PERFORMANCE OF A LARGE IRRIGATION SYSTEM IN PAKISTAN

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ABSTRACT

Large irrigation systems indeed have their own identity and have a very important role in economic development of many parts of the world. In this research, performance of Irrigation Systems of Lower Chenab Canal and Lower Jhelum Canal Punjab, Pakistan, has been assessed. A comparison between a centrally controlled irrigation system and a system based on public private partnership management has been made. The data regarding performance assessment of both the systems were collected by various means. Primarily the data has been collected by field measurements, interviews with farmers, interviews with officers of irrigation department, from previous studies and parent departments (Punjab Irrigation Department and Punjab Irrigation and Drainage Authority). The analysis shows that the establishment costs of both the systems are more than operational and maintenance costs, thus showing the inefficiency of the managerial system both in case of public private partnership management and centrally controlled irrigation system. A huge work on capacity and moral character building is required for continuous improvement of and obtaining goals from transferring management to farmer's organizations in Pakistan.

KEYWORDS: Pakistan, Irrigation, Performance, Farmers, Establishment, Cost

INTRODUCTION

Poverty plummeting is a vital challenge facing the developing and undeveloped countries around the world. Agricultural sector plays a key role in poverty alleviation in an economy with a modest technological base, large population, low education rate, and a significant percentage of rural population. About 60% of food production in Asia (Pakistan 80%, China 70%, India and Indonesia each 50%) comes from irrigated land. In sub-Saharan Africa it is only 9%. The performance of irrigation systems has a major role in making irrigated agriculture cost-effective.

Numerous studies have been made to identify the means of improving the performance of irrigation systems. Ararso et al., (2009) have analyzed three water management options to improve food production in Sub-Saharan Africa. They have studied six sample countries – Cameroon, Democratic Republic of the Congo, Ethiopia, Nigeria, South Africa and Sudan. It has been shown that proper water management approaches can achieve security of food in the region. Results of research work done by (Errahj et al., 2009) in North Africa, encourage development and extension agencies to redefine collective action as a tool of learning and empowerment centered on the co-construction of public policies. Laghari et al., (2008) conducted a perceptive research on wheat evapotranspiration in Pakistan to design rational irrigation scheduling for wheat's' optimum yield. Chopankulov et al., (2008) investigated cotton irrigation scheduling in central Asia. There are several other studies, addressing similar issues (see for example Ghumman et al., (2009), Zardari and Cordery (2009), Bekkar et al., (2009) and Ghumman et al., (2006)). But given the nature of the issues involved, there still are several areas which need further work.

Kuper et al., (2009) have concluded in their research that the field realities in North Africa are extremely volatile. They have provided evidence of local family farming systems as a factor of social and economical stability. There is an international debate on participatory management. Kadiri et al., (2009) has investigated the appropriation by farmers of state-initiated Water Users Associations for the Moyen Sebou irrigation scheme in Morocco. They have shown that no doubt the liberation and participation of farmers is an important feature in the development of the area.

In some parts of the world the FOs has improved the recovery of water fees from the farmers without increasing the water fee and without putting any additional fiscal burden on the farmers. Similar trends have been found by the case study done by (Cakmak et al., 2009) which showed that following the transfer of irrigation schemes to the user organizations in Turkey, significant improvements are recorded in irrigation water fee collection rates and financial cost reduction in the systems operated by the Irrigation Associations. Batt and Merkley, (2009) have investigated role of water management and user association for irrigation improvement in Egypt.

The present work is an effort to observe a large irrigation system at the gross-root level and assess its performance. A comparison has been made between the performance of distributaries run under conventional centrally controlled irrigation system and the distributaries operated in conjunction with FOs.

STUDY AREA

There are several large irrigation systems world wide. Irrigation system of Pakistan is among the world's known large irrigations systems. It includes 58,500 km of canals and 1.62 million km of watercourses. Apart from canal water, groundwater is also used for irrigation and more than 895,000 tube-wells are currently in use in Pakistan. However, due to low productivity, water scarcity and poverty itself, full utilisation of the agricultural potential is still an unrealised dream in Subcontinent. There is a deficiency of about 25% in water availability for irrigation. Delivery efficiency of canal system is only 35 to 40%, at present. Inequities in water distribution is also a major issue in Punjab Province as tail reaches of distributaries and minors receive less water per hectare than the head and middle reaches. Other problems include inadequate maintenance of infrastructure, sedimentation of canals, reduced water transmission efficiency due to the unlined nature of the water courses and inept implementation of operational rules. To make all this worse still, it is considered that the perfunctory behaviour of the officials of the Provincial Irrigation Departments, in addressing the problems of the farmer, are a major stumbling block in the way of improvement. None of the programs of water reforms have ever been undertaken by the federal government. On the contrary, the various governments have always claimed to focus on improving institutions and overall governance in the water sector. Decentralizing the irrigation management, improving farmers' participation in management and developing the physical, financial and environmental sustainability of irrigation systems are just some of the goals that have been fervently pursued at one time or another. As a major initiative of institutional reforms, Provincial Irrigation and Drainage Authorities (PIDAs) – which, in theory at least – are financially autonomous bodies, have been created to formulate and implement policies. Area Water Boards (AWBs) – one per canal command and each covering 0.4 million hectares on average – have been established with representation of PIDA, the agriculture department, and farm-household organizations. Farmer organizations FOs – one per distributary – have also been established with the objective of receiving water from the AWBs, and distribution to the farmers. An FO operates and maintains distributary canals, and assess and collect irrigation charges, 40 to 60% of which are passed on to AWBs for operation and maintenance (O&M) expenses. Khal Panchayat (KP) – one per outlet – represent farm households sharing water below each outlet along a watercourse.
In Punjab, management has officially been transferred from PIDA to about 150 FOs. Management of most of the distributaries of Lower Chenab Canal (East and West Circles) have been transferred to FOs whereas none of the distributaries of Lower Jhelum Canal System has been transferred to FOs

