Chapter 2 International Sea-borne Trade

2.1 Outline

The international movement of goods through the Suez Canal is dependent upon the general world economy, global trade and competitive pressures from airfreight, overland routes and the Panama Canal.

In this chapter the following factors that influence to the sea-borne trade through the Suez Potential are discussed.

1) Containerization
2) Vessel Development
3) Sea-borne Route: Panama Canal route
   Arctic Ocean route
4) Land Transportation: Pipelines for Crude Oil
   Land bridges for Containerized Cargo

2.2 Containerization

2.2.1 Trends in the world

There are several general cargo commodities experiencing a continued loss of market share to containers. Break bulk refrigerated commodities are still in decline, despite the overall growth in refrigerated trades. The increased capacity of new containerships for refrigerated containers combined with the increased trade route services of strings of larger containerships has further reduced the future potential growth for refrigerated general cargo moving in conventional refrigerated vessels.

General cargo of the roll on-roll off (Ro-Ro) type continues to grow in the domestic or a short-distance trip. But Ro-Ro is not popular in long-haul trip. The Ro-Ro trade is handled by a consolidated group of companies whose vessels carry containers to balance their capacity utilization. Growth in Ro-Ro and also heavy lift cargo will follow closely the industrial growth of the world, with energy industry growth contributing significantly to this growth.

Strength of demand for imported higher value goods moving in containers is forecast to continue as recovery from the Asian economic crisis of two years ago proceeds. With the prospect of additional increases in container trade, the industry has responded with new orders for significant numbers of new container vessels.

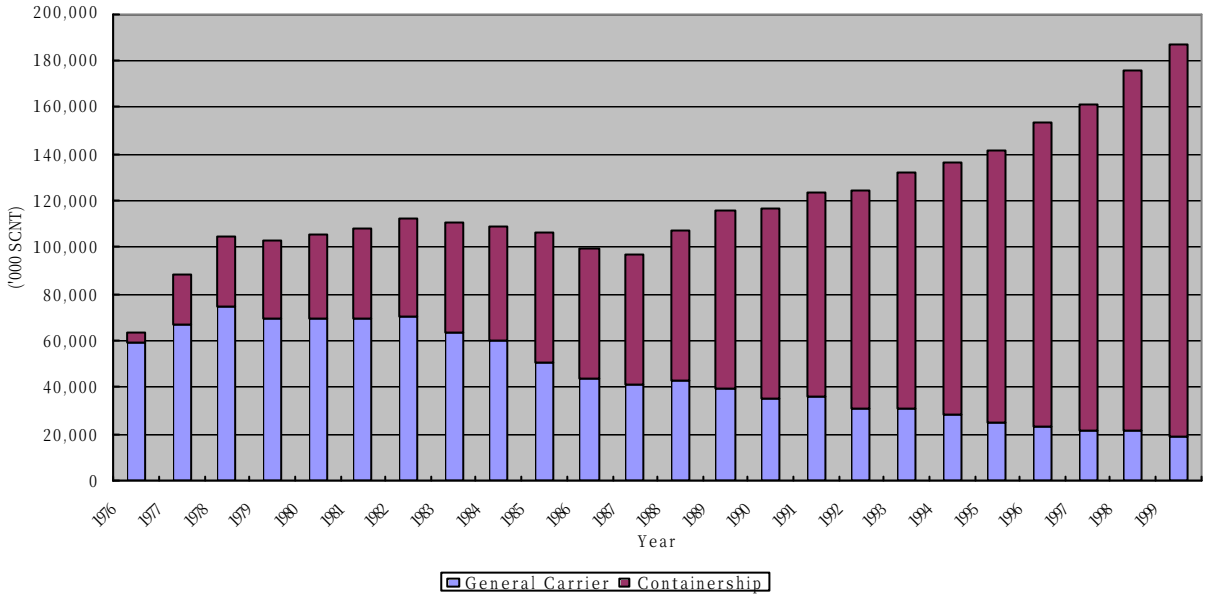
The pattern of an annual Fall seasonal peak in container cargo trade will continue in the future, but the peak period will likely lengthen as shippers and carriers adjust rates and planning to reduce the impact of the capacity problems faced almost every year. The lengthening out of the peak shipping period is also a reflection of the increasing maturation of some trade lanes, with container penetration complete for high value commodities and additional container traffic coming from special applications such as tank containers and the use of flat racks to carry outsized goods on container vessels.

