THE GEOGRAPHY OF CANAL COLONIZATION
IMPLICATIONS FOR POLITICAL ECONOMY

Adeel Malik
University of Oxford

Syed Nadeem Hussain
Formerly St. Cross College, Oxford

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Details of Archival Research

- Primary sources:

  The Punjab Government General Administration Report (1850)
  Report of the Indian Irrigation Commission (1903)
  District Gazetteers, Census Report of Punjab 1921
  The Punjab Colony Manuals of 1922, 1924 and 1936
  Board of Revenue Reports; and Returns of the Agricultural Statistics of India
  Report of the Indian Irrigation Commission (1903)
Other sources

- Personal correspondences, notes and general remarks, replies to printed questions etc. by high ranking British officials who were in charge of canal colonization

  *Punjab Colony Manuals*


- Secondary sources:

  These include some pioneering work done by-

  *Paul W. Paustian* (1930)

  *M. L. Darling* (1928)

  *Imran Ali* (1988),

  *Farmer* (1974),

  *Stone* (1984)
Pre-British developments:

Three principal modes of irrigation that preceded the British canal irrigation.

- **Wells** – old means of irrigation;
- *Persian Wheel* - in use from the medieval Slave and Mughal dynasties;
- **Inundation canals** – They depended on water levels in rivers for their flow, making them useful only during flood periods.

*Main feature*

Water supply fluctuated with flood cycles in successive years.
Examples of earlier canals

Some of the prominent pre-British irrigation canals included:

- Western Jumna canal in east Punjab - built by Feroz Shah Tughlak


- Canals in Multan built by Diwan Sawan Mal, governor of Multan under Sikh rule.

- Canals built in Dera Ghazi Khan and Muzzafargarh districts.
Canal Irrigation under the British

Canal irrigation 1849-1880:

- British canal irrigation activity started in the year 1817 and was restricted to the plains north of Delhi and the deltaic Madras region.

- Most of the early British canal irrigation schemes were directed towards rehabilitating, restoring and extending existing schemes.

- In 1849-1850 a canal irrigation scheme was conceived to water the area previously irrigated by the Huslee canal in Baree Doab (land between Beas and Ravi rivers)

- It was described as ‘politically important’ not only because of the economic benefit but also because it was a means to provide work to the disbanded and immobilized Sikh soldiers from the Anglo-Sikh war.
Canal Irrigation after 1880

- This was followed in 1868, by *Sirhind Canal* which took off from Sutlej River and irrigated a vast area between Sutlej and Jumna rivers.

- Convinced about its profitability from earlier experiences, the British vigorously pursued canal irrigation as a state policy after 1880.

- This policy was different from the earlier phase in two respects:
  - A more elaborate and dense network of large perennial canals was laid down.
  - New canals were not only constructed but also colonized with people.
<table>
<thead>
<tr>
<th>Canal</th>
<th>Colony</th>
<th>Doab</th>
<th>District</th>
<th>Tract</th>
<th>Period of colonization</th>
<th>Type of land grantees/grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidhnai Canal</td>
<td>Sidhnai</td>
<td>Bari Doab</td>
<td>Multan</td>
<td>B</td>
<td>1886-1888</td>
<td>Self-cultivators, Rich peasants</td>
</tr>
<tr>
<td>Upper Bari Doab Canal</td>
<td>Chunian</td>
<td>Bari Doab</td>
<td>Lahore</td>
<td>C</td>
<td>1896-1898 1904-1906</td>
<td>Peasants, Civil grantees, Military grantees</td>
</tr>
<tr>
<td>Lower Jhelum Canal</td>
<td>Jhelum</td>
<td>Jech Doab</td>
<td>Shahpur, Jhang</td>
<td>B</td>
<td>1902-1906</td>
<td>Horse/Mule Breeding grantees,</td>
</tr>
<tr>
<td>Lower Bari Doab Canal</td>
<td>Lower Bari Doab</td>
<td>Bari Doab</td>
<td>Montgomery, Lahore</td>
<td>B</td>
<td>1914-1924</td>
<td>Horse breeding grantees, Military personnel</td>
</tr>
<tr>
<td>Upper Chenab Canal</td>
<td>Upper Chenab</td>
<td>Rechna Doab</td>
<td>Gujranwala, Sialkot, Sheikhpura</td>
<td>C</td>
<td>1915-1919</td>
<td>Compensatory grants, Civil grants, Military grants</td>
</tr>
<tr>
<td>Sutlej Valley Project</td>
<td>Nili Bar</td>
<td>Bari Doab</td>
<td>Montgomery, Multan</td>
<td>B</td>
<td>1926-1940</td>
<td>All the above mentioned except military grants.</td>
</tr>
</tbody>
</table>
Irrigation levels in Punjab

