# SOCIAL AND ENVIRONMENTAL IMPACTS OF INLAND AND COASTAL WATERWAYS

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## 1. INTRODUCTION

Waterways were the bedrock of many great civilizations in history. Cities were built on river banks and trade between distant countries was carried through waterways that linked sea routes. Inland waterways even at present offer significant opportunities for creating economic & environment friendly transport systems that would help ease the growing pressure on other modes of transport. Inland Waterways transport has immense potential for passenger as well as domestic cargo transportation. India has a potential of 14,500 km of navigable waterways for commercial transportation. However, it is an under developed mode of transportation with a share of less than 1 percent in the total cargo handled in the country in comparison to developed countries like US, China, Germany, etc. This paper provides an overview of the social and environmental impacts of the inland and coastal waterways.
The problems involved in quantifying and comparing other environmental impacts are also highlighted. The pollution caused by ocean freight, for example, is only indirectly linked to the quantity transported.

Moreover, there is no clear objective basis for comparing air and water pollution. Even more difficult are environmental harms like the introduction of nuisance species or the disposal of contaminated dredged materials, which affect marine ecosystems more than humans. "Environmental impact" may be considered to have three components: Environmental stressors such as pollutants, noise, or exotic species are released in natural ecosystems. Each tone of goods transported places additional stress on the environment; many stressors may therefore be measured in units per tone of goods transported; The total amount of stress placed on the environment depends on the quantity of goods and the distance they are transported; in the simplest form, total stress is the quantity of goods times the distance carried multiplied by the stress per ton. The second component of stress involves the spatial pattern of goods transported, including the transport mode used; The environmental impact of the total stress is determined by the nature of the receiving environment. Ambient characteristics such as physical ecosystem

characteristics, density of the human population affected, and whether the receiving ecosystem is considered critical or includes endangered species will determine both the physical impact of the stress and willingness to pay to prevent it.

Some environmental stressors--notably air and water pollutant emissions--are easily quantified, and clearly rise with increases in freight. Others, such as airport noise or the introduction of exotic species, increase with the number of trips made, but not with distance travelled or quantity of goods carried. Inland navigation can contribute to making transport more sustainable, particularly where it substitutes for road transport, but inland shipping and especially the development of waterways for navigation can have considerable environmental impacts. Waterway development works for inland navigation can have significant impacts on the ecological value and water quality of water bodies. The nature and extent of the impacts depend on the kind of works concerned and, to a large degree, on the characteristics of the water body itself. The kinds of mitigation techniques that can be employed can also differ markedly, for example between sections of river with rocky bed and banks, and reaches with sandy or muddy bottoms situated in flood plains. In some cases new works for navigation can be designed to improve water quality or biodiversity and create valuable habitats. Rivers and their floodplains are among the most impacted ecosystems in the world. Energy production, freshwater transfer, agriculture, deforestation, pollution, urbanization, drainage, river regulation, and flood protection schemes can lead to ecological deterioration and the loss of important functions, which in turn could threaten future uses of these systems.
Navigation infrastructure and operations can also impact the ecological character and functions of waterways. Likewise, a degradation of waterway conditions from any of the above factors might adversely impact the suitability of that waterway for navigation uses. Navigation should ideally be undertaken in a fashion that is in consonance with the other needs of the waterway, including the full range of physical, chemical, and biological functions as well as the social constraints and requirements placed on the system.
Transport is an important component of the Indian economy. Since the economic liberalization of the 1990s, development of infrastructure within the country has progressed at a rapid pace, and today there is a wide variety of modes of transport by land, water and air. However, India's relatively low GDP per capita has meant that access to these modes of transport has not been uniform. Despite ongoing improvements, several aspects of the transport sector are still riddled with problems due to outdated infrastructure and lack of investment in less economically active parts of the country. The demand for transport infrastructure and services has been rising by around 10% a year with the current infrastructure being unable to meet these growing demands. According to recent estimates by Goldman Sachs, India will need to spend US$1.7 trillion on infrastructure projects over the next decade to boost economic growth.

