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Inland Water Transport in Pakistan: Limits and Prospects

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Abstract *The long-standing critical requirement of exploring alternate means to road and rail transport, for movement of essential commodities and commercial items, across Pakistan came to the forefront owing to various studies on the subject. This was reflected in the National Transport Policy, promulgated in 2018. Accordingly, the implementation of developing Inland Water Transportation Authority is in progress, as the government is expected to legislate on the matter. Inland waterways play a vital role in economic development, especially for remote rural areas. Focus on this sector would open new vistas of development along the banks of various waterways, and its extent can be enhanced in the regional context, up to the Kabul River in Afghanistan. This paper highlights the spadework done up till now and points at the impediments to making Pakistan's inland water transport system workable while proving a cost-effective solution to ever-increasing cargo traffic. The paper analyses the potential of the Indus River, along with various tributaries and canals associated with irrigation of the vast plains of Pakistan. The projected insufficiency of water throughout the year in the system is discussed considering available data and records based on historical perspective. The establishment of Indus Water Transport Company by the Government of the Punjab, and achievements thus far have been underscored.*

Key Words:
Inland Water Transport, Indus Basin, Waterways, Boats, Navigation, Irrigation.

Introduction

Waterways and channels have been the main routes of traffic and transportation of goods since the age of oars and sails. The big cities emerged along the riverbanks of Nile, Euphrates, Danube, Seine, Mississippi, and Indus, and were interconnected. In the nineteenth century, railways came into existence with the advent of the steam engine, and large railway companies started capturing most of the inland waterborne traffic. However, in some areas where railway lines were difficult to construct, waterways remained the preferred mode of transportation available for a long time (Mallon, 1960).

The inland water transport is an environmentally friendly, energy-efficient, and low-emission transport mode. This enables bulk transport at a lower emission discharge than road transport and can play a key role in establishing sustainable transport systems (Mallon, 1960). Water transportation is typically the least expensive mode to move large volumes of bulky and heavy commodities over long distances, such as raw materials for industrial and agricultural production. However, when the cargo origin or destination sites are not next to the waterways, the water transportation system requires a transfer system to another mode at one or both ends, involving the additional transfer and handling costs. This hybrid arrangement, though workable yet entails cost mitigation for roll on and roll off at transshipment points from water barges to line-haul trucks; the distance involved in each leg thus is the paramount consideration for adoption of such an arrangement.

In principle, the inland water transport system hinges on the availability of navigable water bodies, canals, or channels, free of obstructions and with sufficient depths along the route for the carrier, materials, and human freight (Lambert, 2010). According to Lambert, depth is a relative concept when talking about water transport, normally a channel depth of six to ten feet is considered suitable to allow navigability for medium-sized craft.

The Indus River system and the tributaries of Brahmaputra, in Indo-Pakistan Subcontinent, the Olga river in Central Asia, and most rivers in China, Europe and the U.S. have been utilized for transportation purpose. In comparison to other modes of transportation, inland waterways transport has an almost negligible effect on the ecological system. It is a safe, sustainable, and efficient mode of transport and is vital for economic development and prosperity of a country, capitalizing on this potential. Currently, inland water transport handles 46 percent of all inland freight in the Netherlands, 32 percent in Bangladesh, 14 percent in the U.S. and nine percent in China. In 2007, China's inland waterways transported 1.2 billion tons of cargo, compared with waterway cargo of 800 million tons in the U.S. and 500 million tons in the EU (Nagabhatla and Jain, 2013).

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Prospects of Inland Water Transport Development in Pakistan

The Indus River has been navigable, and till the late 18th century, the barges were sailing from Lahore to Thatha, with British officers on board. During this time, the British government felt the need to establish the most extensive irrigation system of the world, for use by the breadbasket of Indo-Pakistan, to support the agricultural economy. Thus, the canal and watercourses were designed and diverted toward irrigation. The newly established railway system shared the burden of transportation. After partition and in the wake of the Indus Waters Treaty in 1960, the per-capita availability of water on Pakistan's side of rivers was reduced drastically. The population explosion has further compounded the situation.

