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Investment in Water Infrastructure and Withdrawal of Water in a Trans-boundary river basin: A study of Jammu and Kashmir in Indus River Basin

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Abstract

Water resource development is fundamental for reaping the multidimensional uses of water. Investment in Water Infrastructure is the most effective way of water resource development and bridging the demand -supply gap of water services. These investments become essentially crucial as the water resources flow across the political borders and threaten the sovereignty of nations. Jammu and Kashmir (J&K) is endowed with enormous water resources yet the transboundary nature puts a restriction on its utility. The history of rivalry and interdependencies among the riparian nations for cross boundary water resources has led to emergence of Indus Water Treaty to solicit cooperation. The treaty explicitly permits the use of west flowing rivers within the limits. As J&K is primarily drained by western rivers, the restrictions create a set back to the overall water resource development. This study critically examines the trans boundary nature of water resources in Jammu and Kashmir and the impact of the Indus Waters Treaty on J&K's water resource utilization, identifying major investments in hydropower, agricultural, and domestic water infrastructure. Using qualitative analysis of secondary data, including treaty frameworks and project reports, the paper assesses the benefits and limitations of current investments. Findings reveal that the confined availability of water resources still leaves a room for enormous economic progress of the region through water Infrastructure development. Yet a series of compliance measures, financial viability and disproportionate project allocation have hindered optimal water development. Nonetheless, strategic reforms in water governance and investment prioritization offer pathways for sustainable economic growth. The study contributes novel insights into managing transboundary water resources within constrained policy frameworks, emphasizing the need for adaptive, equitable, and sustainable water infrastructure development in politically sensitive regions.

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Introduction

Water is fundamental for the life and prosperity. A reliable access to water resources for sustaining livelihoods is crucial for water security in the region.[12] Several developed nations have secured benefits of growth and poverty eradication by prioritizing water sector development.[1,17] Water Infrastructure is the major ingredient for water resource development. Water Infrastructure is an inclusive term comprising of any structure, natural or artificial, that provides accessibility, storage, regulation or conservation of water resources.[26] Water Infrastructure is instrumental in capturing the dynamic uses of water resources and reaping social, economic and environmental benefits.[20] The term broadly includes hydropower structures for power benefits, the domestic services for providing health and well-being to the residents, flood control and irrigation infrastructure for securing the livelihoods of agriculture dependent households.[10,56] The capital-intensive nature of water infrastructure calls for a significant level of investment.[53] Investment in water infrastructure provides the finances for bridging the gap between the demand and the supply of water services. Substantial investments in water infrastructure can be integral in shaping the economic architecture of the regions.[9]

However, these investments become uncertain when water cannot be encompassed in the geographical boundaries of a region.[16] As the water resources cross the political borders, the sovereignty of the nations/ regions over water resources gets challenged.[52,62] The stake of Water sector development in these kind of water resources is decided by the level of cooperation among the riparian parties.[18,58] This transboundary nature of water resources amplifies the cruciality of investment in water infrastructure for securing regional interests.[30,54,63]

Water resources in the Union Territory of Jammu and Kashmir are present in enormity. The vast endowment of water resources can be a source of prosperity and economic development of the region. However, the political and topographical characteristics of water resources restrict its availability to the region. The water resources in J&K are trans-boundary in nature, with Pakistan and China being the riparian parties.[60] The cross-border water resources in J&K have created social and economic interdependencies among the riparian countries. The history of rivalry among the two nations has catalysed conflicts, thus, troubling the overall development of water resources in both the regions.[21] To solicit cooperation among the rivals, Indus Water Treaty (IWT) was furnished in 1960 with both the parties being signatories to it. Indus Water Treaty divides the Indus River system into East flowing rivers comprising of Beas, Ravi and Sutlej and West flowing rivers comprising of Chenab, Indus and Jhelum.[25,33] The treaty grants exclusive rights over East flowing rivers to India, while the jurisdiction over West flowing rivers is subject to permissible boundaries.

Jammu and Kashmir is traversed by the west-flowing rivers of the Jhelum and Chenab, thereby providing the Union Territory with significant water resource potential. However, the extent to which this potential can be utilized is constrained by the provisions of the treaty.[36,44] Despite the limited availability, the state has enormous resource potential for developing water infrastructure to facilitate economic progress in the region. The study looks into the trans boundary nature of water resources in Jammu and Kashmir through Indus Waters Treaty and gives an insight about the levels of investment in water infrastructure and water withdrawal in Jammu and Kashmir of Indus River Basin (IRB).

Details of the Study Area and Methodology

Indus River Basin plays a crucial role in shaping the socio-economic outlook of several countries in South Asia. The river is spread across four major countries of Afghanistan, China, India and Pakistan draining total area of 1,165,000 Square Km.[7] The percentage share of each country in the Indus River basin is presented in Figure 1.[7] Pakistan (47%) and India (39%) are the two leading stakeholders of the Indus waters. The incidence of partition and increased rivalry among the two major shareholders of Indus River demanded a pact to govern the transboundary nature of the river. The dispute settlement among India and Pakistan led to origin of Indus Waters Treaty in 1960 thus, dividing the rivers into western and eastern tributaries.[55]