The container shipping company alliances and mergers continue to affect the market through newly optimized service patterns and joint service arrangements. The recent increases in average rates have been easier for shippers to accept with improved service offerings and better transit times on many routes.

Exports from China to Europe have grown significantly recently, leading to very high vessel capacity utilization westbound to Europe.

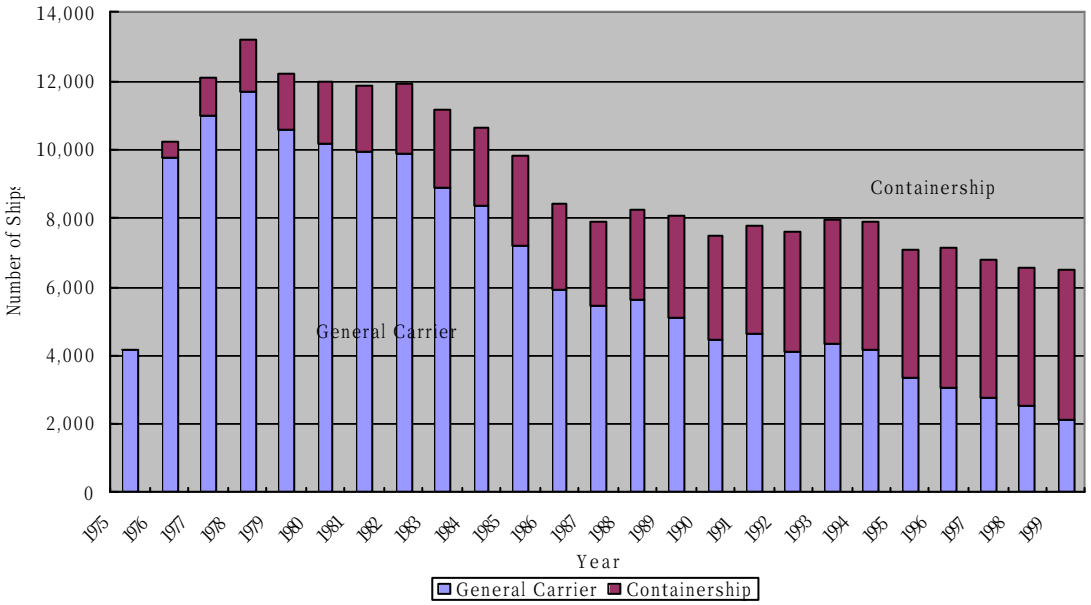
2.2.2 Trends in the Suez Canal

The cargo volume loaded in general cargo carriers has been decreasing and general cargo is shifting to containerships. As vessel size of containers is increased to almost double from 1980, containerships and containerized cargo has become major transit of the Suez Canal.



Source) SCA Yearly Reports

Figure 2.2.1 SCNT of Containerships and General Cargo Carriers



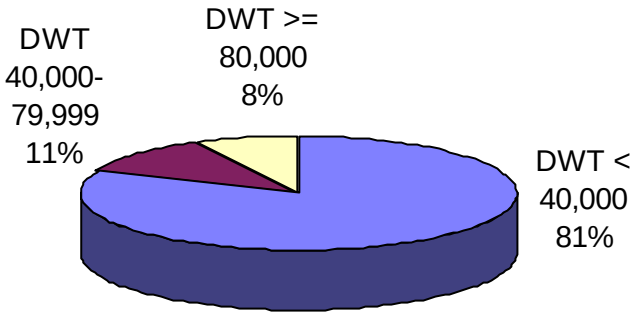
Source) SCA Yearly Reports

Figure 2.2.2 Number of Containerships and General Cargo Carriers

2.3 Vessel Development

2.3.1 Vessel Size

The development of the world fleet is an important factor for the future of the Suez Canal. Information from Clarksons Research was used to examine the size of vessels. As for all ship types, 92 percent of the active world vessel fleet and order book is below 80,000 tons deadweight. Of this, 81 percent is below 40,000 DWT.