With over 200 million people, Pakistan annually generates a total domestic transport load of around 239 billion passenger-kilometres and 153-billion-ton kilometres. In-country trade comprises various agricultural products from fields to markets and industrial items originating from zones spread across the country. Accordingly, this load of domestic and international trade is supported by a 9,574-kilometre national highway and motorway network constituting only 3.65 per cent of the entire road network but carrying 91 percent of the national passenger traffic and 96 percent of the freight. Moreover, the freight density is likely to multiply manifold due to the Belt and Road Initiative (BRI), and the China-Pakistan Economic Corridor (CPEC) traffic. Therefore, a 350 percent increase in road length would be required to maintain the current density in the short and medium-term. With an average cost of over one million dollars per kilometre for a highway, a budget of around 35 billion dollars is required to maintain the current trade volume density. One hundred seventy billion tons per kilometre points to an over-stressed road network, and 35 billion dollars expenditure on road networks within the next eight years for Pakistan's feeble economy seems difficult (Shafique et al., 2018).

On the other hand, the Indus River, with its five tributaries and established canal system, provides a potential of 30,000 kilometres of inland waterways – three times more than the length of the current road networks. Further, the construction costs, logistic barriers, costs of land acquisition, community relocation and compensation, etc., would be absent in this case. The development of inland waterways, thus, could be explored as a potential transportation solution for the country (Hine and Chilver, 1991).

A country like Pakistan, with significant population centres, major agricultural producing regions and manufacturing areas near major rivers and canal systems, presents an opportunity to develop a commercial navigation network. Notably, an inland water transportation system along the Indus River, its tributaries and canals can reduce transportation costs to improve the competitiveness of existing products and help the government promote the selected zones along the water route for attracting developmental activities, in accordance with an overall long-term development strategy. The estimates of resultant cost saving vary in magnitude, but experts suggest that the establishment of the inland water transport in Pakistan may reduce fuel costs by about eight to 10 times compared to road transport and three to four times lesser than rail transport. To implement this vision, the Government of Pakistan approved three pilot projects, which included a hydrographic survey of approximately 200 kilometres length of the River Kabul/Indus between Jinnah Barrage and Nowshera to ascertain the feasibility of water transportation and availability of sufficient depths for safe navigation (Ali, 2013).

Although most of the previous studies were not optimistic about the economic viability of inland water transport in Pakistan, its technical feasibility was never a matter of great concern. Moreover, a significant change has occurred in the global economic environment. The cost of fossil-based energy is rising, both in financial costs and environmental/ ecological impact. These factors alone provide the requisite incentive for serious consideration of the inland water transport as an alternate mode of transportation. Further, considering the prospects of inclusion of inland water transport in CPEC has added a new dimension to the Chinese government's BRI. According to the Pakistani Planning Commission's Task Force on Maritime Industry, one litre of fuel carries a ton of cargo 20 kilometres by truck and 70 kilometres by rail, but 180 kilometres on water.

Moreover, to carry 1,500 tons over 200 kilometres, 60 trucks would consume 15,000 litres of fuel, while three trains would consume 4,200 litres. A single waterborne barge would consume only 1,600 litres of fuel (Khan et al., 2016). Likewise, building a kilometre of a standard 24-feet wide road costs 80-100 million rupees. Therefore, the cost of commissioning the entire 200 kilometres of the proposed Indus Pilot Project is less than 100 million rupees. Similarly, the maintenance of roads - averaging one percent of construction cost -requires billions of rupees every year, but the maintenance cost of waterways would barely be 20 percent of the maintenance cost of roads. The roads in Pakistan are designed to have a life of ten years, but this is reduced significantly since the damage caused by a single container truck is equivalent to 1,500 to 2,000 cars. Therefore, by utilizing a waterborne transport system, the CPEC can benefit both in terms of upfront costs and future maintenance. Consumers and producers would be the direct beneficiary in terms of reduced prices, as the cost of production would decrease. Farmers in the Punjab and Sindh could also benefit from water transport by swiftly transporting fertilizers and agricultural produce to the markets.

Waterway Transport in the Indus Basin

The Indus River is the most significant supplier of water to Pakistan. The British introduced the modern irrigation system in the Indo-Pakistan Subcontinent around 1850. Anticipating the shortage of water in eastern rivers after the Indus Waters Treaty in 1960, several link canals were constructed that connected the east half with the western half. The riverine and canal system is spread over 30,000 kilometres and physically connects the country.

Waterborne transport dates to the British era, due to the non-existence of concrete roads and railway network when Indus Flotilla Company was established in 1847. Boats were utilized to transport cargo on the rivers of Pakistan. Eventually, the British neglected inland water transport and focused on the development of railways. For instance, the non-construction of navigation lock in Sukkur Barrage practically stopped the water transport on either side of the Indus River.