The Lower Chenab and Lower Jhelum Canal Systems have been investigated in this paper. The Lower Jhelum Canal takes off from the Jhelum River at Rasul Barrage. With the system commissioned in 1904, its command area includes the greater part of Chaj Doab – Sargodha and Jhang districts lying between River Jhelum and Chenab. It was initially planned to draw 17.6 m^3 to irrigate 247,665 hectares. The capacity of main canal was increased in the years 1916, 1937, 1940 and 2002. The area along the left bank of river Jhelum downstream Malakwal town up to village Khandan had previously been irrigated by inundation system. In order to organise the canal water supplies to the area in a more scientific manner, Shahpur Branch was constructed during 1933 with a cultural command area (CCA) of 91,303 hectares. It is essentially a non-perennial branch canal. Presently the designed discharge of LJC is 156 m^3/s for Kharif and 120 m^3/s for Rabi crops. Its CCA is 614,475 hectares and gross command area (GCA) is 660406 hectares. The combined length of the main canal and the branch canals is 405.96 km. The length of distributaries and minors is 2,060 km. Total Length of Lower Jhelum Canal System is 2,466 km and number of outlets are 3,050. The system comprises four divisions: Rasul, Shahpur, Kirana and Sargodha.

Lower Chenab Canal (LCC) takes off from River Chenab at Khanki Headworks. Its command area is divided into two parts, the LCC East Circle and West Circle. The LCC (East) canal system has a discharge capacity of 185m^3/s and length of 453 km. Its commands cultivable area is 0.63 million ha. There are 119 distributary channels and 3918 outlets. It consists of four divisions namely Khanki, Burala, Upper Gugera and Lower Gugera. The crops grown in the command area are rice, cotton, sugarcane, wheat, vegetables and fodder. The west circle includes Faisalabad, Jhang and Hafizabad divisions. There

are 57 distributaries and minors in Faisalabad division, 80 in Jhang and 54 minors and distributaries in Hafizabad Division. Abiana collection by FOs in Haroonabad has also been worked out.

METHODOLOGY FOR PERFORMANCE ASSESSMENT

Various methods and indicators are available for assessing the performance of a canal system (Grusse et al., 2009), (Roerink et al., 2007) and (Bos et al., 2005). Performance indicators defined by Pavlov et al 2006 are given below:
The economic delivery efficiency (the ratio between the operation and maintenance cost (O&M) and the distribution cost) is used assess the bureaucratic behaviour of the system which spends a lot of money on administration, as compared to the operation and maintenance. The relative water cost (the ratio between the total irrigation cost and total production cost is used to see the share of irrigation cost in the total production cost of a certain crop. The relative farm irrigation cost (the ratio between on-farm irrigation cost and total irrigation cost is used to see the share of on-farm irrigation cost. High values of relative farm irrigation cost show that there is potential for the reduction of on-farm irrigation cost. The delivery performance ratio of outlet shows the equity of water supply.
To assess the performance of the LCC and LJC systems, a mix of the indicators defined by (Pavlov et al., 2006) and (Grusse et al., 2009) have been adopted. Comparison between traditional centrally controlled operation and operation in coordination with FOs has been made using data of the two systems.

DATA COLLECTION AND ANALYSIS

Recovery is the cost collected by the irrigation department from the farmers for the delivery of water from the source to the farm gate. A fixed amount is charged by way of Abiana. The information about the water fees was collected in detail for each division. The % age of Abiana collected by FOs for various years was given importance.
The status of water for various canals was collected and analysed. Field measurements were made for discharge. Farmers and officers of irrigation department and Punjab Irrigation and Drainage Authority were interviewed. Data was also taken from the previous studies and from website of the Program Monitoring and Implementation Unit (http://irrigation.punjab.gov.pk)