## 2. DATA COLLECTION

Some environmental stressors--notably air and water pollutant emissions--are easily quantified, and clearly rise with increases in freight. Others, such as airport noise or the introduction of exotic species, increase with the number of trips made, but not with distance travelled or quantity of goods carried. Moreover, the ecological harm caused by such stressors may not be quantifiable or directly related to quantity of freight. This raises the question of how to address stressors which cannot easily be expressed as emission factors per unit of freight. Three approaches may be taken to this issue: Limit the analysis to those stressors which can be easily quantified in comparable terms i.e. pollution. These are often considered to be the most harmful environmental impacts of transportation, and limiting the analysis to them may not distort the results significantly; Include all kinds of impacts, but be descriptive when quantification is not possible. This acknowledges the importance of all kinds of impacts, but unfortunately can make it easy to disregard those which are not quantified in comparable units; Use valuation techniques which convert all environmental impacts to the costs they impose, the costs of avoiding them, or willingness to pay to avoid them. The advantage of this approach is clearly that it provides a common unit of analysis with which to compare different kinds of impacts. The disadvantage is that such valuation is highly subjective and quite difficult to carry out. This paper does not choose among these approaches, but provides information which could be located to permit any of them. It describes the major environmental impacts of freight in qualitative terms. When emission factors per unit of freight are meaningful and available, it provides them. In some case estimates have been made of the social costs of environmental harms attributable to transportation; these are given as well.

*Air Pollution*

Air pollution is generally considered to be the most important environmental threat posed by transportation. The table below summarizes the major pollutants emitted by moving vehicles, their source, and the harm they can cause to humans, ecosystems, global climate, and property (buildings and materials). Most of these pollutants are emitted by most forms of transportation. Two points should be borne in mind. First, literature on transportation-generated air pollution generally describes the quantity of pollution and its environmental and health impacts one product at a time. However, in some cases chemicals combine to have additional impacts beyond the problems caused by each individually. The best-known example is that of photochemical oxidants, which form through chain reactions between hydrocarbons and other volatile organic carbon compounds (VOCs), nitrogen oxides (NOx) and oxygen when in the presence of sunlight. This leads to the formation of photochemical smog, a particular problem in cities such as Athens and Los Angeles.

*Global Climate Concerns*

Transportation contributes to global climate change through emissions of carbon dioxide, methane and other hydrocarbons, nitrous oxide (N2O), and water vapor discharged by aircraft. These gases absorb radiation in the stratosphere. Though transparent to sunlight, these reflect long-wave radiation normally emitted back into space by the earth. For most transportation modes, the same engine emissions have both local and global impacts. Standard data on air pollutant emissions cover all of the major greenhouse gases except CO2. The Intergovernmental Panel on Climate Control (IPCC) has developed a methodology for estimating carbon emissions based on the amount of carbon in each type of fuel and the efficiency of combustion; the more efficient the combustion, the greater the share of the carbon converted to CO2.

*Water Pollution*

The normal operation of transportation vehicles does not generate water pollution in the way that it generates air pollution. However, transportation has both direct and indirect impacts on water quality. Shipping activity, in particular, directly affects the environment in a number of ways. The routine discharge of ballast water from marine vessels, if ballast is not segregated from cargo, introduces oil pollution at sea and in coastal waters, and can lead to introduction of nuisance species transported from the boat's origin to its destination. Shipping is a source of oil and chemical spills at port, in coastal waters, and more rarely at sea. The routine maintenance dredging of ports and inland waterways stirs up toxic sediment and frequently leads to the disposal of dredged material in the open ocean. (Of course the existence of the toxic sediment stems from many sources other than transport; the dredging simply raises the toxics and poses the problem of where to resettle them.) These problems increase with growth in shipping, although they are less directly linked to ton-kilometers of freight than is air pollution. The water-quality effects of land transportation are less direct. Road accidents and vehicle exhaust are both sources of oil and hazardous chemicals which run off the road into surface and ground water. The roads themselves, as well as parking lots, driveways, and other paved surfaces lead to an increase in impermeable surfaces, particularly in urban areas. Impermeable surfaces interrupt the filtration of rainfall into the ground water. An increase in impermeable surfaces will therefore aggravate flood risk and lead to more pollutant runoff into surface waters in heavy rains.

*Shipping*

Shipping poses threats to the environment both on inland waterways and on the ocean. These problems come from six major sources; routine discharges of oily bilge and ballast water from marine shipping; dumping of non-biodegradable solid waste into the ocean; accidental spills of oil, toxics or other cargo or fuel at ports and while underway; air emissions from the vessels' power supplies; port and inland channel construction and management; and ecological harm due to the introduction of exotic species transported on vessels.