Source: Agricultural Statistics of India 1884-1884; 1924-1925, Department of Commercial Intelligence and Statistics, Central Publication Branch, Calcutta, (1886; 1927)
The Geography of Canal Colonization
Three geographic drivers of canal colonization

Archival evidence suggests the relevance of three core aspects of geography:

a) *Location*- Punjab had an ideal location as it lay just beneath the foot hills of the Himalayas, Karakorum and Suleiman ranges. Its political geography also made it strategically important for the British.

b) *Climate*- Rainfall was a key climatic factor determining the need and impact of canal irrigation.

c) *Topography*- The topography of Punjab also made it highly conducive for canal colonization.
Punjab’s geographic suitability for irrigation - I

“The capabilities of the Punjab for canal irrigation are notorious. It is intersected by great rivers; it is bounded on two sides by hills, whence pour down countless rivulets; the general surface of the land slopes southward with a considerable gradient. These facts at once proclaim it to be a country eminently adapted for canals.”

— (General report on the administration on Punjab 1849-50, 1854)
The Report of the Indian Irrigation Commission 1901-1903 reinforced Punjab’s geographical suitability for canal irrigation, differentiating it from the rest of India as the most conducive province for extensive canal networks.

“The first province visited by us, the Punjab or land of five rivers, is of all the Indian provinces that which is best adapted for extensive irrigation from perennial canals...... The unfailing supplies of its snow fed rivers, and the even surface of its arid plains, have rendered it possible to construct, at a comparatively small cost, the vast network of canals by which the greater part of the province is now protected from the worst effects of drought....”

Variable geography of Punjab shaped the intensity and impact of canal colonization

- North and central Punjab had a milieu of montane and sub-montane areas which enjoyed adequate and unfailing rainfall accompanied by natural hill torrents. This obviated the need for any large scale canal irrigation.

- South and South-West Punjab had the lowest rainfall and the largest proportion of uncultivated land.

- South-western parts of Punjab:
  - were more intensely penetrated by the canal infrastructure under British rule
  - majority of extensions post-independence were also carried out in this region
  - contained plentiful possibilities for agricultural and social engineering
Indian Irrigation Commission (1903) divides Punjab into three geographical tracts:

**Tract A — Secure** - comprised of montane and sub-montane districts lying in the North, North-Western and North-Eastern Punjab that had abundant and consistent rainfall thus obviating any need for any major artificial irrigation works to provide protection against drought.

**Tract B — Rainless** - comprised of districts in the West and South-West Punjab where cultivation was almost impossible without irrigation since normal rainfall was extremely deficient.

**Tract C — Insecure** - comprised of districts lying in the North, North-East and Eastern Punjab which could very well be cultivated without recourse to artificial irrigation other than wells etc.
The three tracts of British Punjab

<table>
<thead>
<tr>
<th>TRACT A – SECURE</th>
<th>TRACT B – RAINLESS</th>
<th>TRACT C - INSECURE</th>
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<tbody>
<tr>
<td><strong>Districts</strong></td>
<td><strong>Districts</strong></td>
<td><strong>Districts</strong></td>
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<tr>
<td>2. Kohat</td>
<td>2. Dera Ismail Khan</td>
<td>2. Gurdaspur</td>
</tr>
<tr>
<td>8. Rawalpindi</td>
<td>8. Lyallpur (Faisalabad)*</td>
<td>8. Delhi</td>
</tr>
<tr>
<td>10. Attock (Half)*</td>
<td></td>
<td>10. Gujarat</td>
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<td>11. Amballa</td>
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<td>12. Gurgaon</td>
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<td></td>
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<td>13. Jhelum</td>
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<td></td>
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<td>14. Rohtak</td>
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<tr>
<td></td>
<td></td>
<td>15. Hissar</td>
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<tr>
<td></td>
<td></td>
<td>16. Attock (Half)*</td>
</tr>
</tbody>
</table>

*Post 1947 districts.
Rainfall and artificial modes of irrigation

The total average rainfall varies, as a general rule inversely with the distance with the Himalayas. Along the foot of the hills there is a zone of the country where it amounts to over 30 inches per annum and is fairly certain, so that a large area of crops can be grown every year with the help of local rainfall alone. Further out the average rainfall is between 30 and 20 inches, and becomes more uncertain, so that while it is still possible in good years to grow a large area of rain crops, they are more insecure and in years of drought cannot be sown or fail largely. Still more to the south west comes a zone where average rainfall is between 20 and 10 inches and exceedingly variable so that the rain crops are very precarious...........