RESULTS AND DISCUSSION

Establishment, Operation and Maintenance Costs (O&M): The organizational setups of both the systems (Conventional Management System of Irrigation Department and Participatory Irrigation management System) are given in Figure 1 (a, b) and Figure 2. Establishment and O&M costs are given by Figure 3. It shows that the establishment and O&M costs are 0.634 and 0.265, 0.515 and 0.237, 0.942 and 0.492 and 0.135 and 0.113 (US $/1000 m^3/year) for Sargodha, Kirana, Shahpur and Rasul divisions, respectively. The Shahpur Division has comparatively high distribution. Shahpur Branch is non perennial (only operational in Kharif season for 6 months when flood water is available due to monsoon), whereas the O&M and establishment costs are spent throughout the year for the maintenance of the canal. Hence, its distribution cost per unit water is higher as compared to that of other cases. In case of Rasul Division, its major part consists of the main canal – there being only a very few distributaries – so its distribution cost per unit volume of water is less than that of others. Establishment costs of LCC under the control of participatory irrigation management were found to be higher as compared to that of the LJC system. The participatory management system as per its organizational chart is not fully implemented yet. Nearly all the staffs of the old Irrigation Department has been kept intact whereas new staffs have also been hired presently. It might take several years for participatory management system to function in its true spirit.

Status of Water Supply: Water supply status of both the systems of Lower Chenab and Lower Jhelum Canals is given in Figure 4 and 5 respectively. The Lower Chenab Canal is controlled by participatory irrigation management (Area Water Board) whereas the Lower Jhelum is controlled by the conventional management system of Punjab Irrigation Department. Figure 4 and 5 shows that the water supply in both the systems is stable for the previous 3 years. It has rather slightly improved in both the cases. Both the systems are performing satisfactorily. Irrigation Department is under a great challenging position. It has to show a comparable performance in presence of participatory irrigation management. However as explained earlier the participatory management system is in its development phase. So presently the establishment costs of Participatory management system are comparatively higher. New staff has been hired but none of the already working staff has been relieved off. As stated earlier, it may take several years for its full satisfactory functioning.

