshari Basis*”). Since then, sufficient quantities of water were available to cater the irrigation requirements of those days when the population was very low and the requirement of food grains was meager viz a viz present need. Most of the land as such used to remain un-utilized and un-exploited. However, as time passed by and the population continued to increase at a rapid rate, the dependence / pressure on the land increased and consequently the inhabitants felt the need for exploiting each and every patch of land lying waste.

This sort of situation resulted continuous process of increase in the water requirement and the farmers continued to maintain and improve the canals (*Kuhl*s) to cater to the increased requirement of water on voluntarily (*halshari*) basis as long as it could be possible within their resources. Subsequently, as the process of planned development started in the country as well as in Kashmir, the various public services assets including the irrigation canals were taken up by the government under their control through the irrigation department for taking care of their improvements and other maintenance works as it was becoming absolutely difficult and impossible for farmers to look after the canals (*Kuhl*s) properly. On lot of occasions, the standing crops used to suffer lot of damages whenever some major breaches or damages were caused to the canals due to floods.

The present study looks to the management of irrigation systems by farmers and government. Study revealed that the government managed irrigation schemes are performing better than the farmer managed irrigation schemes. The O&M work is done well on time and also desiltation work is carried out regularly on GMIS schemes. The government managed irrigation systems are technically sound whereas, farmer managed irrigation systems are of traditional old structures with no headworks or other necessary structures for flood control etc. The study also showed that the productivity of crops under GMIS schemes are relatively better than FMIS. The turns over schemes were further extended and their command areas increased on almost all the irrigation schemes.

It also comes out clearly from the study that the distribution of water on government canals was rational in respect to *zamindari Kuhl*s, where tail enders are used to suffer during peak season. The major reason identified for the take over of *zamindari Kuhl*s by the irrigation department is due the inability of farmers to manage these systems which require huge sums every year for O&M and desiltation work.

The ongoing insurgency / militancy in the Kashmir from last two decades deteriorated the overall economic development of the region. This lead a more heavy toll on the public services assets. The irrigation structures were no exception to this debacle. With the day to day improving situation, the public services assets in the region are getting a new face lift and crores of rupees is spent every year. The irrigation infrastructure, which was in a decrepit state, are now remodeled and also their overall look after and management is done by the state irrigation and flood control (I&FC) department. The *Zamindari Kuhl*s (FMIS) are

handed over to irrigation department on the demand of farmers as it becomes out of their resources to maintain these age old structures in present day conditions.

The recommendations from the study comes out that government should take all the *Zamindari Kuhls* (FMIS) under their own control which are in a bad shape and where it is impossible for the farmers to repair / maintain it on their own. However, on every scheme, water committees should be formed who can look after the desiltation work from the farmers side which becomes obligatory almost every year. These committees can also perform better during the water crisis period, when tensions arise over the sharing of water between the farmers of different villages, sharing the same canal / Kuhl.

The *Zamindari Kuhls* (FMIS) performing better may be kept as long as they are able to maintain these structures. However, the engineers of the I&FC department should provide them the technical guidance and also make funds possible for necessary headworks and flood passages etc.

The government should place more emphasis on the minor irrigation schemes as these schemes fit to the uneven and hilly terrains of the Kashmir valley.

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