

# Prospects for Indian shipping

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**India's quest for rapid economic growth will falter unless transport systems for both domestic and overseas trade match the needs. Shipping and shipbuilding are as old as recorded history, yet remain cost effective and relevant today for inland, coastal and overseas traffic. Shipping and shipbuilding can become catalysts for industrial development and export-led growth, but an attitudinal shift from skills to knowledge is a prime requirement. Fleets, ports, manpower, management and shipyards need updating, and should become globally competitive. Ocean resources must be husbanded, and national maritime assets and interests safeguarded. Negligence could have serious long term adverse effects. Holistic modernization is required to arrest decline and to energize the industry, as slow or piecemeal solutions may result in wastage of scarce resources.**

THE first permanent habitat clusters of humankind were established on the banks of perennial rivers, which provided natural defence, water for sustenance and agriculture, and a highway for trade and commerce. The adventurous curiosity that drives human spirit overcame ocean barriers, and the mouths of great rivers became the sites of ancient ports whose fabled wealth is remembered even today. Adam Smith noted that industry prospered naturally along navigable rivers and the sea coast before extending its reach elsewhere<sup>1</sup>.

A recent study by the Harvard Institute of International Development<sup>1</sup> suggests that liberalization alone will not lead to eventual uniform closure of the North-South gap; a nation's climate and geographic location – including the ratio of coastline distance to land area – are also identified determinants. Geographic orientation and coastal outreach enhance the natural advantages of peninsular India, while the tropical climate is a disadvantage to development. Air-conditioned workspace would possibly overcome the disability, but is clearly not feasible very soon. On the other hand, the advantage of sub-tropical climate in the northern states is reduced by the adverse coastline to area ratio. This must be noted as India crosses a milestone of independent existence, and the nation emerges from a period of consolidation with the expectation that a liberalized economy will quickly lead to prosperity.

A broad brush analysis of key economic data from the World Bank of high growth, low and middle income

nations<sup>2</sup> indicates that external trade grows faster than GDP. Since this must be complemented by internal trade, it is clear that availability of efficient transport systems will determine national development. The same organization<sup>3</sup> rates transport infrastructure highly for employment potential, value addition to GDP, and returns on investment. Yet, it is regrettable that unreliable surface modes force the Indian exporters of handicrafts, footwear, and garments to opt for freighting cargo by air. If transportation costs are not to constrain Indian competitive potential, shippers must have a choice of modes wherever possible. The selected mode would then be appropriate to the unit value of the cargo, transit time, reliability and the like. It has been estimated that the capacity in the eleven Indian major ports alone must increase by a factor of 2.25, from 200 m tonnes to 650 m tonnes in a ten-year span (1994–95 to 2004–05) to support a 7% annual GDP growth<sup>4</sup>. This will entail an estimated outlay of Rs 25,000 crores. Shipping has been neglected for so long that its relevance must be reassessed before making such a large investment. Holistic consideration must include a historical review to validate the present state and determine how it came about. Secondly, objectives must be clearly defined, and the assessed essential inputs furnished. There is merit in applying the mariners' view that ships, like humans, have personalities that are subject to the cycle of life – in which design, shipbuilding, repair, and ship breaking are milestones. Any other approach is likely to become a ritual exercise, like annual National Maritime Days.

## Historical review

The rise and fall of great cultures has been determined by the vigour and self confidence of its people. The ultimate determinants of prosperity and global importance are creativity, innovative initiative, and productivity. Shipping, shipbuilding, and ship repair require all these. Not surprisingly, there is close linkage throughout history between shipping and a nation's position in the international table of precedence. Mesopotamia, Egypt, Greece, and Rome declined when their maritime presence waned. The strong economies of India and China collapsed when they lost control of their maritime trade. Since maritime vigour has also marked the development of most modern industrial giants, Adam Smith's postulation still seems to retain validity.

The dock at Lothal is evidence of past maritime and harbour engineering skills. Poompuhar, the Bali-Kalinga link, and the Srivijaya empire clearly indicate that ancient India exhibited easy familiarity with the sea as a medium for trade and cultural cross fertilization. More recently, residual shipbuilding skills were nurtured in Surat and Mumbai by the Wadias until the Industrial Revolution. Despite imperial discrimination and depleting stocks of Malabar teak, local centres of high craft skill have survived; the dhows of Beypore are as prized in Arabia today as Rolls Royce cars.