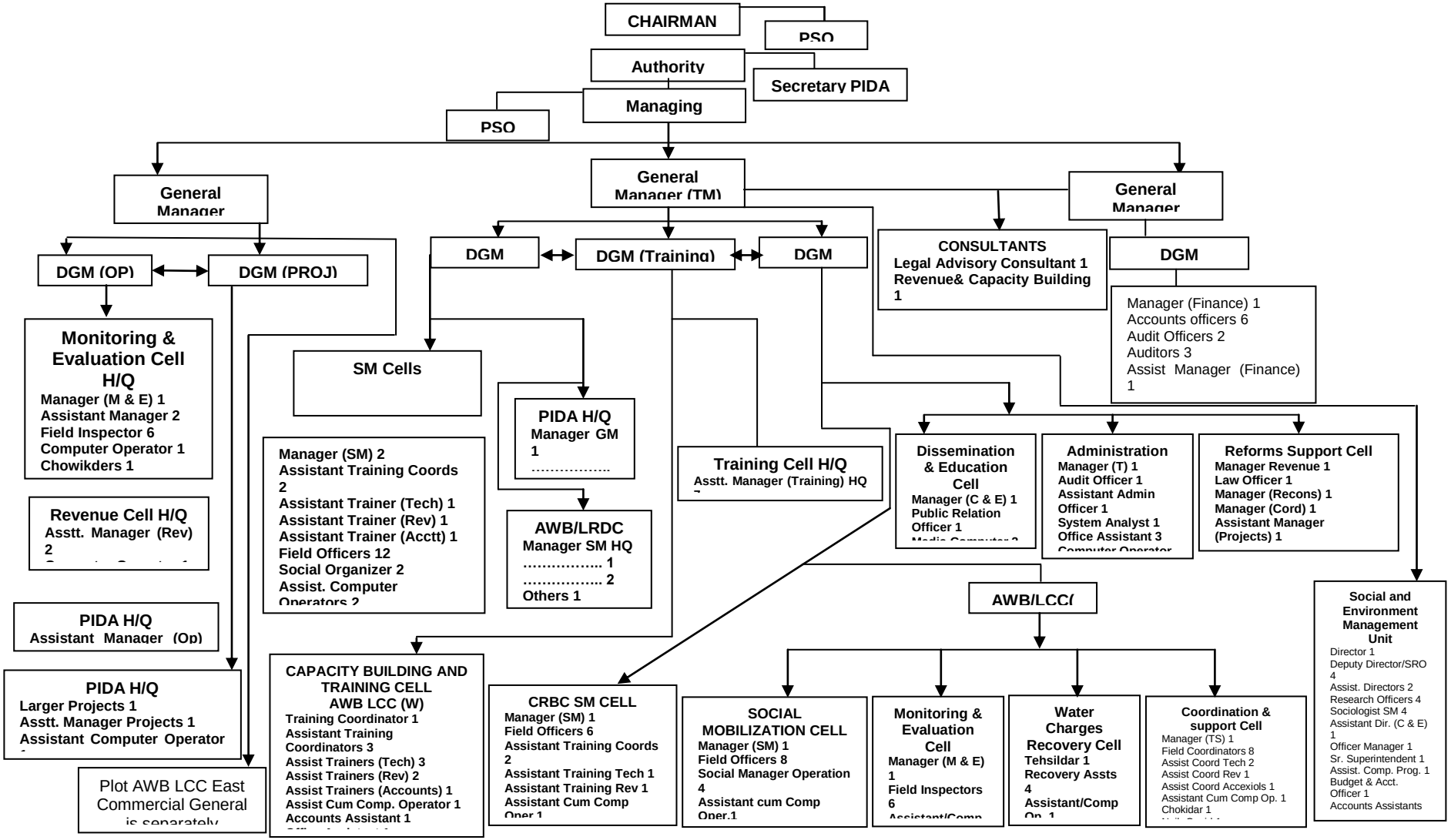

Figure 1 a: Organizational Chart of Participatory Irrigation Management System

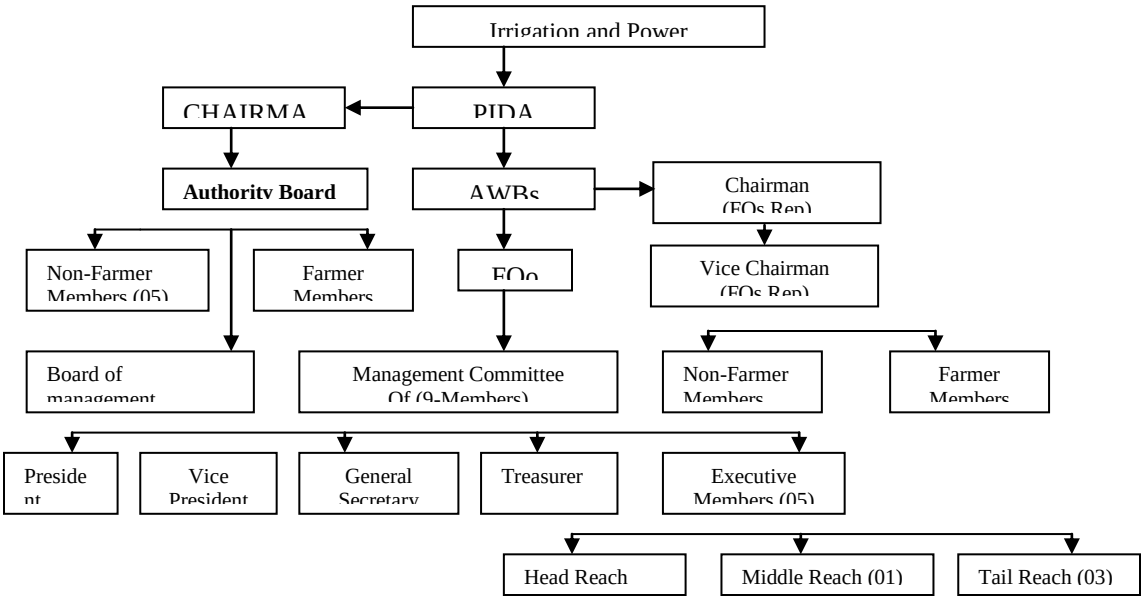

Figure 1 b: Organizational Chart of Participatory Management System (REFORMS TIERS)