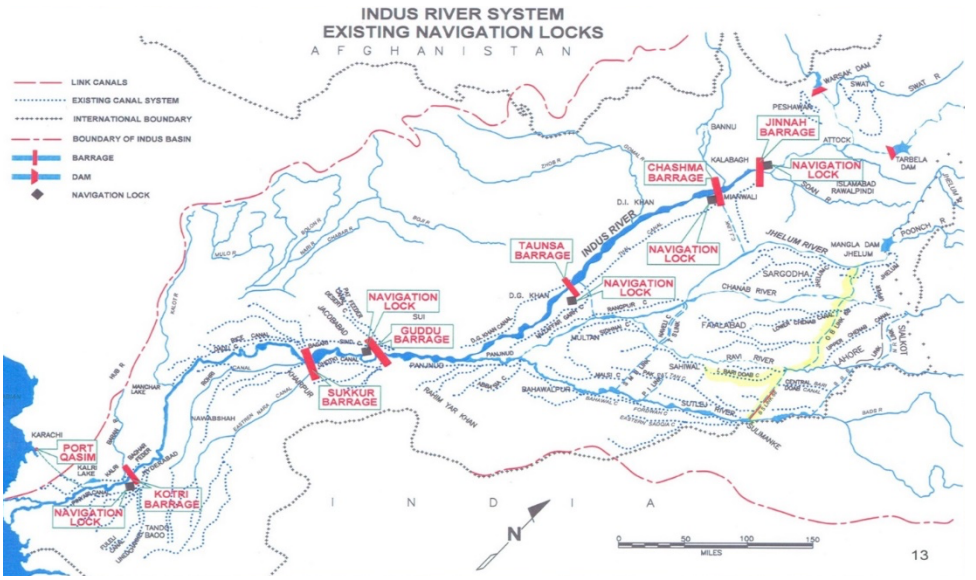

Figure 1: Indus River system existing Navigation Locks.

Although Pakistan is gifted with an extensive riverine and canal system, the dream of an inland water transport system could never be realized. In the early 1960s, a Presidential Order was issued to study the viability for re-establishing inland water transport along the Indus River. Both strategic and economic aspects were considered. Strategically, both rail and road transport were deemed vulnerable, firstly because they ran parallel to each other. Secondly, the only link between Punjab and Sind on the Indus River was in the shape of a railroad bridge linking Kotri on the East bank and Sukkur on the West bank. Initially, inland water transport was analyzed as an extension to the construction work under the Indus Waters Treaty.

In 1962, a comprehensive survey for integrated transport network was carried out. The survey mainly relied on Tipton and Kalmbach, Inc., and stated that the depth of the Indus River was mostly limited to three feet in the dry season. Few cities such as Sukkur and Hyderabad were in close proximity to the channel. All barrages on Indus had locks except the Sukkur barrage. The waterborne traffic mainly comprised logs rafted from Kalabagh to Sukkur and subsequently to Hyderabad in the southern direction. This study finally concluded that the possibility of large-scale inland water transport in rivers and canals of (West) Pakistan was not promising (Masood et al., 2016).

The International Sedimentation Research Institute Pakistan (ISRIP), in a study in 1963, stated that the inland water transport had been wholly neglected in the past. However, the study proposed a three-pronged strategy that included providing links via rail and road routes from Karachi to up-country main cargo centres, while simultaneously incorporating the maximum usage of natural channels of transportation. In conclusion, it was highlighted that navigational facilities were missing in the existing riverine system of Pakistan, and significant technical and logistics problems were expected during installation/ construction. Moreover, several crossings at regular intervals and substantial operation and maintenance costs may render the project cost ineffective.

In 1963, the suggestions mentioned above were validated by Mr. Mohiuddin, the general manager (planning) of the water and power development authority (WAPDA). He stated that utilizing the Indus River, canals, and creeks from Sukkur to Karachi link was a viable option. The national transport research centre (NTRC) and NesPak

in 1975, alluvial channel observation project (ACOP) in 1983 and the WAPDA in 1988 have agreed that the first phase of the inland waterborne transport should be south of Sukkur to Karachi.

In 2003, while reviewing the inland water transport in the context of the highway development program for Pakistan, the World Bank stated that there was negligible inland waterborne trade traffic along the north-south corridor of Pakistan. The study indicated three major routes along the River Indus: Kalabagh to Sukkur, Sukkur to Kotri and subsequently south of Kotri till the Arabian Sea. The study was optimistic regarding the viability of navigation channel from Kalabagh till Port Qasim, provided some engineering efforts were made at a few places. Nevertheless, the project was considered economically infeasible due to limited speed, limited range of cargo available for inland water transport, and competition with the well-established road-rail network in the country.

