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# Natural Resource Management and Nation Building in Pakistan: Agro-Commercialization in *Tehsils* of Colonial District Multan, Pakistan

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**Abstract** *Nation-building refers to the process of constructing or structuring a national identity using the power of the state. Natural resources and technologies associated with it and their use have been an integral part of human life, as old as civilization. The land formed the main ingredients of a natural resource. Pakistan is fortunate because its soils, topography and climate are generally suitable for farming, but its agriculture sectors face the problem of scarcity of water in regions like Multan. The development of irrigation resources was, therefore, one of the major concerns of the Governments who ruled the region. Like other Punjab districts, Multan witnessed the commercialization of agro products and the growth of market towns following the extension of irrigation and communication facilities. However, it was immensely transformed by the Sidhnai Canal Colony system. This paper also attempts to analyze the economics of conjunctive water management practices in Tehsils of Colonial Multan. This research is based on original non published official reports from Punjab Civil Secretariat Lahore and British Indian Library London. The paper is mainly based on archival documentation, settlement and assessment reports and gazetteers..*

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## Introduction

Pakistan is a country in South East Asia and consists of four provinces-Punjab, Sindh, Baluchistan, North-West Frontier province and one state-Kashmir. Its total area is 803,940 square kilometres. Its present population is estimated at 165,803,560. Its boarders are with China, India, Afghanistan, Iran and the Arabian Sea. It is estimated that Pakistan population will be 259 million in 2030 and 316 million in 2050. As the population is increasing very rapidly, the demand for food is also increasing. The demand for food was 20 million tons in 2000. It is estimated that food demand will be 40 million tons in 2025. There are two cropping seasons in Pakistan; one is called Kharif, and the other is called Rabi.

The Canal network was developed in Pakistan during the British occupation of the subcontinent. At that time of British occupation, water rights were allocated for 70 percent of cultivation every year, but the water was promised upon the availability of water in rivers. During the last 50 years, extension in the irrigation

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sector was about 15 percent more area. In most of the areas, existing canals were developed and extended. Two big water reservoirs were added for the storage of water. Land irrigated through canals is 14.23 million hectares, land irrigated through tube-wells is 3.75 million hectares, and land irrigated by other sources is 0.2 million hectares. The agricultural sector is playing a vital role in Pakistan. It contributes 25 % of GDP. The surface water source in Pakistan is the Indus River, and its tributaries are Chenab, Jhelum, Sutlej and Ravi.

Geographically Multan was bounded on the East, North and West by the districts of Montgomery, Jhang and Muzaffargarh and on the South by the Bahawalpur. The Sutlaj has separated it from Bahawalpur and the Chenab from Muzaffargarh, but in the case of Jhang and Montgomery, the boundary was artificial, running for the most part through the desert country. The greater part of the Trans Ravi tract was added to Multan in 1851, the river having previously formed the boundary. In 1880 five more villages on the lower Ravi were transferred so that the whole area dependent for inundation on the Ravi might be included in the Multan district.

Again in 1898, eight more villages near the confluence of the Ravi and Chenab were absorbed with the object of facilitating certain extensions of the Sidhnai Canal system into the neighborhood. To the west, the deep stream of the Chenab formed an over-varying boundary un till the years 1898, when it was laid down that specified villages should always remain a portion of the Multan and Muzafargarh Districts, respectively, whether they were on the right or the left bank of the rivers. (*E.D. Maclagan, Settlement Report of Multan District 1901,p.1)*

The total area of the district, according to the village survey carried out in 1897-1899, was 5,948 square miles, of which 2 257 square miles were classified as government waste. The area, excluding government waste, was thus 3,691 square miles, of which, again, only 1,237 were found to be an average under crops. The cultivation was thus only 27% of the total area, while only 21%, and was actually under crop *(Settlement Report 1901, p.7)*

Administratively, the district was divided into five *tehsils* as management units. The headquarter of the Multan, Shujabad and Mailsi *tehsils* had been at those places from the beginning of the British rule. Those of the Lodhran *tehsil* were for two or three years at PirKotSaadat until they were removed to their present situation on the high road from Multan to Bahawalpur. The headquarters of the Northernmost *tehsil* were at SariaSiddhu till August 1899, when in consequence of the changes caused by Sidnai Canal, they were transferred to Kabirwala. As regards the eternal boundaries of these *tehsils,* there have, exclusive of small alternations, been three main changes made since annexations. Firstly, during the settlement of 1856-1859, a large stretch of desert country lying between the old bed of the *Bias* and its old right-hand high bank was transferred from the SariaSiddhu to the Mailsi tahsil.