However much the decline of past maritime glory is regretted, the Indian experience is not as unique as many imagine. Chinese junks were as large as later Spanish galleons and the volume of trade with the Pacific Islands and the Indies complemented the overland Silk Route<sup>5</sup>. The Ming Navy of the fifteenth century had more than a thousand vessels; the seven cruises of Admiral Ho saw his fleet in Malacca, Bengal, Sri Lanka, and the Red Sea. Trained exploration in philosophy is a proud legacy in both countries, but wisdom and insight did not transfer to technology and engineering with anything of the vigour exhibited in medicine and mathematics. Industry did not proceed beyond the solid base of craftsmanship in either India or China. Chinese corrective measures in the last two decades have been successful, and merit examination in India.

Indian industrial infrastructure of the nineteenth century was also based on craft skills, and did not rise higher. River navigation on the Ganga and the Brahmaputra provided the main means of transport, and a supportive assembly and refit facility for paddle wheel steamers was established in Calcutta. This potential nursery for inland navigation was permitted to decline as investments were made on road and rail networks, and navigation channels degraded. South Asian barriers to transit trade after Independence were no help either. Similarly, repair and refit bases were created in Calcutta and Mumbai for the upkeep of ocean-going vessels serving subsidiary Imperial routes to Burma, East Africa and the Gulf. The anticipated requirements for Liberty ships for Far Eastern logistics spawned the greenfield Hindustan Shipyard during the Second World War. Thus a stock of skills relevant to ship repair was created to support commercial and military operations, and gradually enlarged to utility vessel construction, with external inputs of drawings, specifications, materials, supervision, and management. These lost relevance as the British Empire contracted.

Shipyards were nationalized and modernized after Independence, order books filled, and transfer of engineering arranged by way of drawings and specifications from overseas. Indigenization of a wide range of shipbuilding quality materials and equipment was taken up. Most importantly, faculties of Naval Architecture and Marine Engineering were set up with rudimentary associated

research facilities. Thus the foundation was laid for the industry to mature on its own to gradual freedom from foreign dependence. Unfortunately, as the yards remained linked to acquired inputs, self reliance did not occur as in the case of China or South Korea. The Indian Navy is the only exception, with a careful progression from warship refits, modernization, licensed production, modified design, and finally to design *ab initio*. This has required great efforts in Human Resource Development, equipment and material indigenization, and joint work with the Defence Research and Development Organization.

Overall, the Indian maritime industry has remained captive to a craft culture of replication, with gradual improvements dictated by the touchstone of experience. Skills are passed down through generations to family-based practitioners. Changes have come about through acquired techniques and skills, and innovation from within has not been vigorous. There has not been a natural progression to the stage of innovation through disciplined engineering education and production, with free exchange of ideas implicit. Consequently, entire inventories and craft skills become instantly obsolete on encountering a changed administrative scenario, or superior alien products – whether based on craftsmanship or engineering culture. For example, traditional mariner skills have never been lost and Indian merchant seamen form backbone crews in foreign flag shipping even today. Such surviving skills will always have a market, but often at labour intensive levels, with a glass ceiling intervening where scientific knowledge or insight would be required. Therefore, the lesson from history is the need to transform from craft to engineering skills industry-wide, and to provide overlays of technology (for design knowledge), and science, for original research insights. The industry must quickly learn to discriminate between bought out manufacturing packages – generally available, if obsolescent – and transfer of know why technology, which is difficult to acquire.

Addressing this core attitudinal issue will require will power and determination, mere funding without a national commitment will not be productive. As the South Korean experience indicates, even if much of the materials and equipment were procured overseas initially, the industry would quickly prosper and advance to the stage of sustained self-reliance. Shipbuilding is a value-added assembly industry and productivity and turnover – not an oversized and underpaid workforce – determine shipyard viability. As the range of bought out industrial items required for shipbuilding is extensive, a healthy shipbuilding industry will engine the growth of quality conscious ancillaries, where growth in employment opportunities could be spectacular. Given the high visibility attached to ships, there can be no better export promotion platform for Indian industry. Every advanced coastal economy has relied on shipbuilding to enhance the global competitive standards of its general industry.