After the completion of the Kotri Barrage in 1958, the river flow to the delta stopped altogether, except in monsoons. With the construction of Warsak, Mangla and Tarbela dams afterwards, on rivers Kabul, Jhelum, and Indus respectively, and other additional diversions for irrigation, the flow downstream of Kotri Barrage exists only in high floods.

The Indus River, in its surveyed portion, particularly between Attock Khurd to Khushal Garh, suffers from several physical constraints, which include:

- Several outcropping rocks divide the available channel into two parts.
- Unsafe curves.
- Very high-speed currents between 12 to 14 kilometres per hour at different locations.
- Dykes both parallel and perpendicular to the flow of the river.
- Sandbars and imbedded rocks narrow the width of the river, hence reducing the sight clearance around the bends.

This renders a significant section of the Indus River north of Khushal Garh inappropriate for safe navigation. The reach north of Khushal Garh should be navigated with caution due to the presence of eddy currents which could destabilize the vessel. Moreover, additional power and steerage would be required in additional tug(s) when travelling upstream in the river. The river should be dredged periodically to ensure the removal of obstructions and maintenance of a certain depth. Another requirement would be employing highly skilled operators and navigators for safe navigation through these obstructions. To avoid these impediments, the vessels could ply downstream from north of Khushal Garh along the River Chenab into the River Indus and then onward to Guddu Barrage and finally to Port Qasim. All previous studies stated that inland water transport southwards of Sukkur till Port Qasim is a viable option through canals, drains and creeks in Sindh. However, the availability of sufficient water downstream Kotri, around the year, remains a question mark.

Limits of Inland Water Transport in Pakistan

The global impact of climate change has adversely affected Pakistan. In the past decade, unprecedented torrential rains in quantum and magnitude have hit Pakistan badly, and 2010 saw a devastating rainy spell. More than twenty million people were rendered homeless with basic infrastructure destroyed. Similar but less intense monsoon driven spells were witnessed in the following years, and the situation is likely to worsen every passing year. With no major reservoir on-site, such floods will likely affect the inland water transport infrastructure. The other caveat is the shortage of water in drought-stricken times and areas, which will otherwise render this service grounded in shallows thus ineffective (Asgary et al., 2012).

The overarching factor is water diversion to agriculture, especially with limited water availability after the Indus Waters Treaty. More so, all the federating units are sensitive about the water share from the available resources apportioned according to the historical flow with lesser population. Moreover, waterborne transport on the Indus and associated port infrastructure on its banks may add to the already existing menace of pollution. This will further aggravate the situation of fragile inter-provincial harmony. The decentralization of governance from federal to provincial levels under the 18th constitutional amendment is problematic too. There is little technical or financial capacity to manage mega projects within the provinces. According to this constitutional amendment, water resource management is a provincial matter. However, basin-scale navigation requires a central authority to control the resource, which would be a contentious point requiring legislation and debate on this sensitive issue.

Why Inland Waterways Transport?

The need-based analysis to venture into developing navigational facilities on the Indus River and main canals in Pakistan have been discussed during the past two decades by various governmental and non-governmental agencies e.g., the Ministry of Railways and Communications, the defunct Central Engineering Authority, West Pakistan Irrigation and Power Department, Water and Power Development Authority, Tipton and Kalmbach, and Harza

Engineering Company. These agencies have expressed conflicting opinions. Some agencies consider inland navigation in Pakistan as "definitely discouraging", while others vehemently support it as the safest alternative route in an emergency. The inland navigation and water transportation are practical and economical for moving goods, particularly moderate and longer haulages. Pakistan essentially needs this mode of transportation to supplement the carrying capacity of the existing systems of roads and railways, which are unable to transport the cargo arriving at Karachi Port regularly without delay. After the construction of new terminals as per the master plan of Port Bin Qasim, the volume of cargo traffic is expected to increase. Therefore, the additional mode of communication in inland navigation becomes a necessity to take maximum advantage of the port facilities. The following relevant factors should be considered:

- The present railroad and highway traffic system, which provides the only link between the Karachi Port and the hinterland, needs improvements for handling the cargo load that is to be transported from Karachi to upcountry and vice versa.
- Port Qasim and its channels are best suited for the implementation of this project due to the proximity of the ancient inland water route close to the famous port of 'Daibal' near Gharo creek. Moreover, being at the mouth of the Indus delta, it is easy to connect the existing channel with the natural creeks with suitable dredging effort and make the initial segment till Kotri workable.
- Extensive hydrological surveys and studies may be conducted with subject matter experts on board to point out the technical issues and suggest a suitable set of remedies.