*A) Operational Oil Pollution:*

Ships are designed to move safely through thwater when they are filled with cargo. When empty, they fill their tanks with ballast water in order to weigh them down and so stabilize them as they cross the ocean. Before entering the port where they are to load up, they discharge the ballast water, whose weight will be replaced with freight. The water discharged is typically somewhat unclean, being contaminated with oil and possibly other wastes within the ballast tanks. Its discharge is therefore a source of water pollution. It should be noted, however, that segregated ballast tanks, which are required on newer tank vessels, reduce or eliminate the oily ballast problem. A similar source of pollution is bilge water; this is seepage which collects in the hold of a ship and must be discharged regularly. On oil tankers the bilge water is typically contaminated with oil which seeps out of the cargo tanks; thus this is also a source of oil pollution. Such discharges are referred to as "operational" pollution because they have long been considered a part of the normal operating procedures both of oil tankers and of other ships managing their fuel. Oily discharges, even those hundreds of kilometers from the coast, wash up on beaches and shorelines, killing birds and contaminating tourist facilities. The 1973 International Convention for the Prevention of Pollution from Ships, and the 1978 Protocol for its implementation which entered into force on 2 October 1983 (referred to as MARPOL 73/78), put in place a set of discharge standards and equipment requirements designed to prevent operational oil pollution.

*B) Solid Waste Disposal*

The disposal of plastics at sea is a significant source of environmental harm, since the materials are both buoyant and persistent. Debris is generally of several types. Fishing boats discard old nets and lines, frequently made of plastic. Freighters accumulate and sometimes discharge materials used to pack break bulk freight to keep it from shifting as the boat moves. This material, called dunnage, is typically either wood or plastic. Such materials have spread throughout the world's oceans, and have been found as far as the poles and the sea bottom.
Discarded plastics pose a threat both to marine species and to coastal regions. Discarded nets carry out so-called "ghost fishing", continuing to trap animals as they drift through the water. Band shaped packing materials can encircle marine mammals fish, or birds, forming a girdle which tightens as the animal grows. Marine organisms also ingest plastics, which can kill them or reduce the nutritional value of their food intake. In addition to their harm to marine life, plastics wash up onto beaches worldwide. Wood used for dunnage, if not grated or pulped can damage small boats which run into it. Annex V of MARPOL 73/78 regulates the discharge of garbage from ships. All discharge of plastics is prohibited anywhere in the world.

*C) Accidental Spills*

Spills from waterborne vessels are one of the major sources of water pollution from shipping. They are of several types. Cargo spills frequently occur while loading or unloading in port, due to handling errors or equipment problems. Such spills are typically relatively small in volume. They may be of any kind of cargo, though petroleum products

(primarily cargo rather than fuel) and other chemicals are most common. Spills of non-hazardous cargo are more common than spills of toxics or flammable materials, because the precautions taken in handling dangerous products tend to promote much greater vigilance and far fewer careless spills. Much less common, but potentially more dangerous, are cargo spills which occur when a boat runs aground or breaks up in bad weather. Such disasters typically occur when boats are moving into or out of ports or in other restricted areas, where there is little or no room for maneuvering or going off course in case of bad weather.

### *INLAND WATER NAVIGATION IN KERALA*

Today the land transportation infrastructure in Kerala has reached the limit of their capacities and is failing to meet the ever increasing demand of traffic. the inland water transport (IWT) system in Kerala can be revived for the movement of freight, passenger and tourist traffic .the IWT includes country boat movement for transportation of men and material ,passenger service boats, ferry boats, barges for cargo movement in organized sector ,passing of sea going fishing vessels, inland tourism, water sports etc.it is necessary in the present scenario of our growth to utilize the vast networks of waterways and navigable canals to reduce the pressures on the traffic system. it will help to provide an integrated mass and rapid transport network for all of kerala.development of IWT is essential not only for on land navigation but also to harness the enormous potentials in other sectors of the economy.
The city of Kochi is located on the western coast of India in Ernakulum district of Kerala. It is bound by Thrissur on the north, Idukki on the east and Kottayam and Alappuzha to the South. It has historically been the ancient trade gateway to the hills of Kerala which were revered by the traders for the spices it produced. It is, by all accounts, the commercial and industrial capital of Kerala. Blessed with natural beauty and good climate, the city also boasts of good road, rail and air connectivity with other Indian metropolises such as Mumbai, Chennai and Bengaluru. The discovery of the ancient port of Muziris has confirmed the importance of ancient Kochi as a major link on the maritime circuit for trade and business. There are many evidences of trade links between Kochi, China and ancient Rome in the form of Chinese fishing nets and seals found at several locations.

## 3. SOLUTIONS

*A) Integration of coastal shipping with Inland water Transport*

There is potential for integration of coastal shipping with Inland water Transport and thereby to enhance its share in the total transport system of the country. The seamless integration of the coastal shipping and inland water transport can be effective only when the vessels can operate in both the sectors economically. The availability of inadequate water depth in the inland waterways may have certain disadvantages for design and construction for an optimum designed vessel.