## Opportunities

Given its long decline, the relevance of shipping and shipbuilding to current and projected Indian transportation requirements must be examined. Conventional displacement hulls provide the most economical bulk transport mode per tonne km, particularly for commodities of modest unit value. Despite the evolution of high technology hybrids like hovercraft and hydrofoils, water transport will not attract high value traffic where speed is the governing factor. Nevertheless, shipping is often the chosen mode when the congestion, inconvenience, and handling delays which contribute to total transit time are factored into the decision matrix of competing transport modes. The quality of service provided is a vital factor determining traffic volumes and types, and the capital cost of upgrading shipping channels to handle higher traffic volumes is often lower than modernizing roads, railways, or airfields to support the same traffic capacity. The World Bank has cited<sup>3</sup> two examples, in China and Brazil, of transport pricing across modes affecting investment decisions. Upgrading the Indian road network to support 7% GDP growth has been estimated at Rs 95,000 crores over ten years; but port modernization has been estimated at Rs 25,000 crores<sup>4</sup>. This would suggest that investment in navigable waterways is cost effective where a choice is available. Fuel consumption is also lower, as is atmospheric pollution. Stringent international standards have been evolved to control waste disposal, safety, and operator skill levels. Mechanisms for periodic inspection; and certification are in place.

Taking that Cinderella, Inland Waterways, first, it is quite clear that both rail and road capacity fall short of current high value traffic demand along transport corridors such as the Gangetic plain. This zone has the largest population concentration, the most fertile hinterland, and the richest mineral deposits. Long dormant literacy rates will probably take off in the next decade, and the region could then attract industrial investments resulting from the current trend to de-industrialize in East Asia. There could be an immediate requirement for compact barge-based gas turbine booster power units sized around 20 MW to ease power shortages, since planned mega plants will have long lead times. Both industrial and agricultural traffic will increase exponentially, as economic growth generates massive bulk transport requirements for construction materials, reefer cargo, petroleum and natural gas products, fertilizers, newsprint, tubulars, foodgrains, coal, steel, bulk chemicals and road transport vehicles – items where speed of delivery from plant to regional distribution points is not as high a priority as it is for passenger traffic. The 1620 km Ganga National waterway from Haldia, extended from Patna to Allahabad could prove very useful if ready by the end of the Ninth Plan as promised. Year-round navi-

gation by vessels drawing 1.8 m is an exciting prospect<sup>6</sup>. Similar traffic growth can be predicted for the 891 km Brahmaputra waterway from Sadiya to Dhubri, even if transit traffic arrangements through Bangladesh to Calcutta do not materialize immediately. In both cases traffic could be expected to be substantial both ways, which would call for innovative designs of shallow draught, multi product, carriers. Bonded container traffic between Calcutta/Haldia and inland ports would ease delays in port clearance and speed international cargo movement. The potential for short and medium haul tourist traffic on these routes could be tapped through a variety of specialist vessels like hovercraft and river cruise vessels. This is especially valid for the 168 km Kallam-Kochi-Kattapuram stretch of the West Coast Canal, as Kerala develops a high tourist destination profile. It has been estimated that a modest outlay of Rs 50 crores will permit 24 hour navigation in three National waterways.

Turning to international trade, India's unique central location in the Indian Ocean Rim is a natural advantage that should be exploited. The arc of nations from Australia to South Africa includes many vital trade partners. Given the rapid growth in passenger and goods vehicle production facilities, India could become a significant exporter to West and South East Asian markets, given the Ro-Ro port facilities required by car carriers. The high reputation for auto components and memory chip based controls that must be established seems achievable. Crude oil and petroleum products, naphtha, CNG and LPG, reefer cargo, steel, iron ore, vehicle components, phosphates, chemicals, coal, fertilizer, timber, edible oils, capital goods, man made fibres, – the list has no end – and the markets, both current and potential, are very large. In every case however, the specialist vessels, port facilities and inland transport must be integrated in time.

It is universally predicted that supplies of land-based resources will fall short of needs before global population increase is arrested. Offshore deposits of fossil fuels, metallic nodules, and marine life will probably require to be harvested on a commercial scale in the next half century, particularly by poor nations, who may not be able to access continental sources. The failure of nations like India to make necessary investments in expensive technology in time could well prove regrettable in the long run. Scientific and technological expertise in robotics, telemetry, and submersibles acquired in space and naval projects can be productively adapted to deep sea applications. Coastal trade in coal, clinker, iron ore, POL, steel and cement constitutes the bread and butter segment of this package.