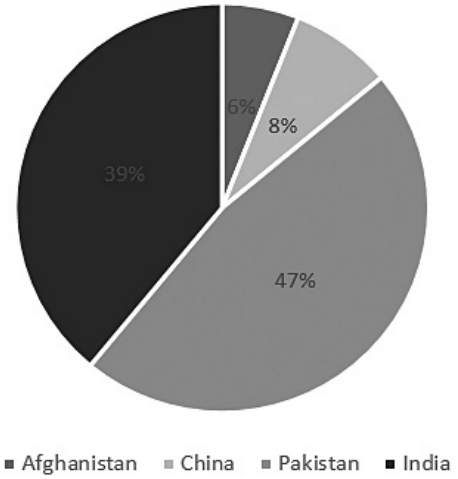


Fig. 1: Country Wise Share in Indus River Basin

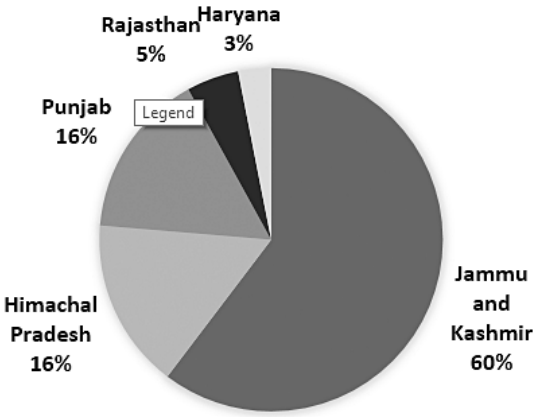


Fig. 2: Region Wise Share In Indus River Basin Within Indian Territory

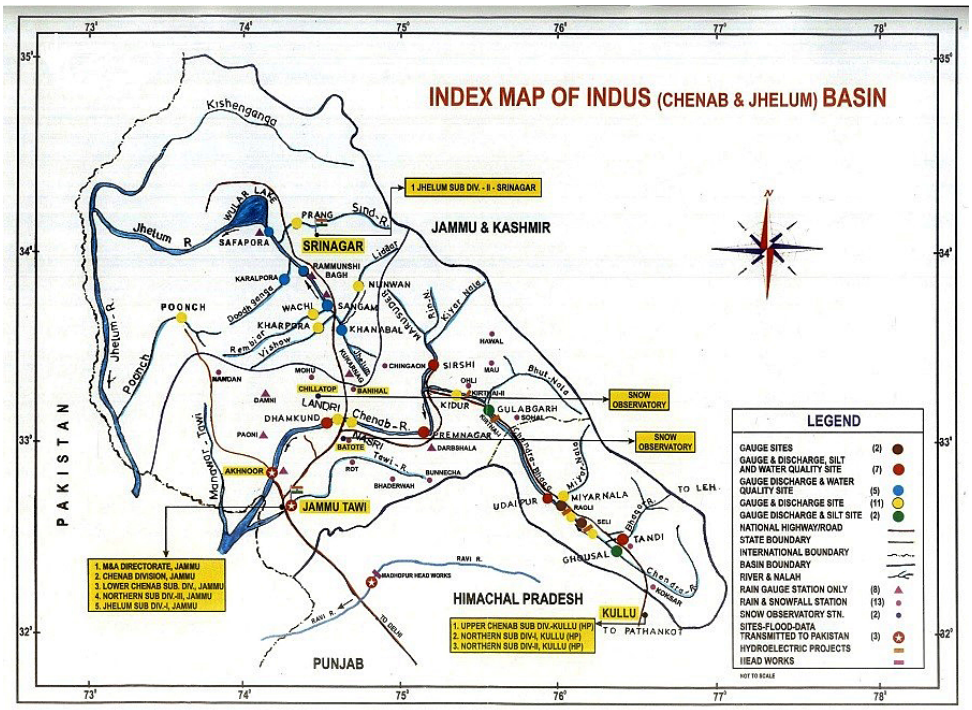


Fig. 3: Map of Indus River Basin within Jammu and Kashmir
Source: CWC, 2019

India comprises of 39 percent share in the total basin area and sustains the population of 4,40,000 belonging to the states of Jammu and Kashmir, Punjab, Himachal Pradesh, Haryana, Rajasthan and Chandigarh.[24] The region wise share in Indus River Basin is presented in Figure 2. The Eastern rivers comprise of Beas, Ravi and Sutlej flow through all the major states of IRB and account for 11.1 km^2 before entering into Pakistan. India has access to unrestricted usage from the Eastern rivers. The Western rivers comprise of Chenab, Jhelum and Indus flowing through Jammu and Kashmir and Himachal

Pradesh. The total flow of Indus River in India from its western tributaries ranges to 232.48 km^3 of which 181.62 km^3 has its origin in China (78%) while 50.86 km^3 is generated within India (22%). Out of the total flow available to India from western rivers, nearly 74 percent is reserved exclusively for Pakistan and remaining 62.21 km^3 is available for restricted usage to India.[15] Water availability from the western rivers is permitted for non-consumptive purposes along with domestic, agricultural or hydropower usage in constrained terms.

Jammu and Kashmir hold 60 percent of the water resources in Indus River System belonging to India majorly contributed by west flowing rivers. The approximate 20 percent water available from the western rivers is significant for the overall socio-economic development of Jammu and Kashmir. The permissible use of Water is defined by Article III of the treaty. While the treaty permits unlimited domestic and non-consumptive usage of water, agriculture and hydropower sector are under the ambit of several provisions of treaty. The agricultural dependency of the population in quite high in these districts. Further, Hydropower sector holds key position in meeting the energy demand. Water resource potential of the river system can contribute significantly in restructuring the economy of these districts. However, for tapping this potential, a substantial amount of investment in water infrastructure must be furnished.

The study aims to analyse the Investments undertaken on Water Infrastructure in Jammu and Kashmir of Indus River Basin for the Hydropower, Agricultural and domestic water development and compares it with the benefits created in the respective fields. The introspection into the hydropower development in J&K is performed by analysing the existing pattern of investments undertaken in Power sector and forecasting it till year 2030. The data is expected to follow linear or non-linear exponential/ power/ polynomial/ logarithmic trend path. Thus, depending upon the nature of data, R square criterion is used as best measure for predicting the best fit trend and forecast the future values.[32,34,35] The benefits received by hydropower sector are examined by the forecasted trend lines of Power generation, Power purchased and Power sold within J&K. The pattern of gap between power/ energy demand and supply are forecasted for a period up to 2030 to understand the performance of hydropower sector. Overall Development of Agriculture in J&K under Indus water Treaty is analysed by comparing the forecasted figures of investments in agricultural sector with the pattern of net area irrigated in the union territory up till year 2030. The forecasted values of imports and population change. The domestic infrastructure development is assessed though the values of investment in water infrastructure and the benefits created in terms of access to safe drinking water for the households. The abovementioned values are forecasted till year 2030 to identify the nature of change.

