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Past, Present and Future of Warabandi (Irrigation Rotation), in Pakistan

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Abstract: The background of Warabandi in Pakistan is base on, to supply irrigation water to farmers on time according to their crops requirements which is the main purpose of Warabandi, but as the time goes on deviation has been observed from main purpose of Warabandi in Pakistan. There are many factors which are responsible for such deviation. The main objective of this study is to identify that factors which caused the deterioration of Pakistan Warabandi system.

Keywords: Warabandi, water allowance, irrigation system, canal irrigation system, watercourses, Indus basin irrigation system.

1. INTRODUCTION

Bhatti and Kijne, (1990), because of climatic conditions characterized by low rainfall and high evaporative demand, irrigation is required for most agricultural production in Pakistan. The Irrigation exercise is near about 75% for the cropped area, whose share is about 90% of the total national agricultural production. The river Indus and its tributaries serve as source of irrigation water for around 86% of the irrigated area in Pakistan

Pakistan irrigation system (14.6 M Ha.) is one of the largest irrigation systems in the world. It comprises the Indus and its major tributaries, 3 major storage reservoirs, 19 barrages/headwork's, 43 canal commands and some 89,000 chaks (watercourse command area). Canals total length is about 56,000 km, with watercourses, farm channels and ditches running another 1.6 million km in length. The first controlled all year irrigation began in (1859) with completion of the Upper Bari Doab.

Canal from Madhopur Headwork's on the Ravi River. The purpose of the earlier canal systems was protection from drought and since then irrigation systems have been formulated to best fit the availability of water supplies in the river and to meet the purpose of bringing to maturity the largest area of crops with the minimum water consumption. Land holdings in the Punjab canal colonies were laid out on a grid system of 25 acres (10 ha.) squares, whereas in the other provinces existing land holdings were of highly irregular shape, which complicated the laying out of the distribution system for irrigation water. The area served by a particular watercourse may range from 40 to 400 ha but the average is around 180 ha. Flow in the cfaak is governed by an open outlet or 'mogha' designed to pass a discharge that self-adjusts in proportion to flow in the parent canal. Design discharges from moghas vary from less than 30 to 120 1/s (1 to 4 cusecs) to enable efficient handling by individual farmers.

Extensive developments in the Indus basin over the last century and lack of appropriate drainage facilities have caused severe water logging and Salt related problems in large areas of sindh and punjab provinces. Public tube wells were first established in the 1940s to address these problems, and the first project related to Salinity Control and Reclamation (SCARP) with 30 to 150 liters per second capacity tube wells was build up in 1963. Development of groundwater by the private pumping wells started soon after the initiation of the SCARP program. The most recent estimate (1984-85) of groundwater contribution is about 40.66 million acre feet per year.

Zia, (2009), in his report that almost 90% of 1700 cubic meter per capita per year (individual requirement) is used for food production. In 2000, 18% of cropland was irrigated which produced 40% of total agriculture production. The available water resource is fixed while the population increasing day by day, causing more competition for water. Smith, 2004, pointed out irrigation as a source of poverty reduction and sustainable livelihood but he also informed that poverty can be increased as a result of poor designed and managed system.

FAO, (2006), mentioned the situation as: "the sector of Agriculture is one of the largest water users globally and faces increasing difficulty in securing a share of water resource that is sufficient to meet the need of growing world population and in managing the impact of its activities on the resource base". Pakistan is situation is not far different than other part of the world rather it's more alarming.

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Warabandi-Types And Objectives

Bandaragoda, Irrigation rotation (W*arabandi),* is an important water-concerning customs that the current lawfull framework has effectively absorbed for broad-based formal use, is chosed here for detail consideration. Pakistan related Water supply system for command areas (canal irrigation systems), tertiary-level water distribution are in practice since from very past according to water rotation procedure called as Warabandi. The words water rotation / Warabandi used as fixed *(bandi)* turns *(wahr),"* or a periodic turn of water distribution of canal within a watercourse, with a fixed tum and a time period for each farmer area. The given time period for agriculture land of each farmer field is estimated according to the farmer area to be irrigated by the related watercourse. The flow water rate in the related watercourse is kept constant depending on the given allowance in water. the farmers are facilitate through a certain allowance *(nikal)* away from the related outlet as an exchange for losses in water due to flow along the watercourse. Actually water rotation is practiced in area facing water shortage, but still in practiced even where the water is in excess. The old method of Water rotation, famous with *katcha Warabandi,* is still in use in some areas, which is manage and controlled locally by land owners without interference of any governmental officials. Before the introduction of scientific rules, there was pliancy in the katcha Warabandi system, making sure water for all the farmers, provided they could togather manage the supply pattern. Anyhow, with the introduction of scientific rules, water distribution authorities which were established to apply these lawful observed an increasing frequency of water concerning problems between landowners and started to intervene. A struggle to establish the traditional arrangement, the most stable *pucca water rotation/ Warabandi* system appeared in which rotation is based on a weekly period between land owners based on the cultivated land size, the water releasing authority on call by watercourse disputing landowners. Once done, it indicates a compromise, the rotation are consider to be followed fixed and become important on all the farmers who have to get water at this tum irrespective of his need.