Then, in 1881, a series of changes were made with the object of increasing the Shujabad and decreasing the Mailsi charge: under these arrangements, the Shujabad *tehsil,* which formerly only reached to the old *Bias*, was extended Southwards by the addition of 27 villages from Lodhran, so as to include all the area ordinarily irrigated from Chenab River, and at the same time 60 villages in the neighborhood of Kahror were transferred from the Mailsi to the Lodharan tahsil.

Even after these changes were made, the Mailsi *tehsil* was still found too unmanageable, and Shujabad too light a charge and further alternations were made in 1897, by which the greater part of the remainder of Jalalpur *thana,* consisting of 46 villages, were transferred from Lodharan to Shujabad, while 104 villages to the East of Kahror were taken over from Mailsi in competition *(Settlement Report 1901,p.2)*

All the *tehsils* of the district of Multan consisting of the fertile and highly cultivated alluvial land along the course of the rivers, while the central part of the *Doab,* this highland was beyond the reach of the canals, properly called the '*Bar*' There were three types of '*Bar*' in the district between the old Ravi and *Bias* was known as Ganji Bar, between the Ravi and Chenab 'Bias Bar', and the 'Nili Bar' was on the Bias and Sutlej. *(Settlement Report, p.3)* Multan was famous for its hot weather, and it was extremely dry. Its heat was proverbial. The average recorded rainfall of the district for the ten years ending 1899-1900 was 6.27 inches. *(*Report on the Administration of the Punjab and its Dependencies for1900-1901,p.80) Accordingly, agriculture was feasible only in the irrigable low lands neighboring rivers. The high inside of the district, known as the *Bar*, consisted of the hard soil, covered mainly with Jand and Jal trees, not cultivated, fit for only pasture grounds. *(Punjab Administration Report,1901, p.86)* The average rainfall of the district was 15 inches a year; therefore, an extension of cultivation was necessarily dependent upon the extension of the irrigation. (*Mooltan District Gazetteer, 1883-84, statistical table III)*

Yet again, the inundation water would depend on the rainfall and, therefore, the scarcity of the rainfall for the agricultural economy of the district had always been felt, which is evident from the fact that the perennial irrigation, which started in 1885 with the opening of Sidhnai Canal brought a major chunk of the district under extensive irrigation. Regions with greater participation and or more streamflow typically had a higher recharge rate depending upon the soil hydraulic conductivity. Thus areas that were most suitable for rain-fed agriculture than those that were typically more suitable for well-driven irrigation too. *(Settlement Report 1901,p.2)* The Multan plains, for example, at the convergence of the major Punjab Rivers, were notable for the high water table due to the abundant surface of the water.

## Inundation Canal System

The district was naturally watered by Chenab and Sutlej rivers. The Chenab, for its more extensive floods and better alluvial deposits, was the most fertilizing. The value for these rivers increased for irrigation purposes in the colonial era by the excavation of inundation canals. A full report of the system of inundation canals as it existed in 1858 was prepared by John Morris, the Settlement Officer in the district at the time of the first regular settlement. (Report on the Revised Settlement of the Multan District in the Mooltan Divis,1855-59, p. 15.) All the inundation canals were of recent formation, the most ancient of them having been dug one hundred and sixty years ago. ( Gazetteer of Chenab Colony 1904,p.5) An important contribution by colonial management in this regard was the participation of the private sector in the economic development process. They desired that the government should promote the culture 'to spend money in such works on the part of men possessed of capital, combined with energy, local influence, and an honest desire to carry out schemes for reclaiming wasteland. (*The Inundation Canals of District*

*Mooltan*, *Appendix B)*

This policy became a standard norm of the district administration, which encouraged a number of people to not only excavate private canals but make the government waste cultivable. James suggested a scheme of colonization of waste land-based on Sawan Mal for populating land on the Diwanwah canal. (Revenue Report of the Irrigation Department Punjab for the year,1887-88 p. 92.) Hugh Jame's proposal for colonization of wasteland was similar to the next government policies in the great canal colonies in the South West of Punjab, like Sidhani Canal Colony.