Methods

The study employs a qualitative analysis of secondary data sources, including government reports, treaty documents, and project evaluations. A thematic review method is used to classify investments across hydropower, agriculture, and domestic water infrastructure sectors. The study further evaluates the compliance measures, financial viability, and distributional aspects of projects to assess their effectiveness in promoting sustainable development.

Results and Discussion

Hydropower Development in J&K under Indus Waters Treaty

Hydropower sector is one of the sectors that guarantees sustainable and clean energy along with efficient energy usage.[4] A well-established hydropower sector can lay strong foundation for social and economic prosperity of any region.[3] In Jammu and Kashmir, the hydropower potential is bound due to the legal architecture of Indus Water Treaty. Article III of the Indus Water Treaty prescribes the provisions regarding construction, designing and operation of Hydropower projects. General storage capacity for Chenab and Jhelum main is not permissible except for the run off river projects prescribed in the treaty. Chenab has a power storage capacity of 0.60 million Acre Feet (MAF) from its tributaries and main river individually. Flood storage capacity for Chenab River and its tributaries ranges to Nil. Indus's river has 0.50 MAF permissible general storage capacity and 0.15 MAF power storage capacity. Tributaries of Jhelum have general storage capacity of 0.50 MAF, power storage capacity of 0.25 MAF and Flood storage capacity of 0.75 MAF permitted.[25]

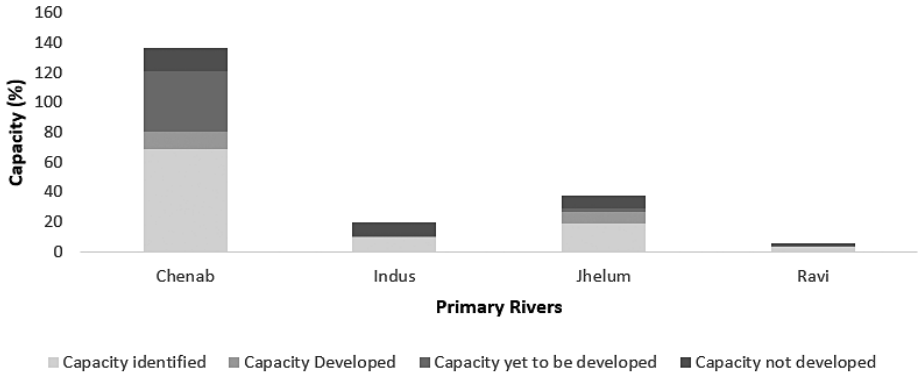


Fig. 4: River Wise Break-up of Hydropower Capacity
Source: Central Electricity Authority [CEA], 2019

Investment in Hydropower Sector in Indus River Basin (IRB)

The permissible hydropower generation capacity under Indus Water Treaty stands around 20,000 Megawatts. Out of the available amount, nearly 82 percent has been identified as capable of generation amounting to 16475 Megawatts. The figure 3 displays the River Wise Break-up of the Hydropower Capacity Identified, Developed, yet to be developed and not exploited under Indus Waters Treaty in J&K.[45] Chenab River Basin holds the highest potential in terms of hydropower generation ranging to 11283 MW (68 percent). Second highest potential of hydropower generation is possessed by Jhelum River with a capacity of 3084 MW (19 percent). River Indus possesses 1608 MW (10 percent) capacity for hydropower generation followed by Ravi River which has the least contribution in hydropower generation ranging to 500 MW (3 percent). With a huge potential for hydropower generation, it becomes crucial to develop a resilient and sustainable water infrastructure to tap the resources.[42] However, there are stark differences in the identified and developed capacities in the four river basins. The utilized capacity is especially low for Chenab (17 percent) river basin despite its significant potential within the UT. The utilization has improved on Jhelum River Basin (43 percent) with the commission of Kishanganga hydropower project in 2018. Another matter of concern is depicted by the high figure of the capacity unrecognized for the river basins within J&K, thus leaving a huge scope for development of hydropower in the territory.

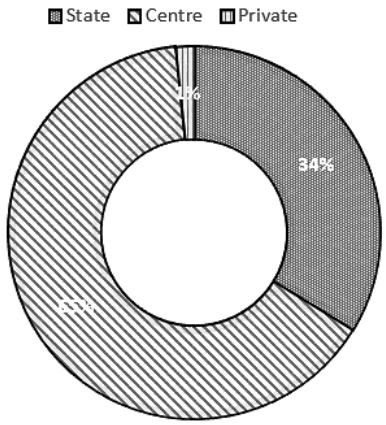


Fig. 5: Contribution of Centre, State and Private Sector in Harnessing Hydropower Potential from the Rivers Under IRB in J&K
Source: CWC, 2019

The contribution of Centre, State and Private sector.[28] in harnessing the potential is displayed in figure 5. The exploited potential values around 3617.46 MW, constituting 22 percent of the available potential. The share of Centre in development of hydropower sector is highest ranging to 65 percent with an aggregate capacity of 2250 MW through 6 projects. The state has developed 34 percent of hydropower sector with the capacity of 1197.4 with 13 projects while the private sector contribution is very low ranging to 1 percent contributed by 5 projects of aggregate capacity 57.50 MW.