Safeguarding natural resources and sea lanes of communications, pollution control, disaster relief, defending national interests in situations requiring military presence, deterrence, policing, hot conflicts – all these call

Selected indicators for ports performance							
Port	Berths	Occupancy (1992-93) %	Number of vessels sailed	Average pre berthing detention (days)	Average turn around time (days)	Container traffic 1992-93 ('000 tonnes)	Number employed (Dec. 93)
Kandla	11	77	1240	3	7.4	358	4,677
Mumbai	53	71	2177	2.4	8.8	3132	25,063
Jawaharlal Nehru	5	68	352	1	5.2	1712	1,507
Mormugao	7	66	705	0.8	6.1	7	3,257
New Mangalore	9	65	482	1.9	5.4	15	2,401
Cochin	13	56	614	1	4.5	431	5,546
Tuticorin	9	71	804	2	5.8	277	2,054
Madras	23	80	1387	1.9	7.2	1487	10,271
Visakhapatnam	17	79	1030	1.3	6	85	10,082
Paradeep	6	67	385	1.4	5.6	—	4,996
Calcutta	33	51	697	1	9.5	1009	19,808
							(Includes Haldia)
Haldia	9	73	717	1.6	5.7	95 above	

Source: *The India Infrastructure Report*, Ministry of Finance, Government of India, 1996.

for a variety of general purpose and specialist maritime defence platforms. Their design, construction, upkeep and effective integration into the National defence matrix requires foresight and vision. The affordability of even a modest inventory of defence platforms will depend on the cost effectiveness of general industrial products and their indigenous content. Unless this is high, naval modernization through the domestic route will not have a significant impact on the domestic industrial sector. Hence it would be unwise to expect captive naval markets to permanently guarantee shipyard profitability as in the USA and UK. Cost plus contracts will probably need to be scrapped in India too. The challenge of freezing designs and equipment fits to the last detail before finalizing a fixed price contract must be addressed through a demonstrated ability to build and deliver at great speed. Owners would then derive no performance advantage from postponing choices.

### Corrective measures

Globalization of the economy will demand drastic modernization of the cargo-handling facilities at all the major and minor ports. Mechanized facilities are needed for containers, general cargo, liquids, and bulk cargo. Slow turn round and low cargo discharge rates – whether mechanical or due to low port productivity – increase freight rates which cannot be fully countered through improved ship design efficiency. Therefore, both facilities and productivity must be improved, to obviate traffic shifts to regional hubs elsewhere, which will add to the cost and time factors constraining Indian commerce. This is therefore an essential first step, almost independent of the fate of the Indian shipping industry; India-USA freight rates are currently a third

higher than the Bangkok/Singapore rates<sup>3</sup>. Cargo handling, stevedore productivity, container management, customs clearance, and reduction in wharf congestion merit even higher priority than channel depths, as high traffic routes are invariably serviced by ships designed to overcome limitations of geography. For example, the Suez Canal dictated the maximum dimensions of ships engaged in the eastern trade for many decades. If cargo and passenger terminals at ports and on inland waterway systems match airport standards, traffic would not need to be diverted to this mode by planned compulsion. The eleven major ports, which today handle 95% of maritime trade, include some potential candidates for upgradation to mega ports, able to handle about 85 m tonnes each.

Indian shipping companies have traditionally acquired tonnage built to proven designs. This conservative approach results in missed opportunities when traffic trends change, particularly when markets turn volatile. For example, VLCCs (Very Large Crude Carriers), OBOs (ore/bulk/oil carriers), LASH (lighter aboard ship) systems, reefers, car carriers, cruise liners, cryogenic product carriers – even cellular container ships have been slow in coming. While venerable Western lines moved away from the clubby cartels of liner conferences into palletized and container cargo, Indian shipping remained loyal to the trusted break bulk general cargo carrier. Inevitably perhaps there has been a decline in their profitability, and fleet quality has fallen too. Reports of Indian flagged merchantmen suffering accidents bring no credit to the industry. The public sector Shipping Corporation of India (SCI) dominates Indian tonnage, and it is understandable that its resource custodians should be faulted for being ultra careful; but the decline of lines like India Steamships and Scindia Steam Navigation indicate that leadership and vision are needed in every boardroom, not just in PSUs. Secure