Canal colonization was not only a tool to supplement revenue but also a mechanism of political control on a local level. Once incorporate to settle down, nomads would be more agreeable to rule over. Historically, powerful pastoral tribes of Multan and neighboring districts had caused a serious law and order problem. Nomadic residents of the high *Bar* incessantly raided each other and settled the population. This was the first organized attempt to make an effort on the part of the district administration to invest irrigation sector in renovating the existing canals. Although the management of the canal was a major step forward, much more work was required. The district had an area of 5,948 square miles; government waste was 3,691 square miles, of which only 1,237 were found under crops. (Revenue Report of the Irrigation Department Punjab for the Year,1887-88, p. 89.)

Only a network of inundation irrigation channels running throughout the length and breadth of the district could achieve that goal. This was due to the natural limitations on the excavation and irrigation capacity of the inundations canals. The maximum length an inundation canal could attain was not more than forty miles; therefore, the vast expanse of the district was naturally out of the irrigational reach of that system.

It was this reason that on the eve of annexation, only those areas of Multan were thoroughly cultivated were the plentiful inundation water was available. This situation in Multan compared critically with such districts as Jullundur where there was 'practically no waste brushwood or forest what so ever. *(*Himadri Bannerjee, Agrarian Society of the Punjab,1849-1901,1982, p.8*)* This was mainly because of the fertile land and comparatively better rainfall; Multan was badly in need of extension and renovation of existing canals.

Sutlej and Chenab Rivers were the main distributors for the inundation canal system. At the time of colonial annexation in Multan district, 14 canals were from Chenab and 20 from Sutlej. The WaliMuhamad and Sikanderwah were exceptional Chenab works. The former, constructed circa 1760, was some 30 miles in length. Striking the western side of Multan city, the Wali Muhammad gave water to 50 villages by means of 319 Persian wheals and 138 watercourses. The Sikandarwah, about 30 miles in length, irrigated 31 villages through 139 jhalars and 198 kassis .On the Sutlej , the Diwanwah , excavated by the interest of Diwan Sawan Mal Nazim of Multan, left the river near Lodhran , extended 35 miles into the mid of the Bar, and watered 66 villages by means of 251 *jhalars a*nd 8 kassis. The Sirdarwah, 38 miles in length, transformed an important indigo-producing region. Twenty four villages took watered by the canal through 263 *jhalars* and 65 *kassis*. (*Settlement Report of Multan District 1901,p.3 )*

Majority of Chenab canals were made by Pathans when holding the position of rulers in Multan and Shujabad; whilst those on the Sutlej were chiefly dug by the

Daudpotras, a powerful tribe, who on the extinction of Mughal power completed the conquest of this part of country, and continued in possession until its acquisition by Ranjit Singh. One of the largest, however, of the Sutlej canals the Diwanwah of tehsil Mailsi was excavated by DiwanSawan Mal, who also enlarged and improved several others and showed great liberality in making grants for the re-excavation and improvement of the canal in general. (Revised Settlement Report of the Multan District, 1855-59 Appendix C, p. 14) There were the average areas irrigated by these canals during the five years 1898-99:- (Revenue Report of the Irrigation Department for the Year, 1898-99, p. 34.*)*

The Multan canal series were excavated from the Sutlej and Chenab rivers. These canals in construction were of very ancient type. They had no headworks, head regulates, distributaries, and uniformity of depth and breadth. The water freely entered into them in an uncontrolled volume. They worked only for a few months in the summer season when the water level in the rivers was quite high to enter into them. The bed of these canals and the water level in them were below the level of the adjoining lands. The water for irrigation purposes was used not by overflow but by lift either by construction a well on the canal bank called *Jahalar* or by cutting ditch channel from the canal up to the field and then to lift the water by human labour. (Report on the administration of Punjab for the Years,1850-51 p. 90.) This equipment was very laborious and involved a lot of work but was slightly better than the irrigation by wells. Instead of irrigating Bars between the rivers, where the irrigation was badly needed, they irrigated the low lying riverain lands bet along the river channels.