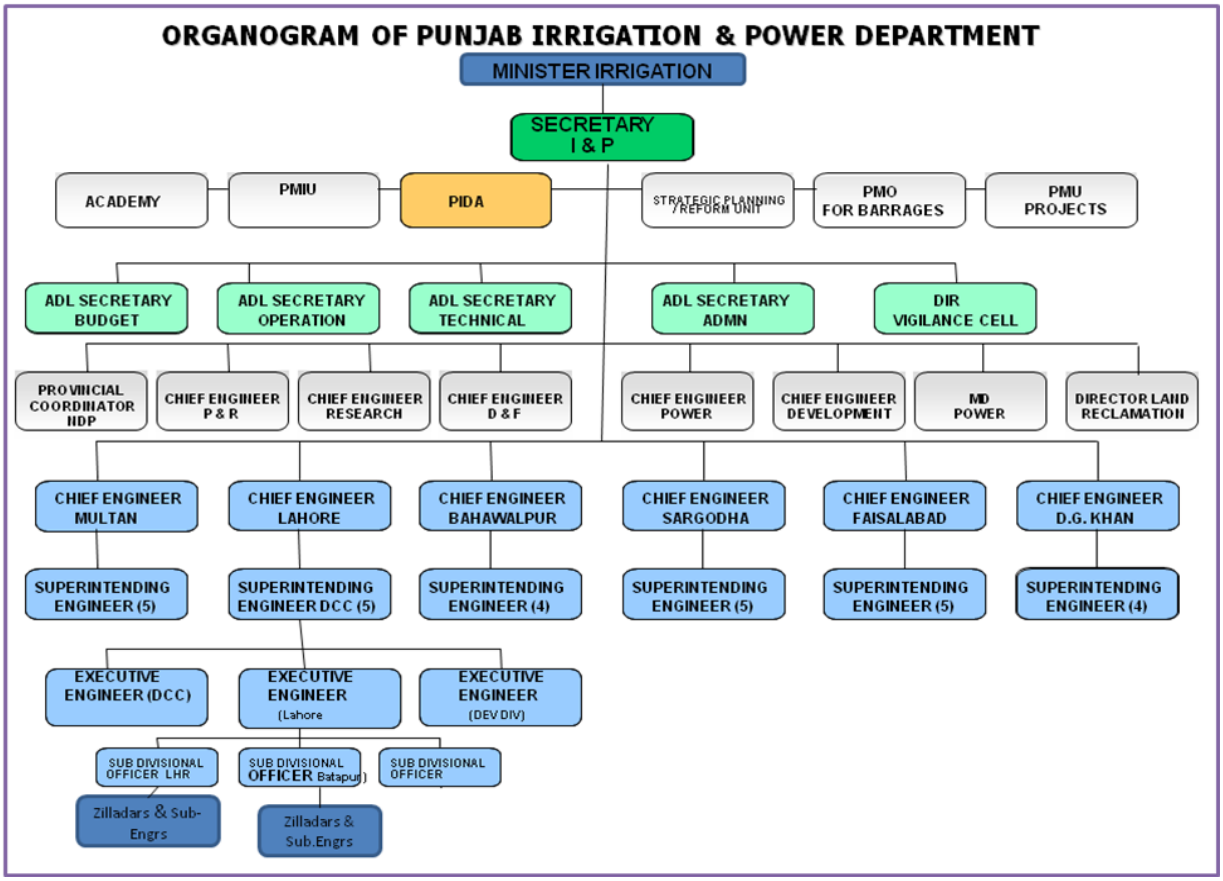

Figure 2: Organizational Chart of Conventional Management System of Irrigation Department.

As mentioned earlier the water supply details at tails of all the channels of Lower Chenab and Lower Jhelum Canals for Rabi 2009-2010-and start of Kharif 2010 were obtained from Program Monitoring and Implementation Unit (http://irrigation.punjab.gov.pk) of Irrigation Department. It is shown in Figure 6 (a, b). Water position of some distributaries under the control of FOs is also given in Figure 7 (a, b and c). It is observed from this data that the %age of tails of canals which remained dry are 6, 1 ,0, 0, 7, 2, 11 and 2 in case of Hafizabad, Kirana, Sargodah, Shahpur (Lower Jhelum Canal divisions), Burala, Lower Gugera, Uper Gogera and Faisalabad (Lower Chenab Canal Divisions) respectively. The %age of tails of canals which remained short of water are 14, 7, 3, 3, 6, 3, 10 and 9 in case of Hafizabad, Kirana, Sargodah, Shahpur (Lower Jhelum Canal divisions), Burala, Lower Gugera, Uper Gugera and Faisalabad (Lower Chenab Canal Divisions) respectively. According to a survey of PIDA the position of canals at tails of Lower Chenab (East Circle) shows that the tails of about 36% channels remained dry, 13% short and 42% as per designed discharge. 9% channels remained close most of the time during Rabi 2007-08. During Kharif 2008, the tails of about 26% channels remained dry, 20% short and 51% as per designed discharge Only 3% channels remained close. According to the division wise water supply status in upper part of Lower Chenab Canal (Khanki and Upper Gugera Divisions) the 45% tails during Rabi 2007-08 and 28% during Kharif 2008 remained dry. The percentages of dry tails were found higher than those in the lower part of Lower Chenab Canal (East Circle) (Lower Gugera and Burala Divisions).

Generally it is observed that during Kharif season when the crop-water requirement is high (for rice crop) the trend of water theft increases which results shortage of supply at tails. In lower part of the LCC system (Lower Gugera and Burala Canal Divisions), the trend of water theft is comparatively less, while in upper part of Khanki and Upper Gugera Canal Divisions which grow more rice crop water theft cases are higher and are not effectively controlled. For Lower Jhelum although it is not under the control of FOs, the condition of tails is relatively better. The reason is similar. In Sargodah division there are orange gardens which require a moderate supply of water. So it is the best division with respect to the performance at tails of the canals. However comparison of the system controlled by FOs with that controlled by the irrigation Department without FOs shows that the performance of FOs is not up to the mark. It looks that perhaps a policing action in developing countries is successful as compared to the participatory management for water theft control.