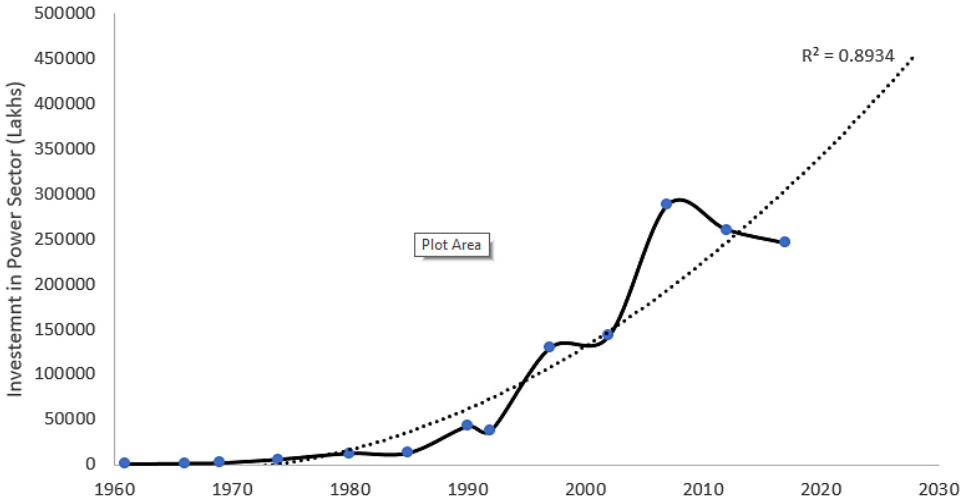


Fig. 6: Investment in Power Sector in J&K since 1961 and the forecasted trendline till 2030
Source: Digest of Statistics, 2019[23]

The investment in hydropower in the union territory of J&K under Indus waters Treaty is assessed through corresponding figures of investment in Power sector in the region. This is due to the fact that Hydel sector is the leading contributor of the power (78 percent). Figure 6 displays the investment figures of the power sector undertaken in J&K along with the trendline forecasted for the coming years till 2030. The investment pattern has displayed a tremendous increase beyond year 1985. This increase is attributed to the multiple hydropower projects initiated by the state as well as Centre on the western rivers. Further, the forecasted path follows a second-degree polynomial regression and portrays a buoyant scenario for the power sector with massive upsurge in investments (R square = 89.85). Indus river occupies a crucial position in shaping the economy of J&K.

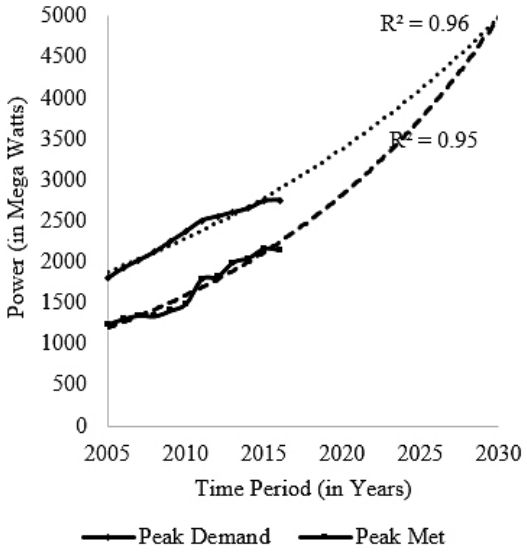


Fig. 7: Gap in the demand and supply of power in J&K
Source: Digest of Statistics, 2019[23]

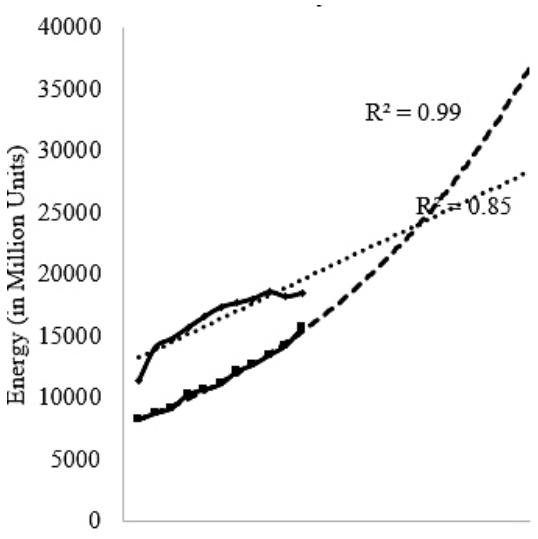


Fig. 8: Gap in Energy Demand and Availability in J&K
Source: Digest of Statistics, 2019[23]

Evaluating the Economic Benefits Generated by Hydropower Sector

The benefits of the hydropower sector in the Union Territory of Jammu and Kashmir can be evaluated on the basis of contribution in power generation and dependency of the union territory on the Centre and other states for Power. Annexure D and E explicitly curtails the hydropower capacity of the western rivers by allowing the build of 'run off river' projects only within specific storage limits.[25] This has a direct incidence on the performance of the power sector as hydel potential is the leading bearer of power in the UT.[14] The economic benefits of the existing investments in hydropower sector are evaluated through the demand-supply gap in power and energy and power generated, sold and purchased for a period up to 2030 in J&K.

The evidences of the crisis are well pictured in the figure 7 & 8, displaying the gap between the demand for power and energy in comparison to its availability respectively.[13,14] The power demand is compounding at 8.8 percent and is likely to exhibit a huge rise due to high patterns of urbanization and industrialization experienced by J&K. The power demand curve is following a power regression line (R square = 95.03). The power availability curve is also following a rise and forecasting an elevated path with exponential trendline (R square = 95.22). However, the gap between the demand and supply does not show chances of diminishing with passage of time. The energy demand curve is growing at a moderate pace exhibited by logarithmic regression line (R square = 85.2). However, the energy availability curve presents a relatively better scenario than power availability depicted by exponential trend line for the coming years (R square = 99.41). The forecasted lines predict that the gap between the energy availability and its demand is likely to narrow down in coming years due to several upcoming renewable alternatives to energy development, yet the situation is grim.