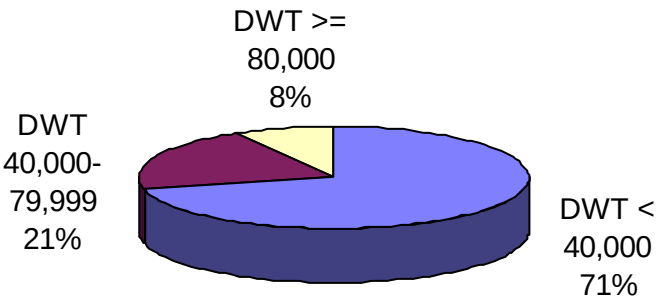
Source) Clarksons Register

Figure 2.3.1 World Fleet - All Ship Types by DWT

(1) Bulk Carrier

The size distribution of the world dry bulk vessel fleet mirrors the distribution of the overall world fleet, with 92 percent below 80,000 DWT, although a higher proportion of the vessels are in the 40-79,999 DWT size range.

The two major commodities that move in these large ships are coal and iron ore, primarily sourced in Australia, South Africa and Brazil. All three countries benefit from deep water access channels and ports. Most of the other countries that serve as marginal suppliers of these products do not have deep-water access and are themselves restricted to loading smaller “Panamax” vessels.

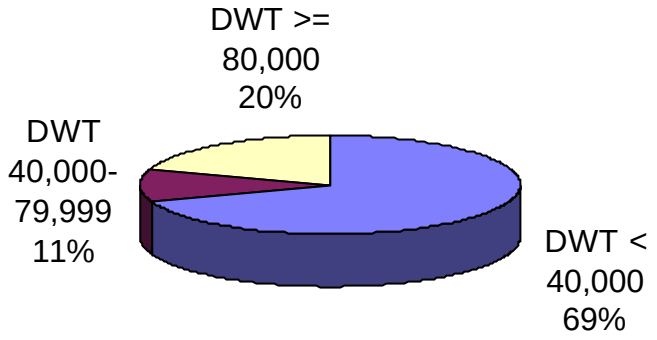


Source) Clarksons Register

Figure 2.3.2 World Fleet - Bulk Vessel

(2) Tanker

The world tanker vessel fleet size distribution has 80 percent of vessels below 80,000 DWT and a smaller proportion of the fleet below 40,000 tons. This is commensurate with the global distribution of supply and demand for crude oil which is on routes that are potentially through the Suez Canal but not the Panama Canal. The Suez Canal restrictions allow for larger ships to pass through and the existence of the SUMED Pipeline provides route alternatives for supplying oil to Europe from the Arabian Gulf.



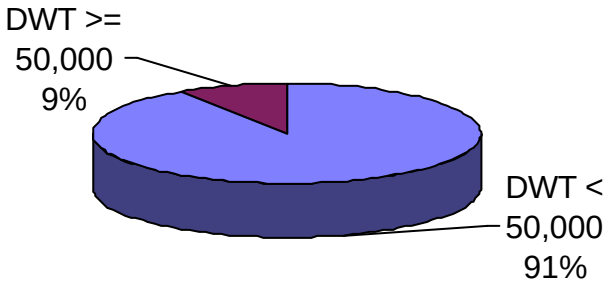
Source) Clarksons Register

Figure 2.3.3 World Fleet – Tankers

(3) Containership

The world container vessel fleet is predominantly below 50,000 DWT. It has been only in recent years that the vessel sizes have moved beyond the 50,000 DWT size marker. The trend toward larger containerships has been discussed previously. It must be noted that the trend toward increasing vessel sizes continues apace in this sector as international trade volumes grow in an environment of globalization and liberalization while ship operators want to achieve better economies of scale and improved financial results.