In its historical context, the earliest canal system in Punjab was inundation canals. These were used to get water from the rivers during periods of high flood season. The Mughal period saw the little canal construction as rulers chose instead to increase agricultural revenues with land surveys, tax farming and land settlement plans. It was the regional states, which arose after the Mughal decline that saw significant canal development in the late 18th and 19th centuries. It has been argued these regional states, the Sikhs of Punjab, the Nawabs of Bahawalpur, rural elites of Multan etc., sought to provide a base for local and regional elites. (Gilmartin, Scientific Empire and Imperial Science. Journal of Asian Studies,p1129*)* These elites, by the pastoral tribal chief, religious figures or wealthy men of commercial casts, were critical to the state functioning and canal construction not only allowed increased agricultural production but also defined a structure of power linking them to the state. The state helped organize canal construction but did not directly control it, relying on its ability to "define" and manipulate 'communities' of canal shares, frequently dominated by privileged elites. *( Empire and Islam, p.1130)*

Canal construction was only one fact of irrigation, and subsequent maintenance is necessary, especially given the high sediment load of the Punjab Rivers. Annual silt clearance was necessary with inundation canals, a task for which in the years preceding the British were generally performed by the local users for rights to the canals' water. *(Empire and Islam, p. 1130)* The problem of silt, however, was not fully controlled until the construction of large storage dams in the mid 20th-century variations in flood volume and other mitigating factors led to canals not always performing within any designed

parameters, but in essence, silt accumulation became a problem with engineering rather a force that necessitated an annually employed workforce. The extension and renovation of the inundation canal system were not just limited to the Multan district; in fact, it was the Punjab wide phenomenon, which greatly improved the state of irrigation and cultivation throughout the province. A number of districts experienced a considerable increase in cultivation. (Bannerjee, Agrarian Society of the Punjab 1849-1901, pp. 24-25.)

In Multan district under government encouragement, Private canal system got impetus, but contrary to it, in Muzaffargarh, due to lack of initiative on the part of the private sector, the government had to take the inundation canal system under its direct supervision, which after renovation began to irrigate 2, 93,853 acres in 1900-01. (*Agrarian Society of Punjab (1849-1901),* p.25) So it would not be wrong to say that even before the opening of the construction of the Sidnai Canal Colony system, noticeably, development in the irrigation sector had taken place in the Multan district. The importance of the inundation canal system remained intact even after the construction of the Sidhanai Canal system. During the period under review, the state and private inundations canals continued to meet the irrigational requirements of a considerable portion of the district.

## Limitation of the Inundation Canal System

However, there were some innate limitations to the inundations canal system as well, as the central *Bar* and *Thal* were naturally deprived of the facility and were totally dependent on rainfall. In the rainy years, there were good crops, but whenever there was no rain, it had a telling effect on vegetation, cattle and human life. Dry years always created a drought situation. (*Administration Report of the Punjab.P.18) Thal,* the introduction of gram cultivation was greatly transformed. Besides inundation canals, well irrigation also increased. In the Multan district, well was known as Persian wheel or Jhalar, the primitive, traditional method of cultivation *(* Irfan Habib. pp. 149-155*).* The value of the well was dependent upon the quality of water, its depth from the surface and the continuity of the supply. The depth of the well depends mainly on its distance from the river. Wells were occasionally found in which the water was brackish and unfit for drinking. A marked line of such well extended from Dunyapur in the centre of the district to Jalalpur Pirwala in the South West. The average figures for the district, as ascertained at the settlement of 1896 -1901, were shown in the margin. (Settlement Report of Multan District 1901, p. 23)

The depth of water varied from about 30 feet to 10 feet or even less and average about 15 feet. In fact, the water table had been rising steadily with the extension of canal irrigation, though not of course to the same extent as in tracts where permanent canal irrigation was introduced. Taking, for example, ten villages in various parts of the area was irrigated by the Sidhnai Canal, the average depth of the water had decreased from 44.7 to 40.1 feet since 1879 the subsidence of the river caused a lowering of the water level, as for example, in Ravi riverain circle, where the water level which in 1877 was 16 feet, was now 26 feet below the surface. (Final Settlement Report of the Multan District 1921, p. 2)

However, regarding the difference of the soils, it remained that in a district like Multan, the distinction between irrigated and un-irrigated land and the composition

of the soil had much less to do with the product than the amount and character of the irrigation received. The soil had been on that account always classed in the Government records according to the method of irrigation.