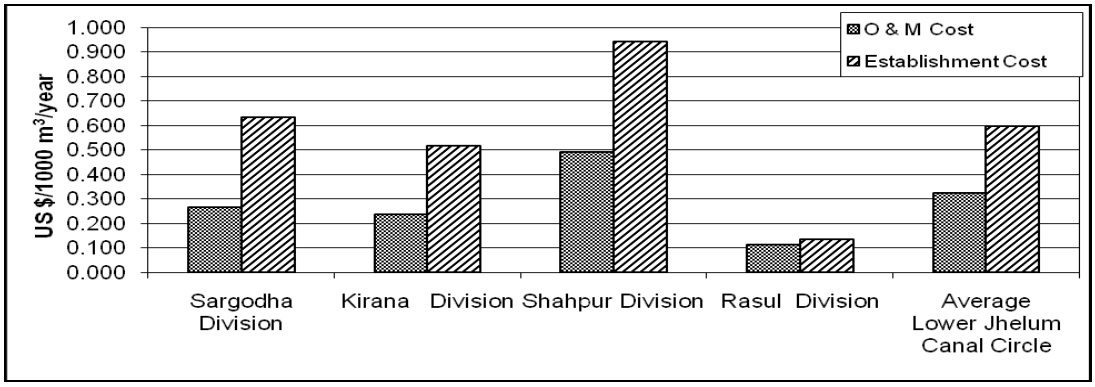

Figure 3: Establishment, Operation and Maintenance costs of Lower Jhelum Canal System

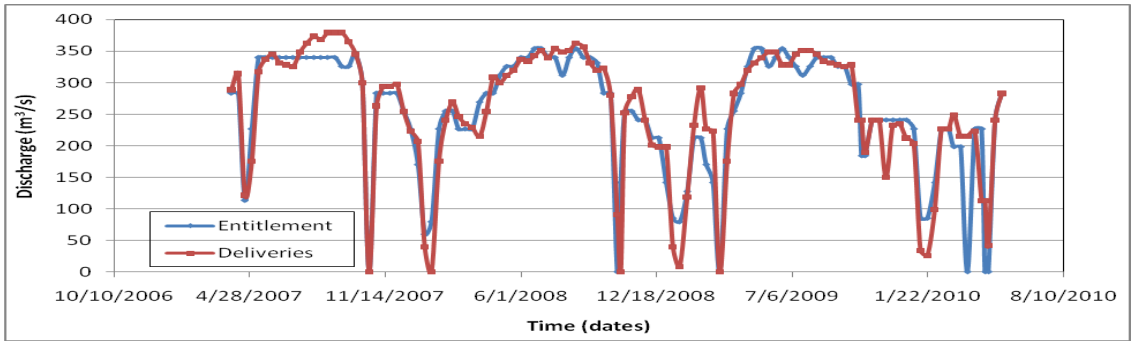

Figure 4: Status of water supply for Lower Chenab Canal status of water supply

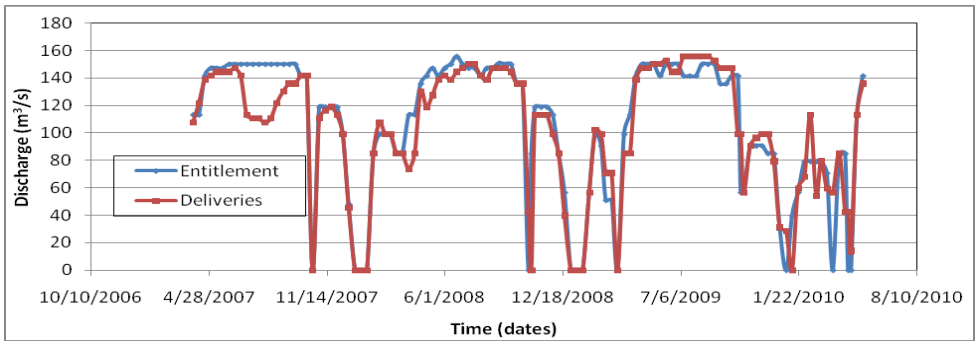

Figure 5: Status of water supply for Lower Jhelum Canal

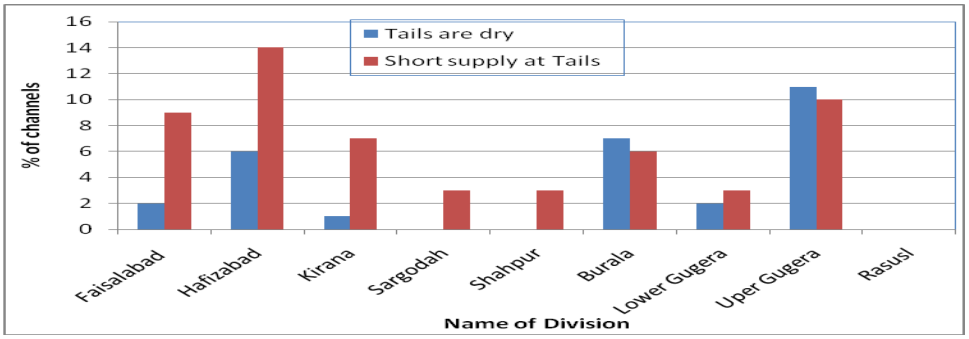

Figure 6 a: Water supply status at tails of Lower Jhelum and Lower Chenab Canal Divisions.