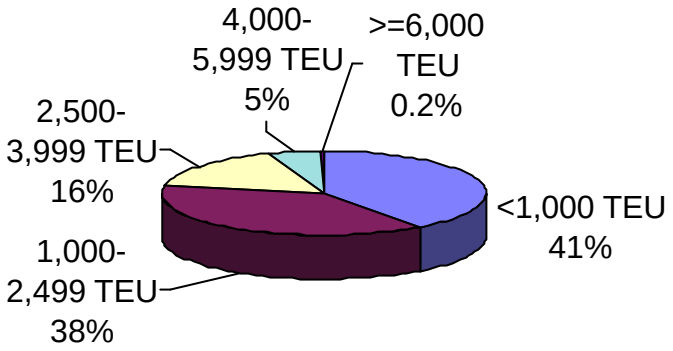
The distribution of the container vessel fleet in tonnage terms is not particularly illustrative. The consultants have therefore used the databases available from Clarksons Research in order to provide a more meaningful breakdown of the fleet.



Source) Clarksons Register

Figure 2.3.4 World Fleet - Container Vessels

Today, only slightly more than five percent of the container fleet have above 4,000 TEU capacities. The very large vessel sizes are active only on those routes (Europe-Asia and Asia-North America) that provide sufficiently large volumes of cargo over a fairly narrow range of ports. Part of the size configuration is also driven by the nature of the goods moving, with predominantly light, volumetric (high TEU requirement) cargo originating in Asia.

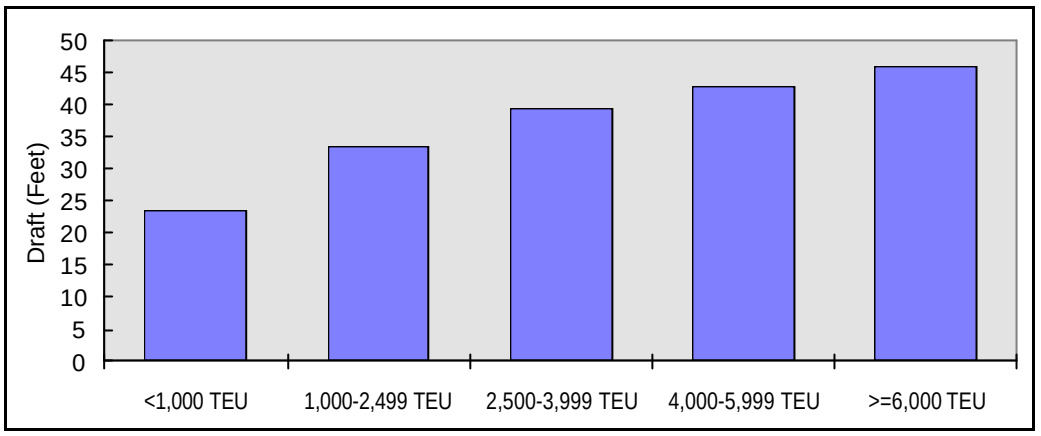


Source) Clarksons Register

Figure 2.3.5 Number of Container Vessels Based on Clarksons Data

The design draft of the container vessels has kept pace with the increase in TEU capacity. There is a strong relationship between DWT and draft, but this is mitigated by both length and beam. For example, a relatively large TEU size vessel, such as those operated by Hapag Lloyd, may still be Panamax, but their beam will be comparatively narrow, creating a deeper draft requirement compared to a larger ship with a broader beam.

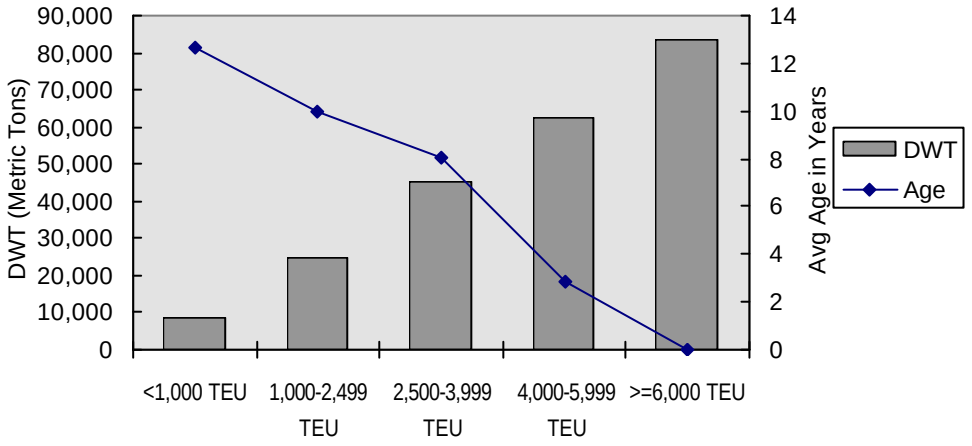
The introduction of the vessel, *Regina Maersk*, began the second phase of post-Panamax containerships operating in world trade. The most important functional characteristics of these *Post II* vessels, is their ability to accommodate 14 rows of containers under deck with 17 rows across on-deck. In comparison, *Post I* vessels, with capacities of 4,500 - 5,500 TEUs accommodate 15 rows, and a Panamax containership accommodates only 13 rows. Along with the larger vessels' greatly expanded carrying capacity, their draft requirements are greater than current operating depths of the smaller vessels. There are no existing container vessels or ordered containerships of draft greater than the Suez already, however.