The cost of a well differs according to the depth of it, and the *Zamindar* could supply material for its digging and construction. The average cost of masonry well roughly was taken at Rs.400 in the Hithar, Rs. 500 in Utar and Rs.600 in Rawa and in Sidhanai Circles. The rate at which well irrigation could be carried on the course varies, but a normal rate of irrigation would be over 1/4of an acre of ploughed land, and in 24 hours, the well-worked hard all the time. Wheat is irrigated during winter by ordinary well-relieved water at the rate of some three or four days to the acre. In 1899-1900, 13,423 wells aided by canals were in use, as compared to 1,546 were out of use. The no of wells aided by *Sailab* was 1,833 used, while 291 were out of use. 2,027 unaided wells were in use, 780 were out of use. (*Multan District Gazetteer 1901-2, pp. 194-95*)

So, the well was of considerable importance in the agricultural economy of the district. Well, sinking became easy and profitable; the landed property was, for the most part, divide into wells that were into well estates or areas attached to wells; the well thus served as a unit of proprietorship. This requirement accounted for the well-oriented pattern of agricultural settlement.

## Perennial Canal System

The perennial canal system was generally unknown in Punjab until the middle of the 19th century and the British irrigation and colonization projects. Perennial canals, like inundation canals, had the problem of silt clearance. Perennial canals need stable diversion works of barrages and headworks. They were also used for the defensive purpose and to be constructed as strategic sites along the river tracts. These barrages had the potential for generating and raising water levels. These barrages permit fast diversion to rivers, especially during the winter season when the low water flow restricts the effective working of inundation or seasonal canals. Right from the British Colonial annexation of Punjab in 1849, Colonial managers launched an expensive water resource management system. The system started in 1851 (Hugh James, *Canals of Mooltan*, 1848, pp. 4-5) on the upper Bari Doab. Their initial efforts were directed to cleaning and expanding canals that were pre-existing at the time of their arrival. While the goal of expanding agricultural land was reported from the first, a primary reason for this construction was the political necessity of newly unemployed Sikh soldiers employed. (*Administration of Punjab and its Dependencies for 1873-74, pp.123-135*)

Early British Canal works were built largely throughout previously populated parts of Punjab (Paul W. Paustian, Canal Irrigation in the Punjab, 1930, p. 48.) Beyond these areas, on the uplands areas of Doabs, lay large tracts of land designated wastes, which did not support a settled population. Rainfall in those areas was reported to be less than 10 inches per year, and the level of groundwater was as low as 50 to 80 feet. ( Mufakharual Islam, Irrigation, Agriculture and Raj in Punjab 1887-1947, p. 27.) During periods following the meagre rainfall, they would support a fairly abundant growth of pastures during which nomad's tribesman known as the *jangils* grazed their cattle. They also provided a considerable amount of fuel and small building wood. (Agnihotri, Ecology, Land use and Colonization, The Canal Colonies of Punjab, p.44.)

Enabled by the employment of the perennial canals, the British crown appropriated these "unclaimed" bar lands as "crown Waste" and began to plan for their development. The forest act of 1878 and criminal tribes act 1871 were complementary legal provisions to enable this take over. Previous pastoral users of the land were largely ignored, with their land-use claims not being recognized as constituting prosperity rights. In contrast to previous use of existing watercourses and channels, the new perennial canals starting with the Bari Doab canal started to be obliged along the ridges of the *doabs* enabling greater expansion of irrigation. (Paustan, Canal Irrigation in the Punjab, p. 29.)

British organized a structure where the description of propriety rights in agricultural land was vital. By trying the local population definition of the land and legally explaining their relationship through the institution of private property, the British also tied them to a social scientific "discourse" where community and custom-defined a social order associated with the colonial state. (Gilmartin, *Scientific Empire and Imperial Science, Colonialism and Irrigation Technology in Indus Basin*, p. 1132) Regular land settlements and assessments were the basic method of colonial administration which necessitated the specific position of the individuals within the socio-cultural structure and the carefully recorded information of land revenue administrators regarding the shares in the village assets and individual property rights in land and water with quality of having local knowledge. (Gilmartin, *Scientific Empire and Imperial Science, Colonialism and Irrigation Technology in Indus Basin*, p. 1133 ) As repositories of local knowledge, local leaders were both thus legitimized and tied into the greater state system.