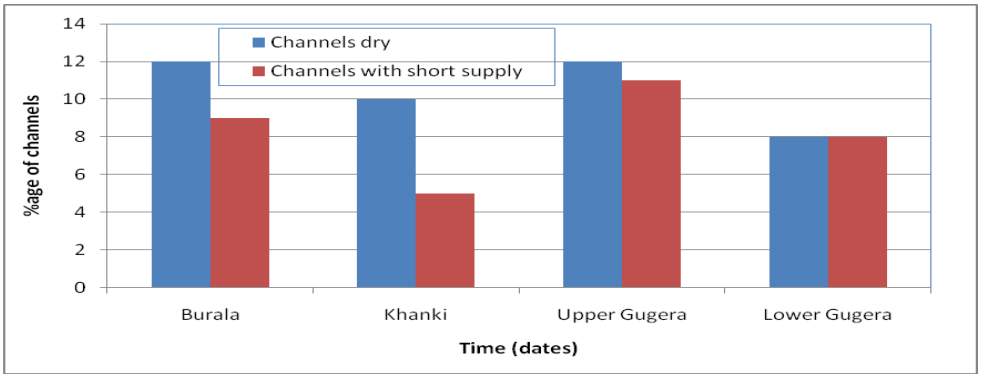

Figure 6 b: Water supply status at tails of Lower Lower Chenab Canal Divisions (East Circle).

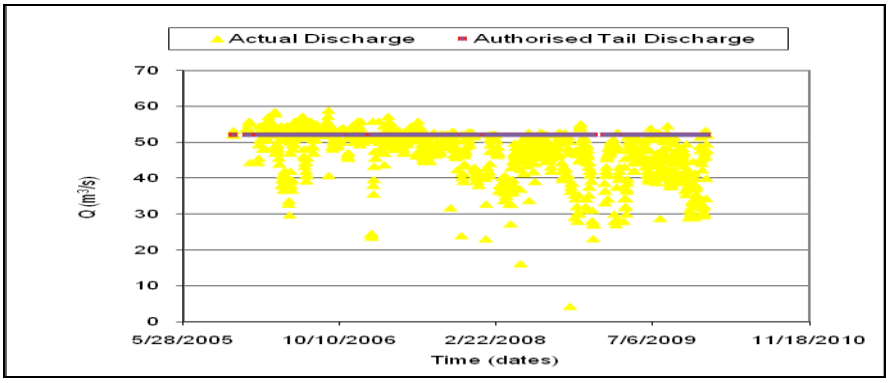

Figure 7 a: Water supply status Jhang Branch of Lower Chenab Canal.

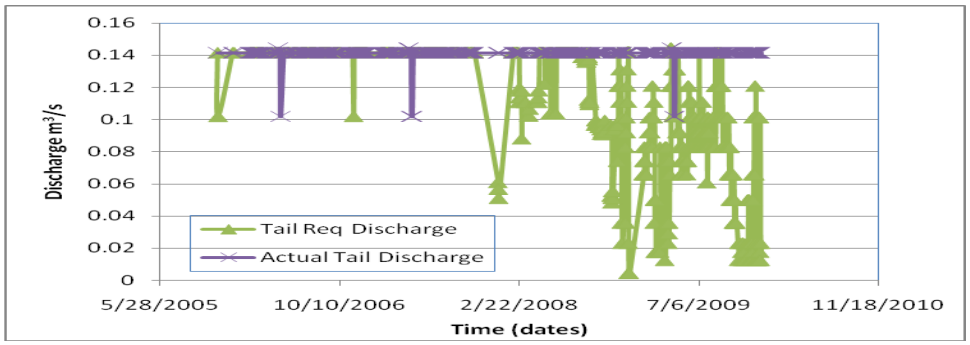

Figure 7 b: Water supply status of Burailli Distributary of Lower Chenab Canal (West Circle).

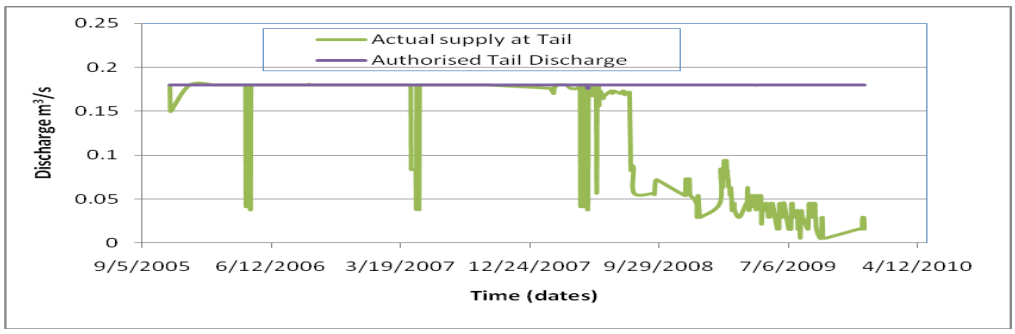

Figure 7 c: Water supply status of Kot Ahmed Yar of Lower Chenab Canal (West Circle).