Source) Clarksons Register

Figure 2.3.6 Average Containerships Design Draft

The age profile of the ships is also illustrative; it indicates that the majority of the vessels currently in service will continue to be active for a considerable period of time. Some of the first generation containerships built in 1969 are still active today, many having been re-engineered from steam to diesel, prolonging their life span.



Source) Clarksons Register

Figure 2.3.7 Average Ages and DWT of Containerships

This profile of containerships is not dissimilar from the profile of the world fleet where the majority of ships have a design draft below 12 meters. This is shown in detail next:

Table 2.3.1 Analysis of Container Vessels Based on Clarkson Data

	Beam (AVG)	Beam (StdDev)	Design Draft	DWT	PCNET	Vessel Age	Existing Fleet	New Vessels
CONT <1,000 TEU	64.1	11.4	23.6	8,855	7,884	12.9	845	144
CONT 1,000-2,499 TEU	91.0	10.0	33.7	24,977	17,068	10.0	793	251
CONT 2,500-3,999 TEU	105.5	1.2	39.4	45,166	32,139	8.1	341	58
CONT 4,000-5,999 TEU	115.1	11.2	42.8	62,251	47,179	2.8	114	62
CONT >=6,000 TEU	139.1	1.5	45.9	83,543	NA	0.0	4	19
ALL CONTAINER VESSELS	83.9	20.3	31.1	23,901	20,201	10.4	2,097	534

Source) Clarksons Register

Table 2.3.2 Number of Container Vessels by Vessel Age Calculated Based on 1999 Clarkson Data

	All Years	>= 25 Years	20 - 24 Years	15 - 19 Years	10 - 14 Years	< 10 Years
CONT <1,000 TEU	978	104	189	152	88	343
CONT 1,000-2,999 TEU	1174	61	98	168	143	704
CONT 3,000-3,999 TEU	325	4	2	16	69	234
CONT >=4,000 TEU	96	NA	NA	NA	5	96
ALL CONTAINER VESSELS	2,573	171	289	336	305	1,472

Source) Clarksons Register

Container vessel fleet will continue to grow in average size with the additional capacity benefiting the shippers moving their cargo on these larger ships.

The expected proportion of large containerships (those of 4000 TEU capacity or greater) in the next building cycle will be higher than that apparent to date. This will come as a result of the industry re-structuring that is taking place today, with fewer carriers and greater rationalization through vessel sharing and alliances.

This restructuring has already led to larger ships being introduced (greater capacity, but little, if any growth in voyages) on Europe-Asia and transpacific trade lanes. It would be unreasonable to expect the transatlantic trade not to continue the same way within the near future. One therefore expects to see increasing number of vessels in the 2,500 - 3,999 TEU range as well as an expansion of voyages with vessels in the 4,000 - 5,000 TEU range in the period covering the next ten years. Thereafter, the ratio of the largest 6,000 TEU plus

size vessels to all containerships will increase by 2010, with the trend likely continuing thereafter.