Inland Water Transport Company

The Government of Punjab has established the inland water transport company with the aim and vision to evaluate the situation and formulate plans for capitalizing on this opportunity and execute the projects in phases. An initial allocation of 500 million rupees was also made in 2016 extendable to three billion rupees in phases. A detailed survey has been carried out with the support of various experts. The reconnaissance of the Indus River from Sukkur to Kalabagh has revealed that no major obstructions exist. The Indus River is navigable throughout the year from Sukkur to Kalabagh for four-foot barges proposed to be utilized. Larger crafts could be plied for more than nine months in a year. This view has been confidently stated because of the changed/controlled releases from Tarbela Dam, which will enhance the low season supplies. Therefore, the river will remain navigable throughout the year. A pilot project comprising of 200 kilometres from Daud Khel to Attock has commenced with the removal of water obstructions and making the area safe for traffic. Likewise, a hydrography department has been established at the riverfront in Jhand. The company's head office is in Rawalpindi, with an operational detachment at Daud Khel. This stretch of 200 kilometres has been selected due to the following reasons:

- The depth of the river is consistent with no outward discharge.
- Bridges in the path are high and do not require any raising in the immediate future and for the operationalization of this pilot project.

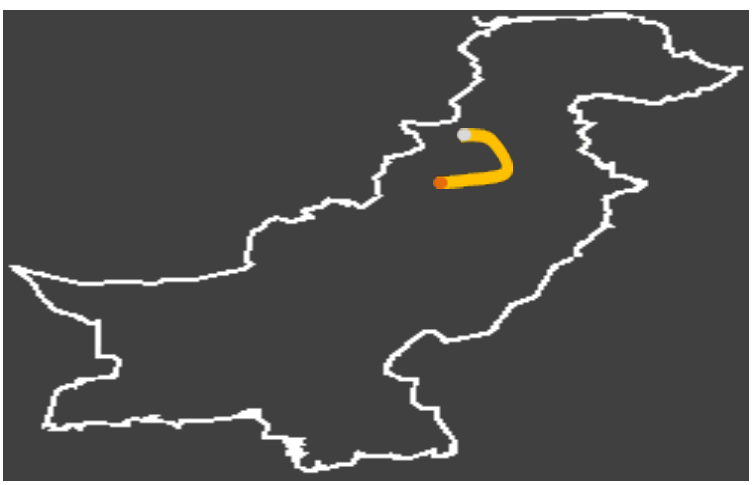

Figure 2: Pilot project of 200 kilometres from Daud Khel to Attock.

- West bank of the Indus River is underdeveloped, and this shipping activity will promote development.
- Factories along the route on the riverfront produce 1500 tons of cement daily. This can greatly facilitate the transportation of cement.

However, the project has suffered traditional bureaucratic red tape-ism, and after the change of government in 2018, the whole project is under audit and scrutiny to check fraud. The enthusiasts working for the project are hopeful that the new drive under CPEC may provide required political and financial impetus to push the project forward.

Recommendations

Pakistan has a well-established riverine and canal system. This vast river and canal system is spread over 30,000 kilometres and physically integrates the country. Pakistan, primarily an agricultural country, has invested substantially into its riverine and canal systems and extended this system significantly by constructing barrages and dams. However, due to the construction of several dams and barrages, mainly on the Indus River, Pakistan lost the link between its key waterway - the Indus River - and the Arabian Sea. It had resulted in less attraction for inter-modal waterborne traffic.

Moreover, due to the non-availability of navigation lock at Sukkur Barrage, the Indus River has been practically divided into two halves for the purpose of inland transportation. Although sufficient depth of water is necessary for safe navigation, the reason for a decrease in regular flow is the construction of dams and barrages on rivers and irrigation canals. Therefore, for future construction of dams and barrages, considerations like the provisioning of suitable locks should be incorporated.

To ensure the success of inland water transport system, we need an institutional framework that should cover the entire spectrum of management of operations and maintenance. The government should act as a regulator and facilitator for inland water transport operations. Therefore, an Inland Water Authority (IWA) and Punjab Riverine Port Trust should be established to implement rules and regulations. The construction of jetties, harbours and navigation channels should be undertaken within the context of Public-Private Partnership, and the government should provide the land for these activities. The development of the inland water transport system should be financed by the private sector.