Agriculture was depended on water sources in Punjab as well as in the Multan region, and it was not unexpected that the most significant division of land was associated with its water resources. The Punjab settlement manual categorized land into five-module for assessing land value and legal status during revenue settlements, and they were *barani, saialb, abi, nahri* and *chahi*. The Sidhnai was opened in 1886; and the three so called subsidiary canals, which from part of the same system, were opened somewhat later, the Koranga and Fazil Shah in 1890, and the Abdul Hakim in 1891.

The inundation canals of the district Multan can be divided under three heads (i) the old Government canals (ii) the Hajiwah and (iii) the private canals. Before the annexation the current system of Government inundation canals was started by the Daudpota and Afghan rulers in the middle of the 18th century and the canals were in good working order but colonial managers took interest to improve this system under the supervision of the irrigation officers to control and extend the water supplies, and the average area irrigated by these canals raised which in 1868-69 – 1872 – 73 was 212,518 acres only had risen in 1893 – 94 – 1897 – 98 to 341,998 acres. (*Settlement Report of the Multan District 1901, p. 3.)*

The canals, moreover, as may be surmised, were primarily Kharif canals, and the normal Kharif crop in the canal area was sown and grown by the aid of the canal water alone: it being as a rule only in cases where the water supply was insufficient that the aid of wells is invoked for the maturing of the Kharif harvest, for plunging and sowing are looked for from the canal, and the wheat crop has in the greater part of the district to depend for its maturing on the watering which can be given to it during the winter by wells: the

function of the canal, in this case, being to drench the soil with moisture in the autumn and so to enable a far larger area to be grown on the wells than could be done if no canal irrigation were available. The best kind of village, therefore, in the canal tract is one in which the whole rabi crop obtains the aid both of the wells and of the canal: and the agricultural capacity of a village or holding may be said more or less generally to deteriorate in so far as it deviates from the above standard.

The characteristics of the cultivation on the Hajiwah and on the private canals were identical with those prevailing on the older Government canals. The Hajiwah, for example, was originally excavated by a Khakwani Pathan called Ghulam Mustafa Khan, who in the first regular settlement, held the contract for the revenue of the bar lands in the East of the Mailsi Tahsil and, with the sanction of government, built the Hajiwah canal to irrigate a portion of those lands, At the second settlement his son, Ghulam Kadir Khan, received from the government in proprietary right a tract of 60,000 acres irrigated by the canal, and the grant was formally completed by a deed executed in 1886. In 1888, Ghulam Kadir Khan died, leaving four sons who immediately began to quarrel among themselves to the great detriment of the canal irrigation, and shortly afterwards, the government took over the canal on the authority of a clause in the deed of 1886. The canal was administered by the government on the understanding that the grantees of the 60,000 acres had the first claim on the available supplies, but that in every other respect the canal was to be treated as a Government canal, the view of this case had been disputed by three out of the four sons of Ghulam Kadir Khan, and the litigation on the subject was still pending before the Privy Council. (*Settlement Report of the Multan District 1901*, p. 4.)

There were at the second regular settlement several small cuts in the Shujabad Tahsil which were treated as private canals several of these fell into disuse owing to changes in the course of the river, and at the commencement of the present settlement, only two were remaining, and these were during the progress of the settlement merged into the government system by being amalgamated with an extension of the Gajjuhatta canal. There was now in the district only one private canal, viz., the Ghulamwah in the Mailsi Tahsil, which was excavated before the second settlement by Ghulam Muhammad Daulatana of Luddan.

This canal, though primarily irrigating the lands owned by the canal-owner himself, also irrigates a considerable area belonging to outsiders, and its cultivation was in all respects on the same footing as that of the other inundation canals, except that it has been more fortunate than most in the stability of its irrigation. (*Settlement Report of the Multan District 1901*, p. 11) Punjab districts were of supreme importance to the cultivator, namely, the rainfall, and this omission was explained both by the comparatively small amount of the rainfall in this district and by the comparatively small influence which it had on the cultivation. The average rainfall at *Tehsils* for the years 1890-91 to 1899-1900 was….