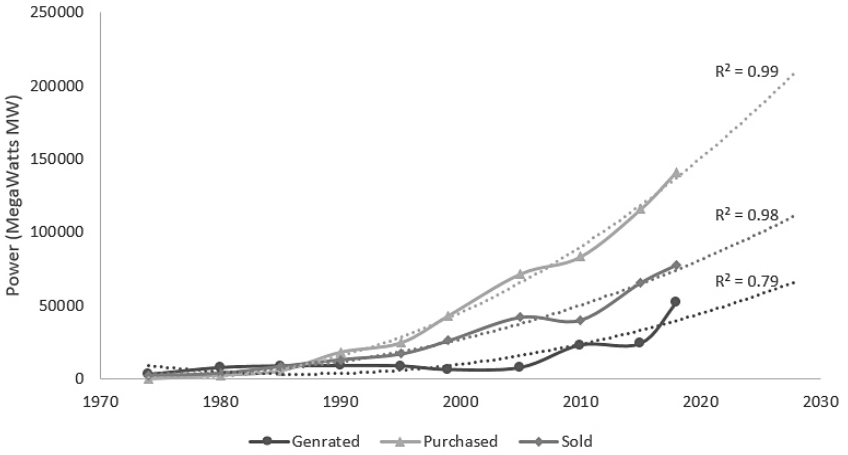


Fig. 9: Power Generated, Purchased and Sold along with forecasted trend lines in J&K
Source: Digest of Statistics, 2019[23]

Figure 9 depicts the five yearly observations of the power generation, power sold by the department and the purchases made by power sector [11] along with their respective trend lines forecasted till year 2030. The power generation curve displays an optimistic scenario for the power sector as the generation is following an increase in coming years as depicted by second degree polynomial regression line (R square = 78.76). The curve for power sold by the sector is moving upwards beyond 1990s and polynomial regression line predicts a similar movement for the coming years (R square = 97.68). A matter of concern is posed by purchase curve of the power sector as forecasted by second degree polynomial regression line (R square = 99.41). The curve has followed a significant increase beyond the year 1995 and the movement of the forecasted line is following a massive rise further.

The primary cause for the high purchases is shortage in availability existent due to the variation in water flows during winters creating a shortfall of reservoir storage and the topographical constraints posing accentuating the technical and commercial losses in transmission.[41] Secondly, the fiscal capacity of the union territory does not prove to be adequate for undertaking new investments in hydropower infrastructure. It is evident from the rate of growth of revenue recovery by the power sector averaging around 67 percent since 1970s. Thirdly, a large part of these purchases is made from NHPC which is responsible for generating 32 percent of the total capacity within J&K.[37] Yet the UT has to purchase the power at regular tariff as approved by centre. This rise presents a state of crisis for power sector as the massive purchases has raised a huge burden on state exchequer.[43] Further, Following the trendlines, the revenue deficit is likely to put the state in trenches of backwardness.

Water Infrastructure for Agricultural Development in J&K under Indus Waters Treaty

Water is a vital input in the agricultural sector. It is a time-tested phenomenon that better irrigation facilities can alter economic and the social outlook of the region.[48] Intensification of irrigation activities can make the regions food secure.[22] On the contrary, the absence of irrigation facilities can deprive the households from economic and social prosperity. Role of irrigation facilities becomes essential for developing countries where dependency on agriculture is high.[2,40] Thus, it becomes crucial to facilitate investments in irrigation water infrastructure to impact the long-term welfare of agriculture dependent population.[6,39]

Indus River has been an integral source in laying firm roots for agricultural development over centuries. The river has sustained a vast amount of population through its extensive drainage system.[49,59] Expansion of the irrigation facilities through comprehensive canal infrastructure had fetched economic prosperity in United India. However, the division of the nation challenged the living of several households from both the nations feeding on the integrated canal network.[46] The demarcation of the boundaries after partition facilitated Pakistan with nearly 80 percent of the irrigated land under Indus River Basin and a supposed privilege of being upper riparian to India.[5] With a threat to livelihoods of million households in the two countries due to unjust water allocation, conflict became inevitable. To bring out the integrated development of transboundary river and comprehensive mechanism of water sharing, Indus Water Treaty was signed in 1960.[50] The eastern rivers under the treaty are exclusively available to India and has developed a strong agricultural base. However, the western rivers are permitted for restricted use to India. The narrow availability increases the economic plight of households as these western rivers drain nearly 68 percent of the region in J&K.[36]

Table 1: Maximum Permissible Area for Irrigation from West Flowing Rivers under Indus Waters Treaty

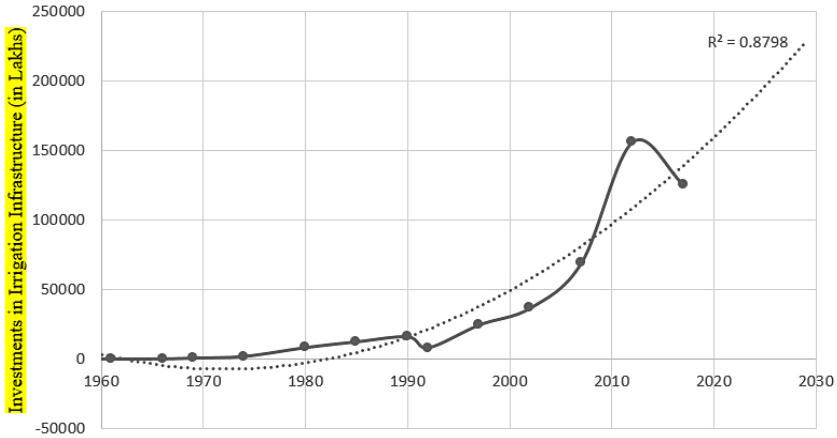
Sno.		Maximum Irrigated Cropped Area (acres)
1.	Chenab Drainage Basin	2,25,000 (not more than 1,00,000 in Jammu District)
	Outside the Chenab drainage basin in the area west of Devak River (aggregate capacity of irrigating channels not exceeding 120 cusecs)	6,000
2.	Indus Drainage Basin	70,000
3.	Jhelum Drainage Basin	4,00,000

Agriculture is a substantial contributor in state domestic product and generation of employment. The effective utilization of the water potential in western rivers through irrigation water infrastructure can lay a firm ground for securing fortunes of numerous households in J&K. However, the gifting of water resources in J&K to Pakistan under Indus Water Treaty has undermined its agricultural potential.