Financial state of major ports (Rs millions)						
Particulars	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95
Operating income	9909	10916	11984	14852	17367	19893
Other income	1507	1666	2490	3012	3259	3280
Total income	11416	12582	14474	17864	20626	23173
Operating expenses	6675	7388	8492	9738	10699	12291
Financial expenses	1840	1916	2501	3024	3747	4479
Total expenses	8515	9304	11002	112762	14445	16770
Operating surplus	3234	3528	3491	5114	6668	7602
Net surplus	2901	3277	3472	5103	6181	6403
Depreciation	—	—	826	921	970	1051
Net accruals	2901	3277	4298	6024	7151	7454

Source: *The India Infrastructure Report*, Ministry of Finance, Government of India, 1996.

enterprises often seek a strategic market niche to match their core skills, and then defend their turf. It has been argued that forecasting the future market and stretching skills to take advantage would be a better long term strategy<sup>7</sup>. This will call for more external inputs to stimulate innovative solutions. Clearly Indian shipping companies, like other erstwhile protected enterprises, must remember that the life expectancy of a typical multinational company is between forty and fifty years<sup>8</sup>, and seek ways to combine financial conservatism with sensitivity, cohesion and tolerance.

The reported move by the SCI to obtain governmental support for continued sole Indian membership in liner conferences<sup>9</sup> seems out of step with the times, particularly as liner traffic to India grew by about 40% in the decade after 1985, while Indian shipping capacity in the sector stagnated. The UNCTAD liner traffic share norm of 40% was reached in 1976-77, but is barely 8.8% now – the sad result of neglecting container traffic. Coastal shipping capacity is inadequate though reserved for the Indian flag, resulting in *ad hoc* approvals for deploying foreign flagged vessels. The Indian share of dry bulk cargo (20%) and POL (60%) is well below industry targets of 50% and 80% respectively. It is this decline, and not denial of conference membership that must be addressed. This view gains force in the light of the audit report on the Shipping Development Fund Committee and the successor Shipping Credit and Investment Corporation of India<sup>10</sup>. The list of major loan defaulters includes many with a proud lineage.

Time and tide wait for none, as mariners know too well. STCV – 1995 (Standards of Training, Certification and Watchkeeping) will come into force in 1998. The International Management Code adopted by the IMO in November 1993 will be implemented by the USA and the EU from July 1998, and will govern passenger vessels, tankers, gas and bulk carriers, and high speed cargo vessels above 500 GRT. This will ensure Safety at Sea and environmental protection through stringent procedures of accreditation and inspection of ships and crew, with defaulters subject to detention, punitive action, or

denial of port services. As the code goes well beyond requiring the mere installation of certified equipment, both ships and crew will need upgradation. Extensive fleet renewal and crew retraining is expected to be necessary, particularly in Asia<sup>11</sup>, and it is to be hoped that the Indian response will not be too little, too late. If tonnage increases do not compensate for the lower manning patterns that will result from increased productivity and higher wages, unemployment in a vital sector will be a sad reality.

The Government of India has responded to the wide range of challenges through the traditional mechanism of broad-based committees. Apart from NCAER and Planning Commission studies, these include a Maritime State Development Council for coordinated development of the 163 intermediate and minor ports which are State Government charges. Their potential could be estimated by recalling that the Viramgam customs cordon had to be imposed in the early twentieth century to protect Mumbai from the minor ports of Saurashtra – a lesson that the Gujarat Maritime Board has internalized<sup>12</sup>. A National Shipping Policy Committee will examine shipping and related HRD issues<sup>13</sup>. The current quantitative restrictions on small craft import are expected to be phased out to comply with WTO requirements, and a group has been constituted to examine the impact on the shipbuilding industry<sup>14</sup>. There has been transparent introspection in the public domain. It has been noted that while Antwerp completed cargo handling in two hours, Mumbai needed a week for the same task<sup>15</sup>. Unfortunately, experience suggests that the committee approach has rarely resulted in timely decisions or action. It has taken three years for the Hooghly Dock and Port Engineers revival plan to be accepted. The recent capital restructuring of Hindustan Shipyard was also slow to evolve.

Speed and agility are therefore as essential for shipyards as for shipping lines. In both cases the design and planning base will need to be energized, but with differing objectives. The efforts of the National Ship Design and Research Centre to deliver single window service for the whole industry is therefore unlikely to yield fruit.