A rough average for the district may therefore be struck at 6 ¼ inches, as compared with 9 inches in Montgomery, 19 in Lahore, and 37 in Gurdaspur, the three districts lying immediately to the north of Multan. The rain in this district, moreover, besides being scanty, is very variable both from year to year and from place. Its influence on the ordinary agriculture of the district was of secondary importance. This cultivation was known

locally as *bar-barani* or *kashtbarani*. (*Settlement Report of the Multan District 1901*, pp. 5-6.)

The connection between irrigation and land tenure in the Punjab Canal Colony District origin steroid from the importance of water for cultivation in a semi-arid region like Multan, rights to wells and embankments, the construction of the private canal by large landowners and the encouragement given by various government had left their mark on the tenure systems prevailing in Punjab. While rights to the land had been informal, rights to a well or a part of well were recognizing these rights, emphasize rights to the land through various legislative measures. Isolated wells with their smallholdings were grouped to gather to form village communities, creating a division between agriculturalists and non-agriculturalists; regulation in the supply of water was ignored by the fixed land revenue assessment system, and private inundation canals were not given the attention that previous government had provided.

The irrigation network that emerged after 1885 was based in perennial canals that let off from spanning rivers and headworks. This rendered cultivable the upland plains that had hitherto remained in accessible to the small-scale and technologically less sophisticated traditional irrigation method. Between 1885 and the end of British rule in 1947, the canal irrigated area in Punjab, excluding the primly states, increased from under 3,000,000 to around 14,000,000 acres. The extent to which agricultural growth allowed the preconditions for successful development to emerge was greatly influenced by the nature of land utilization in canal colonies. "Colonization" or the motives and method involved in settlement of these new lands, determined the character of the emergent society and the degree to which that society was capable of structural transformation from its existing state of economic backwardness and new political structure. (Imran Ali, *Punjab Under Imperialism 1885-1947*, *pp. 8-10.* ) The first colonization project in Punjab was Sidhnai Colony, located in Multan District. The estimation of cost construction is given below.

J. Anderson was the originator of the Sidhnai Canal project as superintendent of inundation canals. The system was open for irrigation through a water channel known as the old Ravi extended from the Sari Sidhu to Multan, supplied by means of Dam across the Ravi at the upstream and permanent reach known as the Sidhnai, which extended seven miles below Tulmba. (*Settlement Report 0f Multan District 1901, p. 24*)

The Sidnai was the only canal dependent on the Ravi. The Sidhnai different from the inundation canals of the Chenab from Sutlej that it possessed a weir, and it differed from the perennial canals because its supply was more liable to fail the critical seasons of the year. This system combined with three subsidiary canals, Abdul Hakim, Fazal Shah and Kuranga. For the distribution of water, the surplus being first divided between the Kuranga and Fazal Shah and the balance going to the Abdulakim. The duration of their supplies was from 88 to 97 days less than to the main canal. (Final Settlement Report of the Multan District 1921, p.2) The following table gives particulars of the canals which constitute the Sidhnai System: (*Multan District Gazetteer* (1901-02), p. 320. )

The marked success of the canal as a financial concern is shown by the figure:- (*Settlement Report of Multan District 1901*, p. 30. )

The Sidhnai Colony started working 1886-88, and the total allotted area, after further extension in the 1890s, was around 250,000 acres. For the utilization of land, the government expressed the wish not to create large properties in which grantees would become were renters, but to allot land to "small well-to-do agriculturists who will cultivate their own holdings as stated Imran Ali ". The actual size of grants in Sidhnai Colony was influenced by the fact that canal irrigation was seasoned rather than perennial guarantees of land had to construct of mature the all-important Rabi crops, and for this, they had to process a certain amount of capital. (*D.C. Multan to Financial Commissioner, 1886*, pp. 5859)

The categorization of the canals, in 1921, this scheme was changed in British Punjab. All the channels were designated productive or unproductive without regard to the financing scheme under which they were built. Productive canals were those which, after the first ten years, could be self finance their operating system expenses and interest in on the loans. Irrigation receipts fell into two categories, direct and indirect; direct recipients include the *abiana* , or water rates charged for maturing crops and subsidiary services such as tools for navigation, water power etc.