Several physical requirements should be ensured for the successful operation of inland water transport, including the requirement of sufficient depth in the channel, dredging at various locations, a requirement of navigational aids and locks and finally, the size of vessels plying these waterways. Moreover, there would be a requirement to employ highly skilled operators and navigators for safe navigation through physical impediments along the channel. The following recommendations may be considered too:

- The inland water transport policy should be formulated, which should address all the issues pertaining to inland water transport. It should include guidelines for the development of the inland water transport sector beyond the biases of interprovincial rivalry on water disputes.
- The government should establish an Inland Water Transport Authority (IWTA) responsible for implementing rules and regulations, maintaining sufficient depth for safe navigation, and producing waterways maps. Similar authorities are working in India and Bangladesh.
- Pakistan Navy and WAPDA may primarily manage the IWTA by providing a project director and requisite staff until the authority is set up. These organizations may also work out the requirement of necessary vessels to initiate the organization.
- WAPDA may be assigned to provide navigation conservancy services on the Indus from Sukkur to Kalabagh. This would involve erecting simple channel markers to guide navigating boats and launches. Then, starting from Sukkur or Guddu, it can be gradually extended to the whole navigable reach.
- Punjab Riverine Port Trust should be established to construct jetties, harbours, and navigation channels within the context of Public-Private Partnership. This trust should also manage the operations pertaining to inland transportation.
- The pilot project between Attock and Daud Khel should be effectively utilized for demonstration purposes and creating awareness among the masses and policymakers.
- Once the channel is marked, the turnaround time of boats will be reduced. Moreover, the assurance of a waterway would encourage private launch and barge owners to start operations on the river. The same was witnessed at Atta Abad, after formation of lake to connect the traffic routes, both ways. In the meantime, WAPDA can demonstrate the usability of water transport by introducing a small tug and barge flotilla in a reach where traffic potential is highest.
- To encourage the private sector into the inland water transport industry, the government should provide incentives through subsidies like provisioning of land at a subsidized rate and tax exemptions.

- The government should allocate a mandatory amount each year to develop the inland water transport sector in Pakistan, and discontinuation in this allocation should be avoided.
- Inland water transport system should become an essential part of CPEC as it would open a new route for transit trade between Pakistan, China, and the Central Asian Republics, and transform inland water transport into a major route in the multi-modal transport chain.
- The small barges' mass production should be undertaken to achieve economy of scale and promote the local shipbuilding industry.
- Measures to promote tourism on river, which will require ferry transportation and involvement of tourism department for uplift of historic and scenic spots.

Conclusion

Although most of the previous studies were not optimistic about the economic viability of inland water transport in Pakistan, however, its technical feasibility was never a matter of great concern. Moreover, a significant change has occurred in the global economic environment. The cost of fossil-based energy is on the rise, both in financial costs and environmental/ ecological impact. These factors provide the requisite incentive for serious consideration of inland water transport as an alternate mode of transportation. In countries like Pakistan, which have a good network of rivers and canals, the viable and cost-effective alternative to rail and road transport is inland water transportation. It is considered a safe (particularly for transporting dangerous goods), reliable, sustainable, and efficient mode of transport. In terms of fuel efficiency, it requires the comparatively least quantity of fuel per ton-kilometre of cargo carried. Another important contribution is the decongestion of highways by transferring freight to inland waterways, which reduce road accidents. Further, it is the most feasible mode of transportation for time-insensitive cargo. Investment in waterways of rural areas has the potential to develop peripheral infrastructure and services, which is vital for economic development and job creation. The industries such as boat building and fishing are directly linked with this sector. This would contribute to reducing isolation and poverty alleviation of these underprivileged communities.

Similarly, the significant benefits afforded by the proposed inland water transport pilot project in Pakistan include the lower logistic and operating costs, creation of employment, and a safe and reliable alternate route for strategic defence. The inland water system provides economy of scale in transportation, reduces congestion/ load on highway networks, ability to fit into a multi-modal system and its ability to be integrated into CPEC, once expanded all over Pakistan. Fast, safe, and cost-effective transport service which caters for domestic and international trade has a direct bearing on the progress of a country. In the case of Pakistan, the volume of passengers and freight traffic has continued to grow at a quick pace, but the quality of transportation has not improved sufficiently. We must not waste the enormous economic potential of the inland water transportation system. The Indus River has historically served as a navigation route of the broader region, and there is a need to revive its role for the economic uplift of the country.

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