Table VI defines the maximum permissible area for Irrigation to India from the western rivers under Indus Water Treaty. Jhelum river holds the potential of irrigating 4,00,000 acres of cropped area. Indus river holds the lowest potential of 70,000 acres. Chenab river has 2,25,000 acres of permissible area for irrigation. Out of the total permissible area, reservation for Jammu and Kashmir ranges to maximum limit of 1,00,000 acres. Further, 6000 acres of Devak river is permitted outside the Chenab drainage basin. Thus, the investments in the irrigation water infrastructure holds economic and social implications.

Investments in Irrigation Infrastructure

The agricultural land in Jammu and Kashmir is characterized by uneven terrains and low fertility. The only remedy for reshaping the agriculture in the state is through investment in irrigation infrastructure. The irrigation infrastructure can provide strong resilience against the topographic and climatic challenges.61 This segment identifies the investment initiated in development of irrigation and flood control infrastructure within J&K under Indus Water Treaty.



Fog. 10: Investment in Irrigation and Flood Control Infrastructure in J&K since 1961 and trendline forecasted till 2030

Source: Digest of Statistics, 2019

Figure 10 depicts the values regarding investment in irrigation and flood control initiated within the union territory since the inception of Indus Water Treaty11 along with the forecasted line till 2030. The investment values display a significant upward movement beyond 1990 and soring high in year 2012. The trendline for the investment figures predict a continuously rising pattern with second degree polynomial regression (R square = 87.98). The investments in the irrigation potential exist through minor, medium and major irrigation schemes depending upon the size of command area along with Ravi- Tawi Irrigation Scheme. These funds are laid under Pradhan Mantri Krishi Sinchai Yojana (PMKSY), Border Area Development Programme (BADP) and several state and Centre schemes sponsored by NABARD.14 Investment in irrigation is accompanied by central and state sponsored funding for flood control projects to protect the agricultural lands from excessive water flow into the fields.

Evaluating the Economic Benefits generated by Water Infrastructure in Agricultural Sector

The Indus Water Treaty has adverse implications for the agricultural sector of Jammu and Kashmir. The contribution of agriculture in GDSP has remained low despite of the primary agrarian nature of union territory.[51] As a consequence, the irrigation potential of the region remains unexploited. The economic benefits of investment in irrigation infrastructure are evaluated by observing the trend of Net area irrigated in the Union Territory since the inception of IWT. Further, the food dependency of the region is compared with the population change to picture the scenario of impeding agricultural crisis in J&K.

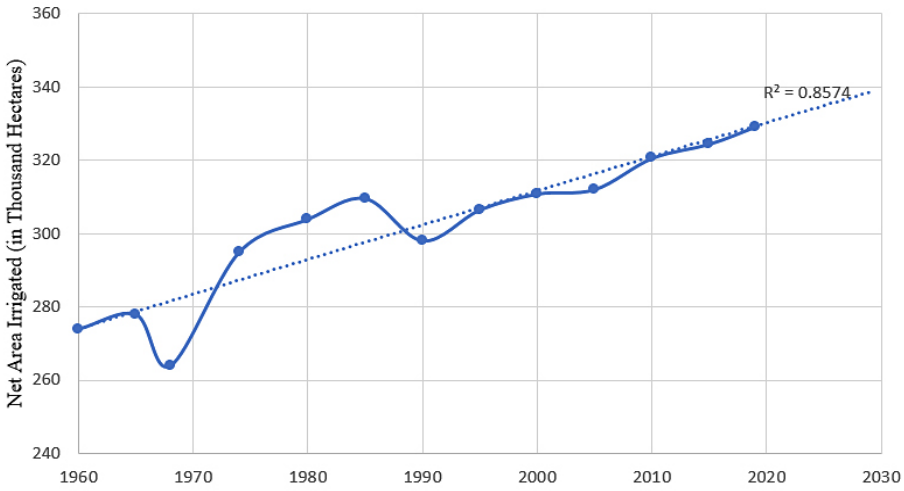


Fig. 11: Net Area Irrigated in J&K since 1961 and trendline forecasted till 2030
Source: Digest of Statistics, 2019

Figure 11 depicts the figures regarding the net area under irrigation with the UT[11] along with trendline predicting the pattern till 2030. The irrigated area curve follows an upward movement. However, the compound rate of growth in the irrigated area is merely 2 percent. Further, the polynomial regression line (n = 2) predicts a similar growth pattern for the coming years (R square = 85.74). The marginal rate of growth of irrigated land depicts the bleak situation of agriculture in the region. Despite the enormity of resources, the progressiveness of agriculture is not achieved. The low state of agriculture has impacted the economic capacity of the union territory through increased dependency on other states for basic food needs.

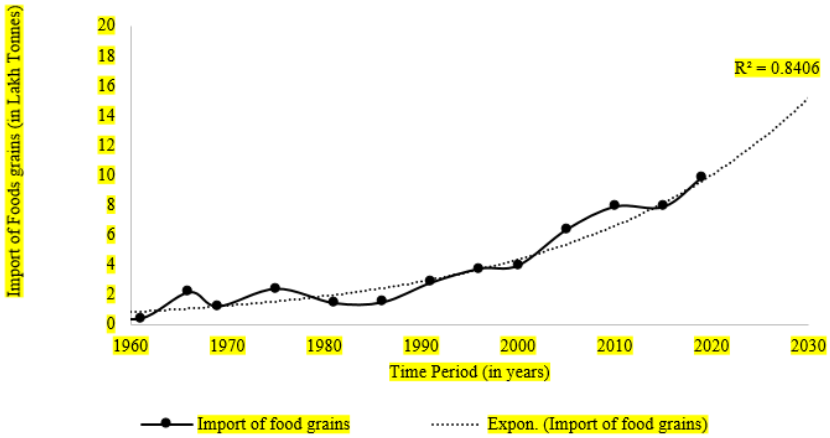


Fig. 12: Import of Food Grains and Forecasted trendline till 2030

Figure 12 pictures the scenario of imports of the food grains by the region since the formulation of treaty[11] along with its forecasted values till 2030. Figure 13 depicts the population change[11] for the same period of imports along with its forecasted trendline. The imports are increasing at an exponential rate with compounded figure ranging to 31 percent. The exponential trendline for the imports also predict the growth in similar fashion (R square = 95.06). On the contrary, the population is expanding simultaneously.