*B) Actively Supporting Self-employed Water Transportation Labor*

In China this was one of the major steps that resulted in a prosperous and vast network of Inland Water Transport. All ports, wharves, and loading and unloading, repairing, lock, winching and communication facilities be opened to self-employed water transportation labor, that self-employed water transportation labor should be allowed to find sources of freight and set up prices by themselves for short-distance transportation, and that township enterprises and farmers be supported in collecting funds for the construction of ports and wharves and regulation of small rivers and tributaries. The circular should also encourage self-employed water transportation labor to cooperate with water and land transportation enterprises in various forms, and to combine transportation with production and marketing.

C) *Actively Developing Economic Alliances in IWT*

The demand for transportation has increased, in this new situation, IWT departments should break the rigid boundaries of different regions, different departments and different trades, go in for various forms of economic alliance, and achieve significant economic and social benefits. In IWT economic alliances can take the following forms:

- Alliance of different transportation: It includes main stream-tributary coordinated transport, river-and-sea coordinated transport, water-and-railway coordinated transport, water and highway coordinated transport, port-to-port coordinated container transport.
- Alliance of different trades.

*D) Allowing Private participation in maintenance of waterways*

The government should allow private players to invest even in the maintenance of waterways and construction of terminals. In this manner greater funds will be invested in the infrastructure and will induce more cargo operators to opt for Inland Water transport. At present only the IWAI undertakes such projects. Whereas if it gives out certain projects to potential private investors it will insure a better infrastructure and maintenance.

*E) Reviving the subsidy plan*

Earlier it was the government policy to provide 30% subsidy to private investors in the construction of barges. Now however this policy has been scrapped. The government no longer subsidizes the construction of vessels. This policy should be revived in order to attract more and more private investors.

*F) Encouraging Multi-Modal transport*

Multi-modal transport is a very interesting approach that solves a large part of cargo mobility problems. Combining private and state transport in a multi-modal transport

system offers the opportunity to capitalize the best rates and transit time as possible. Multi-modal transport could remove the barrier of last mile connectivity in Kerala. One owner could operate the movement of cargo by using more than one mode of transport.

## 4. CONCLUSION

In the above study the advantages of IWT over other modes and the crisis that it is facing in India, particular to Kerala has been reviewed. The IWT also showed favorable advantages over road or rail transport existing in the country. The analysis of coastal cargo movements in India shows that the utilization of Inland waterways in India is minuscule compared to European Union or neighboring countries like China. It gives a clear picture of inefficient handling of Indian ports which not only discourages the Inland Water Transport but also the whole maritime trade. In Kerala however, the major issues that are faced by IWT are those relating to infrastructure or maintenance of the Inland Waterways. Kerala has a rough geographical terrain and a distinct climate. Coping up with these factors will require a humungous amount of effort from both the government. and the private sector. Private investment is necessary in this sector to ensure more funds and more participation by making the most of the Inland Waterways. This sector will best function and develop if kept open for private investment.
Due to the opening up of the Indian economy and its fast growth GDP, there has been an urgent need for efficient transport system in a large scale for movement of bulk goods for providing the infrastructure to the power sector, distribution of food grain, fertilizers, construction material, Petroleum, oil and Lubricants, Over-Dimensional Consignments, etc. Rail and Road, modes are already over burdened, and congested. Their expansion requires huge capital investment, time, a lot of land acquisition making it very often a difficult preposition. Hence, a need has arisen for the development as well as integration of both coastal shipping and inland water transport. There is potential for integration of coastal shipping with Inland water Transport and thereby to enhance its share in the total transport system of the country. The seamless integration of the coastal shipping and inland water transport can be effective only when the vessels can operate in both the sectors economically. The availability of inadequate water depth in the inland waterways may have certain disadvantages for design and construction for an optimum designed vessel.

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## REFERENCES

A) Guidelines for Sustainable Inland Waterways and Navigation
B) Inland Waterways & Environmental Protection, European Conference Of Ministers Of Transport
C) Inland Waterborne Transport: Connecting Countries**,** Sobhanlal Bonnerjee, Anne Cann, Harald Koethe, David Lammie, Geerinck Lieven, Jasna Muskatirovic, Benjamin Ndala,Gernot Pauli and Ian White
D) Long Term Perspectives Of Inland Water Transport In India, Dr.S.Sriraman
E) The Causes of Social Vulnerability to Coastal Hazards in Southeast Asia, Lele Zou and Frank Thomalla
F) Viability of Inland Water Transport in India,Narayan Rangaraj and G. Raghuram