Malhotra, (1982), As a mixed water management system, irrigation rotation (Warabandi) is expected to receive two main purposes, that is high efficiency, **as** well as equity in use of water**).** Efficiency relating to water use is to be possible through the imposition of water Scarcity on each and every user, and equity in distribution through enforced balance rights of scarce water per unit area among all water users anyhow, to face this primary aims, the application of irrigation rotation has to rely heavily on the hydraulic activities of the canal irrigation system.

Calculation of Warabandi Schedules

Merrey, (2009) The procedure of water allocation reflects a feature of the Warabandi system. Official of the irrigation department record the area to be irrigated of each farmer in chak.this is called culturabls command area. the amount of time allocated to each farmer is calculated on the basis on mogha designed to deliver fixed amounts of water up to 113 **I/s** (4 cusecs) into watercourses usually at a rate of about **.21** liters per second/hectare (one cusec for **350 - 400** acres),.the time allowed to each farmer to irrigate their land is calculated by dividing one cycle of rotation (7 days = 168 hrs), by 350-400 acres, which gives time allowed per acres to irrigate. Than multiplying the total command area of individual farmer by time allowed per acres to get total irrigation time of each farmer.

Bandaragode and Rehman, 1995, report that Warabandi system is design on the basis :

- 75% crop intensity to maximize the command area.
- Canal will be run at full supply level and will be closed when fall below 70 to75% of design full supply level in order to avoid silting.
- All moghas will be operated simultaneously.
- Outlets are open and will release water according to the size of command area.
- Average water duty in this system is four cusec per thousand acres (0.28) litrs/sec/hac

Merits and De-Merits of Warabandi System

Chaudhry, (1986)**,** The pacca Warabandi system has been successful in reducing the opportunities for disputes and conflicts among the farmers as water turns are fixed officially keeping in view the benefits for the community as a whole. The system tends to be self-policing, because the next in turn is waiting and ready to take his turn On the contrary, the kacha warabandi system is considered unsatisfactory because it often leads to disputes among farmers, particularly during periods of peak demands and shortages.

A major disadvantage of the pacca Warabandi system, however, is that the amount of water available to a crop area does not depend on the stage of a crop growth and he is compel to either get his turn, or to forget it. This means that the system not only leads to a position of water but sometimes even casing reduction in crop yields due to over irrigation.Renfro (1982) also observed that rigidity of the supply schedule under this system causes periodic shortages and at other times an excess of water supply.

A Comprehensive Legal Base

Bandaragoda, A brief set of laws by the British have been formulated to obtained the objectives of Warabandi. While whenever some important needs and

lawful small chance got up, the laws and methods were changed to face those aims and objectives, keeping the basic laws of the system unchanged. The rules of Northern India Canal and Drainage Act of 1873"still governing Pakistan irrigation. "Operating rules for the canal act providing by Subsidiary legislation , different manuals of methods, and revenue and rates manuals form the future coming layer of scientific rules, while The third layer is a set of new rules and regulations related to other aspects impinging on water user association, land reform and reclamation and water use".

Water Laws and Implementation Organization.

Bandaragoda report that the history of Warabandi in Pakistan indicates the close relation between water laws and their implementing power to make the legal system valuable. The fluctuation in the Warabandi system, particularly as far as its main objective of equity is concerned, is dearly attributable to the collapse of the social organization underlying the tradition of Warabandi, and the current ineffectiveness of the centralist state machinery that replaced it. The essential conditions of the Warabandi system can only be maintained by a consistent pooled effort by a number of people, the operating staff and the farmers. Many other forms of water rights will require, for their effective application, the same degree of stability and a greater responsibility vested with the local community. Both rule application and rule adjudication were performed at a local level. With the establishment of a network of officials belonging to a central authority, this responsibility was diffused and became remotely located. The close-knit and intimately and consistently interacting implementation authority needed for an essentially cooperative effort of this type can only be obtained by bringing a fair responsibility back to the local community level. This does not mean in reduction responsibility of the authority. An increased responsibility of authority will be required to ensure equity through effective rule adjudication and arbitration, by shifting from the present "soft state" conditions to an effective "law and order" situation. The State's increased attention will be needed to ensure the maintenance of the desired conditions of the physical system. In this connection, Pakistan has taken a positive step for the formation of water users' associations. The good intentions behind such formalized rules in any context can only be realized by a conscious effort through appropriate strategies to implement them.