The meagre increase in irrigated area to feed the constantly rising population is the major reason contribution to the sharp rise in imports of food grains. The two figures reveal the difficulties that the region is going to face in sustaining the food needs of its population. This is likely to put a heavy burden on the finances of the region. Further, the treaty compliments the agricultural crisis as it is obligatory to seek permission for every new irrigation programme. The above-mentioned reasons contribute the social and economic backwardness of the region.

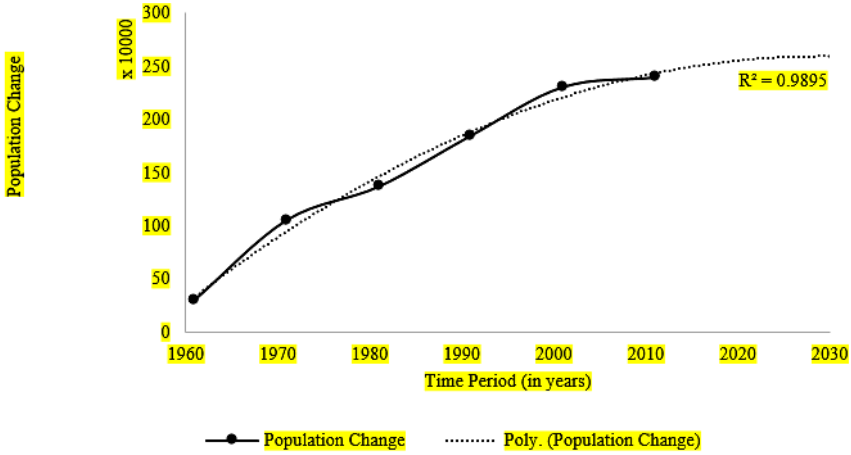


Fig. 13: Population Change in J&K and Trendline till 2030
Source: Digest of Statistics, 2019

Domestic Infrastructure Development in J&K under Indus Waters Treaty

Establishing a water secure community requires prioritizing domestic water supply in water infrastructural development.[19,47] Access to sufficient quantity of water has been accepted as fundamental for ensuring sustainable development globally.[31] Yet a significant population fails to secure suffice water access for basic minimum needs. The deficient domestic water availability poses a threat to the livelihoods making the communities highly vulnerable to social and economic crisis. Thus, investing in domestic water infrastructure is essential for meeting the gaps created due to water deficit for domestic usage.[27,57] Water Supply for domestic purposes in Jammu and Kashmir varies from abundance to rarity. The region displays an extreme scenario with respect to natural water availability owing to the climatic and topographical conditions. As a consequence, several districts within the union territory are running out of water even for essential needs.[8,23] The situation requires strong supply side initiatives in the form of domestic water infrastructure investment.

With respect to domestic water supply in Jammu and Kashmir, the onus is with the Public Health Engineering Department for the development and management of the resource withing the territory. Further, the Indus water treaty that governs the water resource in J&K permits uncompromised domestic water usage. Yet the water sector is facing a major challenge in providing full domestic water coverage due to the expansive urbanizing patterns and increased demand from agriculture. The unanticipated changes in the climate and existing rate of withdrawal of groundwater accentuate the threat to the water potential within the union territory.[38] The Augmentation of domestic water supply in the urban and rural areas of the territory is sponsored by several central level initiatives. National Rural Drinking water programme (NRDWP) is one such major central level initiative to strengthen the drinking water infrastructure and amenities in rural areas. Similarly, domestic water usage in urban areas is funded by Accelerated Urban water supply programme under JNNURM replaced with AMRUT. Apart from this, several state and district level initiatives are sponsored by LIC, NABARD and several international funding agencies such as ADB, JICA etc.[14]

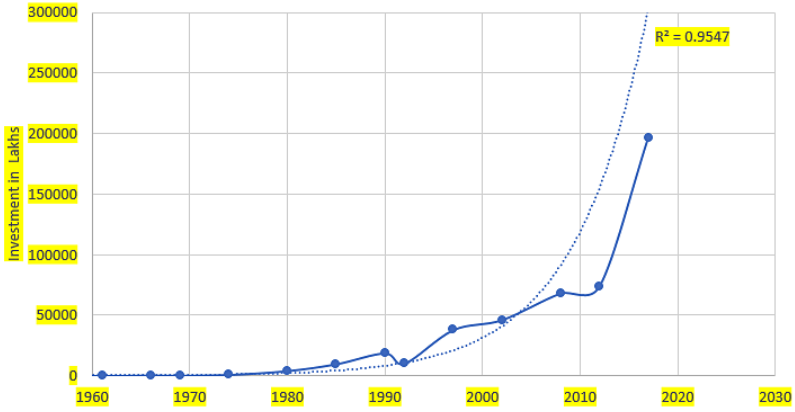


Fig. 14: Investment in Domestic Water Infrastructure in J&K since 1961 and Trendline forecasted till 2030
Source: Digest of Statistics, 2019

Investments in Domestic Water Infrastructure
Figure XIII displays the yearly investment patterns initiated by Public Health Engineering Department[11] along with the forecasted trendline. The Investments initiated by the PHE department has followed an upward trajectory. The data pattern fits the best with exponential trendline possessing maximum R square. The exponential fit reflects the constantly increasing investment patterns towards the domestic water supply for rural and urban areas. While the investments began since the inception of planning, yet the significant drift is observed past 1990s. The rate of change beyond 1990s has risen drastically. Another point of transition is observed beyond the year 2012. The figures of Investment have grown two-fold beyond year 2012. Following the trend line, the values are likely to upsurge at a high rate for coming 10 years.