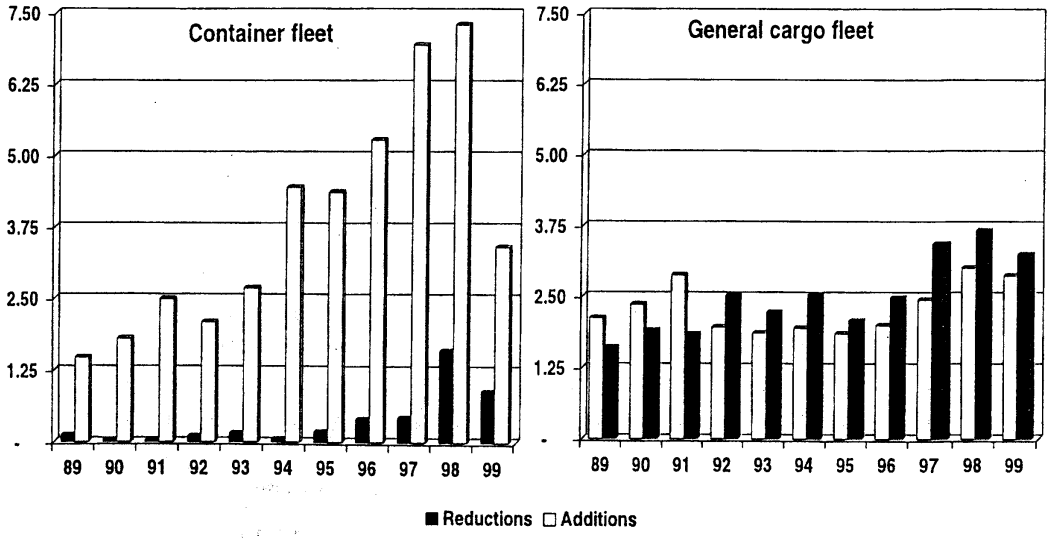
The conclusion that can be drawn from the above analysis is that there is a discernible trend towards larger vessels, indicative of ship operators' finding opportunities to maximize their cargo loads and to achieve better economies of scale.

2.3.2 Vessel Type

(1) General Cargo Carrier

The development of containerships opened a new era of sea-borne trade. Efficient shipment by containership introduced the possibility of worldwide trades and the decrease of general cargo carriers. General cargo carriers were very popular fleet before containerization. Figure 2.3.8 is changes of DWTs of containerships and general cargo carriers. The reductions of DWTs have overcome the additions since 1992.

(Mill DWT)



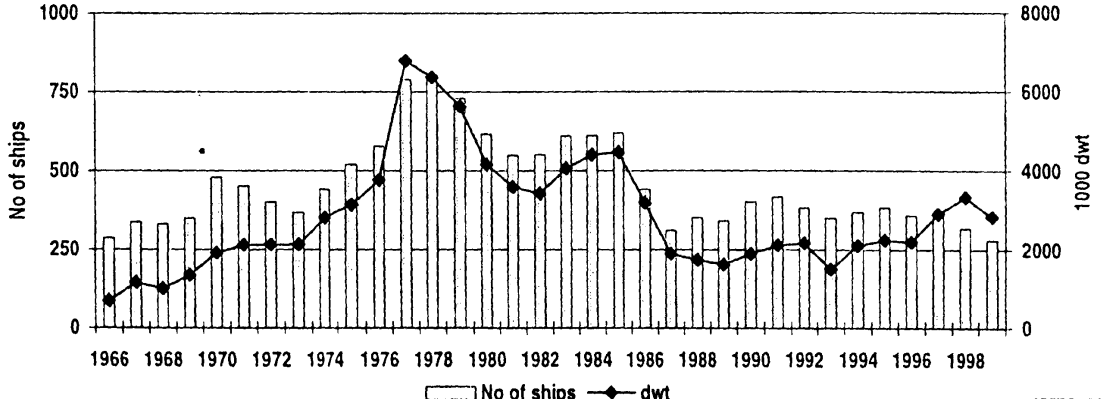
Note) Ships of 300 gt and over

Source) Shipping Statistics and Market Review, 2000, Institute of Shipping Economic and Logistics

Figure 2.3.8 General Cargo Carriers and Containerships –tonnage additions (new buildings) and reductions (as of January 1st. 1989-1999)

It means that the DWTs has become smaller year by year. Figure 2.3.9 shows the year of build of general cargo carriers. The new buildings of them are between 250-500 vessels in recent years.

They consist of for 4types; single-deck, multi-deck, special, and refer.