Present Status of Irrigation Rotation in Pakistan

Shaikh, (2009) describes the present status of Irrigation rotation facing the major constrain include; Physical problems, Financial Problems, and Institutional problems.

Wade, (1982) Ghumman, (2011), pointed out that after the British build a massive canal system in this area, conflicts between local communities developed because of mainly two reasons, 1. Initially as the demand for water was not high, cropping intensity was very less, canal water was not consider as a vital part of productive agriculture, 2. With mathematical formulas and calculations, water was distributed more equitably, which supersede the traditional water allowance, which was based on local political power. So the new canal system resulted in more conflicts and often the big landlords try to sabotage it. But with great administration power and will these issues were settled down.

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Merrey, mentioned in his report that failure of warabandi system was also due to the fact that during design and construction phase more emphasis was given to civil work designs rather than society culture and needs. He also mentioned that due to three main reasons, namely continues sub division of lands, increasing population, and introduction of high yield varieties, farmer tends to change the water course rout to best fit their needs, change in rotation of water and more recently government added rehabilitation of water courses. He further mentioned that change in basic irrigation system design and organization of irrigation related task is the call of the day.

Bandaragoda and Rehman, (1995), mentioned that after independence the condition once again reversed. With the passing time, new rich class was emerged, due to bad land reforms, which resulted in group of influential with political and economic power. Afterward they started exerting pressure on law and order and canal environment. Later on these groups alter the Pacca warabandi for their interest. These altered schedules become a regular practice due to mainly two reasons, 1. Lack of enthusiasm and trust on relative authorities, such ill practices was not brought into notice of relative authorities, 2. The increasing influence of informal setup (like Baradari, political affiliation, caste) which tends to favor the rich group, has influence in dissolving local conflicts informally. Due to inequitable water distribution some farmers trade their turn as the available water is not meeting their water requirement. Borrowing of turn is 14% in the head which increases to 34% in the tail. Also they mentioned that increased cost and reduced budget for the maintenance of physical structure along with low motivation level of agency staff result in physical deterioration of the hydraulic structures.

Bandaragoda, in his study over the irrigation system in Pakistan mentioned that warabandi system as thought of a fix and rigid irrigation system in no more in practice in its true spirit and theme. Presently,

warabandi is the "survivor of influential". He pointed out that scheduling is done only on the primary system, which is not done properly results flow fluctuation in secondary and hence in tertiary units. This is against the basic design requirement of warabandi. According to his report among the other reasons, one main reason for inequitable warabandi is the lack of institutional accountability. Influential Farmers amend the fix warabandi for their benefits without the fear of accountability as any legal action against such practice is rarely seen. Strengthening accountability, collective approach of farmers, motivation is the keys to success. Average water allowance in the older canals is 0.23 litter/sec/ha ranging from 0.2 to 0.3 litter/sec/ha. Secondary units also has almost same pattern but unfortunately the tertiary units have considerable variation in water allowance. Different outlets (Moghas) are delivering different flow with no relevance to command area. It is assumed that such variation cannot be part of design but its post construction illegal activity done by some of the influential farmers. It is called Mogha tempering. Such tempered moghas are in operation from long time but due to influence no one can stop it. Another factor is that contrary to design criteria, due to negligence of operating agencies, minimum full supply level fall well below 75% of maximum full supply level, which cause flow fluctuation in tertiary units. Due to head variation, some of water courses receive little or no water and quite often farmer present this inequity as an argument for mogha tempering.

Future Challenges and Irrigation Rotation

The demand for getting better and up-gradation of the irrigation system has become necessary in fact, over the last three decades, some disorders have been taken placed because of floods, resulting in stoppage of irrigation-water to large areas, with remarkable economic losses. Present observation has indicated that numbers of important hydraulic structures are in a precarious state and the need for improvement is urgent. Out of improvement, the system also requires totally improvements to permit efficient operation and Alternative Rate Mechanisms, are also suggested for optimizing the overall Irrigation Management. A sectoral and National Water Policy is also be designed, to have a proper approached for improvement and management of the water Sector .

4. CONCLUSION

- High Efficiency irrigation systems shall be promoted to increase application efficiency and to tackle with shortage of water.
- Away from laws of warabandi causing dispute among water users.
- Irrigation rotation system, contrary to its goal, resulted in inequitable water distribution.
- Irrigation rotation can be increased to 15 days, with associated increase in water allowance.
- HEIS shall be promoted to increase application efficiency and to tackle with shortage of water.
- Unbalance water distribution is one of the responsible factor for low crop production in the country.
- Due to scarcity water, well management of water resource is very important for agriculture sector.
- The related ministry of water and power should determine a National Water Policy to meet the challenges of water related issues.

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