Abiana: Details of Abiana collection in FO- managed channels of Haroonabad and Lower Chenab Canal (West Circle) are given by Figure 8 and Figure 9. For Lower Jhelum Canal System 77.7% cost is recovered in the form of Abiana against the total distribution cost of the system and irrigation department contributes only 22.3%. It is further observed that with the passage of time, %age of Abiana collected by FOs has gradually declined. The same trend was found for FOs of Lower Chenab Canal (East Circle), (Asrar 2010), FOs of North West Frontier Province (NWFP), Pakistan, (Latif and Tariq 2009) and for the FOs in Sindh, Pakistan (Memon, 2007). A similar report has been given by the Japan International Cooperation Agency (JICA 2007), (Asrar 2010). Abiana collection and water theft are the debatable issues. Performance of various duties depends upon social, cultural and moral values of a society. Interviews of most of the Government Officers showed that these duties need a policing action in developing countries. It will take several years to build the moral values after which these jobs can be well performed by the FOs. According to them the old system of Lamberdars (a well known person among Farmers), Patwaries, Ziladars and Tehsildars is very effective in Abiana collection. However the Punjab Irrigation and Drainage Authority, (PIDA) is doing its best for the capacity building of FOs in order to improve the Abiana collection. Visits of FOs to other FOs are being arranged so that they may share experiences of one another in connection with better FO functioning and collection of Abiana.

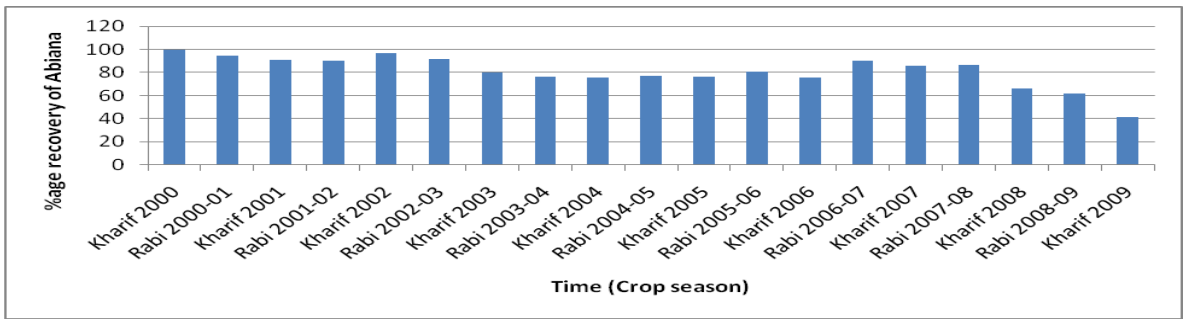

Figure 8 : Recovery of Abiana (Haroonabad)

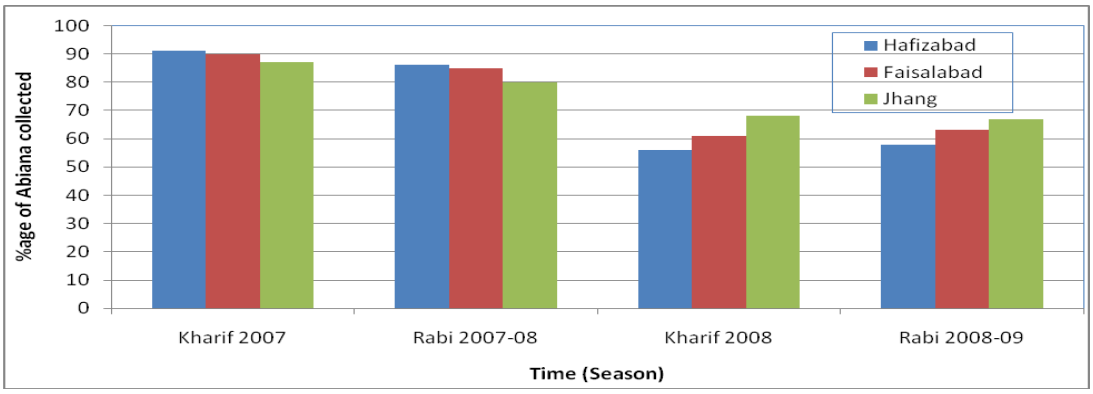

Figure 9: Recovery of Abiana Lower Chenab Canal (West Circle)

CONCLUSIONS

Following are the key conclusions of the present study:

Performance assessment of two large irrigation systems has been made using some key indicators. Establishment costs are high in both the Lower Jhelum and Lower Chenab Canal systems. For Lower Jhelum Canal System 77.7% cost is recovered in the form of Abiana against the total distribution cost of the system and irrigation department contributes only 22.3%.

The water supply position at tails of most of the canals under FOs control is not satisfactory. There is need for proper operational management to ensure an equitably water supply in Lower Chenab Canal System.

The %age of Abiana collected by FOs in Pakistan is declining and needs capacity building of FOs.

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