The importance of artificial irrigation varies inversely with the amount and certainty of the local rainfall.....Further to the south-west, the rainfall decreases in amount and becomes more uncertain, wells and canals become more and more important, until the south-west of the Punjab, no attempt is made to grow a crop unless it is irrigated by a well or canal, or sown on land moistened by river-floods.

— (J. Wilson, C.S.I., Settlement Commissioner, Punjab, 1901)
"The annual rainfall rapidly decreases as the distance from the Himalayas to the south-west increases, and soon a zone is reached below which cultivation by means of the local rainfall only becomes precarious. Accordingly cultivation was then, in part of the Province, confined almost entirely to the valleys of the rivers, where it could be carried on by means of the river-floods, of these small inundation canals, or of wells. ...........

My recommendations therefore are that the Punjab rivers should be carried as far to the east and south as possible; that where rainfall is good or the underground water level sufficiently near the surface to make irrigation from wells practicable, canal water in the winter season should gradually be refused; that every possible encouragement should be give to the sinking of wells, and more particularly........ we should gradually take into our canals more and more of the flood waters of the rivers and spread them far over the country."

(J. Wilson, Settlement Commissioner, Punjab, 22nd October 1901)
The Census Report of 1921 in its section on area, population and density played down any role of soil suitability or fertility in dictating the location of canal colonies to be built.

“Cultivation in the Punjab is affected more by rainfall and irrigation than by difference in the soil...” (Census of India, 1921. Volume XV. Punjab and Delhi, Part I, 1923)

“On what may be called the Northern Plateau, north of the Salt Range, comprising the Jhelum and Rawalpindi districts, and parts of Shahpur and Hazara, the country is so cut up by hills and ravines that it is impossible to construct large canals or to sink many wells, and although the rainfall is towards the south of the plateau, comparatively scanty and uncertain, the crops are almost entirely dependent on the local rainfall..”

— (J. Wilson, C.S.I., Settlement Commissioner, Punjab, 1901)
“Portions towards the south are either not cultivated at all, or are barren and covered with jungle and sandy waters; and yet the soil is friable and has for the most part a fair admixture of loam and sand, requiring the command of water only to fit it for the highest cultivation. Scarcely a stone is to be found, and the land when turned resembles the finest garden soil. If schemes for the supply of water which are understood to be in contemplation, and partially commenced should be carried out, these parts of the Punjab may be made, in time as productive as any other...”

— (Lieut. Colonel G. B. Tremenheere, Superintending Engineer Punjab, Note on the present state of agriculture in Punjab, dated 25th September 1852)
Main Proposition

The more distant is a Punjab’s region from the Himalayas and the more rainless it is, the more profound was the impact of canal irrigation. Canal colonization had a deeper and more enduring impact in the rainless tracts of Punjab.
Is the impact of canal colonization conditioned by rainfall patterns?

- High rainfall regions => lower levels of land inequality => lower impact of canal colonization

- Low rainfall regions => higher levels of land inequality => higher impact of canal colonization
Did the impact of canal colonization reinforce land inequality?

- Canal colonization in Punjab converted land into a coveted economic and political asset
  
  => Reinforced land inequality and entrenched existing elites

- Crown wasteland that was now cultivable through extensive irrigation tracts was distributed by the British to Punjab’s loyalist classes

  => upper segments of agrarian hierarchy, influential political families, and retired military personnel.
Windfall gains for controllers of agricultural land

Average price per acre of cultivated land

- 1865-70
- 1875-76
- 1880-81
- 1885-86
- 1890-91
- 1895-96
- 1900-01
- 1905-06
- 1910-11
- 1916-17
- 1919-20

0 50 100 150 200 250 300
Tracing the impact on political economy

- Ali (1988) highlights the colonial motives behind canal colonies, which ultimately shaped institutions in this ‘hydraulic society’.