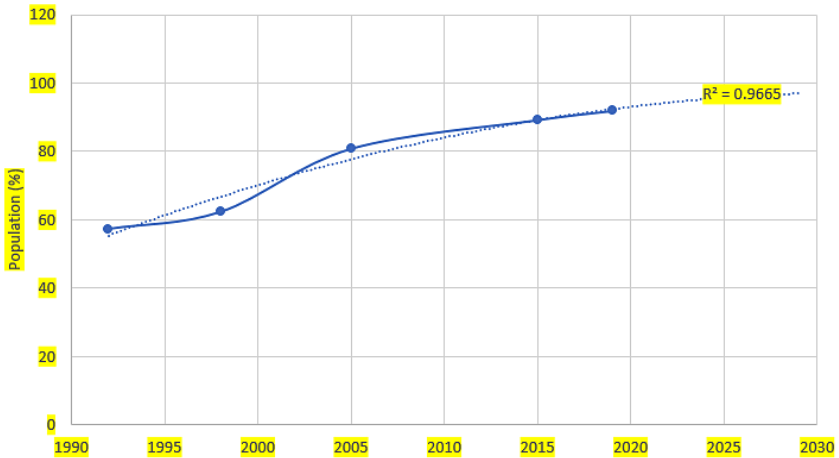


Fig. 15: Population covered with safe drinking water in Jammu and Kashmir
Source: Digest of Statistics, 2019

Evaluating the Benefits Generated by Investment in Domestic Water Supply
Figure 15 depicts the evidences of the increased investment in Infrastructure. It depicts the figures of population covered with sage drinking water in Jammu and Kashmir. The population cover with safe drinking water has followed a polynomial trendline with the maximum fit (R square = 96.65).

However, the coverage of domestic water supply does reveal the real facets of domestic water in UT. The lean supply of water from the existing surface water sources especially during extreme weather conditions and excessive pressure on the groundwater resources has accentuated the water stress for domestic purposes. Thus, in order to meet the deficiency of supply, the administration has proposed to divert Water from Chenab River to feed the water deficit areas of Jammu district. However, it is only through the appropriate management actions and strong governing decisions that the domestic water architecture can be furnished and water availability is ensured to everyone.

Conclusion

Investment in Water Infrastructure is the necessary step to rectify the supply deficit of water resources. Water Infrastructure development becomes highly crucial especially when transboundary water resources are involved. The state of water resources in Jammu and Kashmir is complex due to its trans-boundary nature. The direct consequence of the complexities is subjected upon the development of the union territory. The right step to address the complexity is to provide the necessary interventions in terms of water infrastructure investment. The study has identified the infrastructural development initiated on the cross-border water resources in Jammu and Kashmir under the governance of Indus Water Treaty with respect to three major sectors namely- Hydropower, Agriculture and Domestic Water Supply. The insights from the pattern of investments and benefits helps in building an understanding of the flaws that hinder the infrastructural development over water resources in the union territory.

The analysis reveals a grim scenario of hydropower development in J&K. As the Indus Waters treaty limits the usage of water resources in UT, the prospects for the development of hydropower infrastructure are already narrowed. Further, the constant disruption by Pakistan has slackened the infrastructural progress on the water resources in the region. Apart from the above-mentioned reasons, administrative setbacks have led to failure in tapping the vast potential of water resources. Huge technical losses due to topographical diversity, financial constraints on the expansion of projects and low entitlement from centre despite being a leading contributor are major impediments in the path of hydropower development within the union territory. Though the recent hydroelectric policy, 2017 has eased several measures for inviting new investments through joint ventures, the compliances still complicate the process financially and legally. It is only strengthened and integrated centre-state investment measures with a special emphasis on the public private partnership based micro hydel projects that can render economical and environmentally sustainable solution to the power crisis that the UT is heading. A series of investment measures in hydropower infrastructure can lay a firm background for the strong power sector and its multiplier effect on other sectors of the economy.

The agricultural sector is too in a dismal state. The investments undertaken to strengthen the irrigation and flood control measures within the union territory since the adoption of treaty have provided to be inadequate. The implications are depicted by the unmatched capacity of the agricultural sector in the region to meet the food needs of the continuous growing population. The solution to the poor performance of agricultural sector lies in the infrastructural development to facilitate the water deficit regions with the irrigation while keeping up with the provisions of treaty. The domestic water infrastructural development has performed comparatively well with respect to its coverage. However, despite good coverage in numeric terms, several regions in the UT suffer adversely with water stress due to vast topographical variations. As the water withdrawal for domestic purposes from in IRB is not confined to any limits, the investment measures need to be strengthened for universal domestic water facility in the union territory. Thus, the avenues of sustained economic development and optimal resource utilization in J&K can be defined by the infrastructural interventions with appropriate management and governance policies over the limited water resources available to the union territory.

Policy Suggestions

The transboundary nature of water resources in J&K has attracted conflicts and created demand supply imbalances. Thus, investment in water infrastructure is right step to rectify the water resource supply deficit and address the complexities of Water

resources. The avenues of sustained economic development and optimal resource utilization in J&K can be defined by the infrastructural interventions with appropriate management and governance policies over the limited water resources available to the union territory.

It is only strengthened and integrated Centre-State investment measures that can render economical and environmentally sustainable solutions for the strong power sector. The Hydropower sector must shift its focus on public-private partnership-based Micro Hydel Projects and reap its multiplier effect on other sectors of the economy.

The solution to the poor performance of the agricultural sector lies in the infrastructural development to facilitate the water deficit regions with irrigation while keeping up with the treaty's provisions. The investments in irrigational infrastructure can be useful in reducing import dependency of the Union Territory and thus, laying path for food security.

Regardless of the fact that the water withdrawal for domestic purposes from Indus River Basin is not confined to any limits, the investment measures are not significant enough to ensure secure domestic delivery. Thus, there is a need to build an expansive domestic water supply infrastructure for universal domestic water facilities in the union territory.

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