The *abiana* was a system in existence before the arrival of the British. Water users, be they landowners or tenants, charged per acres of the irrigated crop but the rate varied on the type of crop being grown and source of water, well or canal. Plans for volumetric pricing were proposed, but technical and political obstacles prevented widespread adoption of such schemes until the 20th century. In direct receipts included the "canal advantage rate" and interest of sale of "crown lands" made productive by the irrigation works. "Canal advantage was a levy on landowners were now able to charge more rent and some of this increased income should be passed on the state that enabled it.

The effect of perennial canals of the British was largely detrimental to the older inundation canals. As well as diverting water and thus reducing the effectiveness of the latter, The British were reluctant to provide funds for their annual cleaning as income derived from them was minimal compared to the perennial canals. (Agnihotri, Ecology, Land use and Colonization: The Canal Colonies of Punjab, p. 45) Additionally, the *sailab* land was adversely affected, and the areas available for grazing drastically reduced, well usage dropped as the canal system expanded, and farmers relied on easier utilize sources of water. Some efforts were made by the British to compensate for the loss of land value due to the new canals. Many local landlords were given compensatory grants of colony land without residing there. The biggest problem after the introduction of perennial canals, however, is water logging. Seepage from canals drastically raised the level of groundwater, rendering land unfit for cultivation. This was often accompanied by the development of patches of *kallar,* which prohibited the growth of crops. From the colonial managers, the irrigation networks and canal colonies enabled them to be financially successful. By 1928 the eight canal colony district contributed more revenue than the other 21 districts of Punjab collectively.

Colonial administrators proudly reported that before the construction of the Chenab canal, 1800,000 acres of crown wastelands only gave revenue of "a few hundred pounds" from grazing rights, whereby 1906, the same land contributed revenue of over 70,000 pounds. The net profit to the state was 450,000 pounds

which equalled a return of 23% on capital costs. (Final Settlement Report of Multan District 1921, p. 22) A most important impact of colonial irrigation development was the integration of the colonists into the management made the region substantial overall political stability. As the administration hoped on the colonization scheme, "the eyes of the masses have been opened to the agreed benefits they are receiving under British rule." (*Ibid, pp. 22-23*)

The colonial set-up of canal colonization in the vast and spare lands transformed the settlement pattern of the Punjab province. Former villages had been located adjacent to rivers. Seasonally inundated channels with the canal colonies became regular sources that spaced over the landscape despite land location or relationship to rivers. The modern agricultural development led to the establishment of *Mandis* in the middle of the towns. The new urban centers are Sargodha, Okara, Mianchuunu, Khanawal, Chichawatni (*Annual Report of the Punjab Colonies, for the ending Year 30th September* 1921,*p.34.)* Montgomery and Layallpur. These are the modern canal colonies. There are towns of historical importance, for example, Lahore and Multan. These cities and towns are now the prime metropolitan centres in the area.

## Conclusion

This research is discussed social as well as technical problems about the management of irrigation systems in the Punjab of Pakistan and suggested possible solutions for the management of irrigation systems. To solve management problems of the irrigation sector, the first thing is to know about the root causes of the problem. To suggest and impose any solutions without knowledge of the root causes of the problem may always not be successful. In this thesis, we discussed the basic infrastructure of the Indus Basin System in Pakistan, and then we put light on the irrigation system of Sargodha. The management of the irrigation system in district Multan has social as well as technical problems. The social, as well as technical problems mentioned in the thesis, are identified through literature study as well as through participatory observation living in the area. Before its implementation, Pakistan is a developing country, and social problems are at their peak for the management of irrigation systems in the Indus basin. In district Sargodha, water management authorities have not succeeded in terms of introducing new techniques due to social problems. Similarly, foreign and national NGOs cannot be successful in introducing new projects for better management of irrigation systems in any part of the Indus basin until they know about social problems in the area. Pakistan is a developing country, and people living in rural areas are facing many social problems; and there is a need to solve these social problems, then there can be hope to solve other problems like irrigation related problems. Otherwise, there is a chance that the gap between local people and investors may increase, which might result in overall negative effects. Some problems like the landlord problem will be solved automatically as time passed because ownership of land is reducing from generation to generation, and there is a hope that in the near future, there will be no big landlords in the area. The Children of landlords are become educated, and their thinking is no more feudal as like their forefathers, and there is a better hope that the irrigation sector will be progressed in District Multan.

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