- Land Alienation Act 1900 systematically excluded the landless and lower caste peasants from the land market.

- Three key motives highlighted by Ali (1988):
  - political entrenchment;
  - revenue extraction and
  - military recruitment.

- Lavish land grants to world war veterans and retired military personnel served as an important inducement for recruitment.

  => By the early to mid-twentieth century, Punjab contained less than 10 percent of the total population of British India but contributed more than half the recruits in Indian Army.
The political economy of canal colonization - II

- Imran Ali: The triad of military, civil bureaucracy and landlords — whose power was consolidated by canal colonization — held the levers of governance long after the British left.

- The agrarian structure left by the British in Punjab — and its associated political economy — became a precursor to the political domination of the military and landed aristocracy.

- Land continues to be unequally distributed: 2 percent of households own more than 40 percent of land, with large landowners controlling 66 percent of the agricultural land.
A deeper imprint on the rainless tract

- The rainless tract became a focus of canal building activity.

- Limited cultivation prior to the construction of canals

- Population density was lower as a result: nearly four times lower than tract C

- Canals brought windfall gains to those who owned land and those who received land grants.

- With canals came landless migrants and sub-tenants
Rainfall and landlessness

[Graph showing a scatter plot with points marked for various locations and a fitted line representing the relationship between average grain and prop_muzaara.]
Canal irrigated regions have a greater share of landlessness today.
Land inequality and growth of literacy
Greater share of uncultivated land in low rainfall regions
Regions that were historically uncultivated contain a greater share of landless peasants today

coef = .13506729, (robust) se = .05326066, t = 2.54
Land continues to be an important political asset
Persistence of political elites

<table>
<thead>
<tr>
<th>Region</th>
<th>Agriculturists</th>
<th>Presence in at least two assemblies</th>
<th>At least two relatives in Politics</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>0.709</td>
<td>0.4336</td>
<td>0.249</td>
</tr>
<tr>
<td>West</td>
<td>0.769</td>
<td>0.494</td>
<td>0.227</td>
</tr>
<tr>
<td>North</td>
<td>0.393</td>
<td>0.276</td>
<td>0.053</td>
</tr>
<tr>
<td>Centre</td>
<td>0.503</td>
<td>0.417</td>
<td>0.142</td>
</tr>
</tbody>
</table>
Key arguments

- We argue:
  
  - that the political economy of the colonized regions was shaped in significant ways by the process of canal colonization.

  - by radically altering the political economy of the region, canal colonization serves as an important historical basis for regional comparisons.

  - canal colonization can provide a possibly important explanation for why the development trajectory of colonized regions diverged so significantly from regions that had limited or no exposure to canal colonization.
Situating in global literature

- A growing body of literature highlights the role played by geographical conditions in shaping colonial policies, which in turn shape development outcomes.


Colonization and development

- Acemoglu, Johnson and Robinson (2001): disease and development
  - viewing current institutions as a function of past institutions, it highlights the role of colonialism in shaping early institutions

- Colonial powers faced different geographic constraints in different parts of the world, necessitating different colonial strategies.

- Settler mortality rates, determined by the local disease environment, played a decisive role

- Colonizers often decided to settle in places where the disease environment was favourable. It is in these places where high quality institutions were set up.

- The basic claim is that institutions really matter and geography worked almost entirely through the establishment of early institutions that tended to persist even after independence.
Endowments and inequality


  - Highlighted the importance of factor endowments (e.g., soil suitability for wheat relative to sugar) in shaping colonial policies and patterns of initial inequality—both of which have lingering effects on development.

  - Basic argument rests on how soil suitability shaped crop choices and the resulting colonial policy in the Americas.

  - Land in Latin America was more suitable for the cultivation of sugar crops, which required large quantities of both land and labour.

  - This laid the foundation of an agrarian structure that produced slave plantations and a high degree of land inequality, thus creating conditions for extreme inequality, both economic and political.
Geography, history and development

- We explore how geography, as part of initial conditions, shaped canal colonization which in turn determined the political economy of post colonial Punjab.
- We seek to investigate:
  
  a) the role of geographic factors in shaping canal colonization
  
  b) the extent to which these geographic aspects can help explain contemporary regional differences in socio-economic performance.
  
  c) whether geographical drivers of canal colonization set Punjab apart from other parts of British India, and indeed, regions within Punjab