The shipowner needs computer-based techno-economic capability to foresee emerging markets and to define ship performance parameters. Owner's requirements must include nominations for equipment based on maintenance feedbacks. Shipyards must computerize the design process and go through accepted stages of development like concept, preliminary, and detailed design. Each stage must lead off from the last and must be subject to a critical review and documented records. Production planning, material procurement, and berth involvement must be provided for from appropriate points of development. Effective manufacturing technology must be developed to cut the time and communication gaps between the design office and the shop floor, and achieve consistent Total Quality standards. Simulation software developed in aerospace has been adapted for the automobile and building industries for assembly line and site use, reducing the need for expensive mock-ups<sup>16</sup>. Shipbuilding must do so too. Integrated systems design, modular construction, and pre-outfitting techniques must be adopted to cut down outfitting time and close the gap between launch and delivery. Cranes must be increased in both number and capacity at slipways and wharves. All this will also call for a degree of computer familiarity at shop floors, and comfort with 3D, walk through, and virtual reality simulations. In short, the shipbuilding industry must move away from slavish dependence on acquired skills and nurture innovative initiative – the very Indian qualities that have taken the country to the leading edge of software development.

Modern shipbuilding has moved beyond structural prefabrication, and has imbibed integrated design and construction from aerospace; the traditional approach of sequential construction has largely been given up. Most work is executed in covered assembly areas to enhance safety and productivity. Downhand work is maximized. Tolerances and specifications have been tightened to reduce waste, eliminate rework, and comply with the documentation and inplant inspection standards of the ISO. Moreover, yards have specialized their product lines and harmonized their selected product line with the skill mix of employees and facility layout. It is no longer considered economically viable to support ship repair and the construction of a wide range of ship types from the same site. Indian shipyards must consider these aspects when they modernize. They must carefully internalize any external support acquired, to ensure that they become self-reliant thereafter. If not, the industry will never become healthy, and scarce resources would have been squandered.

## Conclusions

The Indian merchant fleet size was 6.3 m GRT in April 1985, and is only 7 m GRT now. Even this has been

possible by twice raising the shipping age norms, in 1992 and 1995, resulting in reduced replacement commitments. The 1980 Fifth Plan target of 8.6 m GRT will only be reached in the Ninth Plan, which aims at 9 m GRT by 2002. The estimated outlay of Rs 15,000 crores to acquire 3.7 m GRT of new and second hand shipping will not significantly raise India's share of cargo above the present 33.6% unless productivity and efficiency are enhanced industry wide, and the average age of the fleet reduced. The lessons of history and the catalytic potential of shipbuilding in industrial development and export-led growth must not be forgotten.

Developing economies growing above 5% seem to induce double digit trade growths, and continued neglect of shipping, shipbuilding, ports and inland waterways could seriously constrain Indian potential. It will be difficult to maintain the minimum growth rates needed to support even a modest and steady improvement in national living standards without enhancing the efficiency of this transportation system. A holistic approach covering the entire industry is needed, which must be accorded infrastructure status as a whole. This will enable appropriate financial, taxation, and restructuring measures to be adopted. Slow response and insensitivity to current trends are special dangers that must be countered. The most important requirement is an attitudinal shift from skills and blind dependence on acquired production packages to knowledge and self-reliance. If this is achieved, there is every reason to expect a bright future for the industry.

1. Sachs, Jeffrey, *The Economist*, 14 June 1997.
2. *World Development Report 1997*, Tables 3, 11, 12, & 15, The World Bank.
3. *World Development Report 1994*, Chapter I, The World Bank.
4. *The India Infrastructure Report*, Vols. I & III, NCAER, 1996.
5. Kennedy, P. M., *The Rise and Fall of the Great Powers*, Vintage Books, New York, 1989.
6. *The Times of India*, New Delhi, 9 July 1997.
7. Making Strategy, *The Economist*, 1 March 1997.
8. Management Focus – How to Live Long and Prosper, *The Economist*, 10 May 1997.
9. *The Asian Age*, New Delhi, 14 July 1997.
10. India of C-A-G, *The Hindu*, New Delhi, 28 May 1997.
11. Asian Shipping in Rough Seas as Industry Faces Slump, *The Asian Age*, New Delhi, 17 June 1997.
12. *The West Coast India Ports Handbook 1996-97*, Transworld Publications, Mumbai, 1996.
13. *The Asian Age*, New Delhi, 13 May 1997.
14. *The Asian Age*, New Delhi, 4 May 1997.
15. *The Asian Age*, New Delhi, 17 June 1997.
16. The Immaterial World, *The Economist*, 28 June 1997.
17. *Report of the Working Group on Shipping for the Ninth Five Year Plan (1997-2002)*, The Planning Commission, 1996.