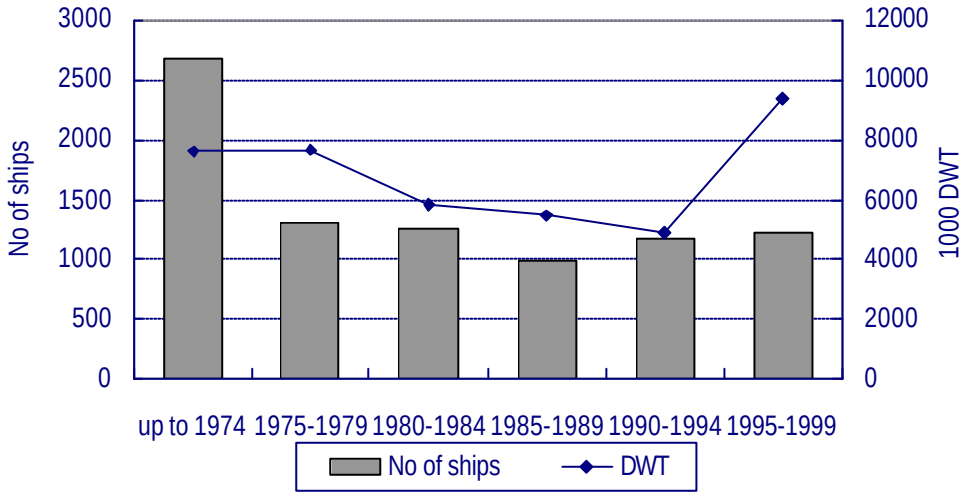
Note) Ships of 300 gt and over

Source) Shipping Statistics Yearbook 2000, Institute of Shipping Economic and Logistics

Figure 2.3.9 General Cargo Carrier –age structure by year of build (as of January 1st. 2000)

1) Single-deck Fleet

Single-deck fleet is the most popular and their DWTs are increasing while the increase of number is not large. It means the enlargement of the vessel size.



Source) Shipping Statistics Yearbook 2000, Institute of Shipping Economic and Logistics

Figure 2.3.10 Division of Age of Single-deck Fleet

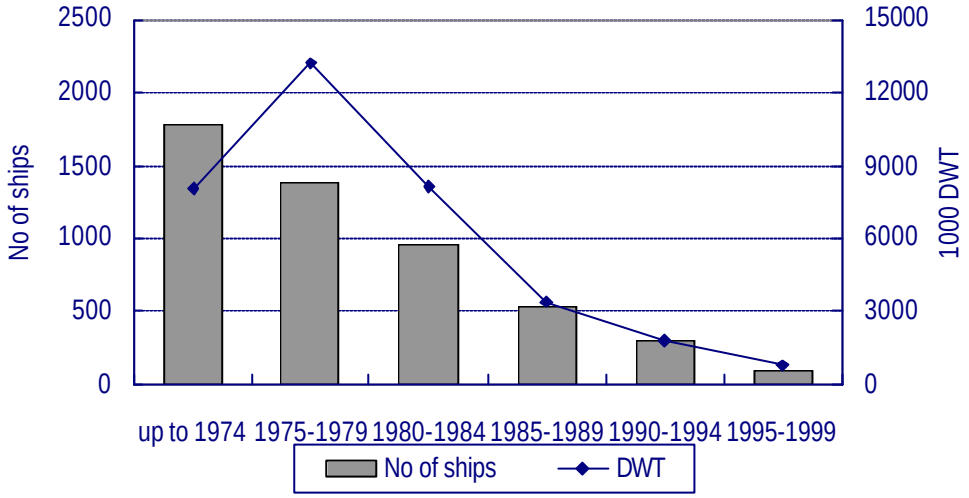
This trade can be explained as follows:

- Containership is more efficient.
- This efficiency leads the decrease of general cargo carrier.

However the increase of world trade requires the various type of transportation. And containerization introduced feeder service. The transport by general cargo carrier is necessary where containerization is behind or where the demand of cargo is small for containerization. This requirement leads the recent increase of general cargo carriers.

2) Multi-deck Fleet

Multi-deck fleet has rapidly decreased both in number and in DWT. This fleet is not efficient and will be erased from the fleet market in the future.

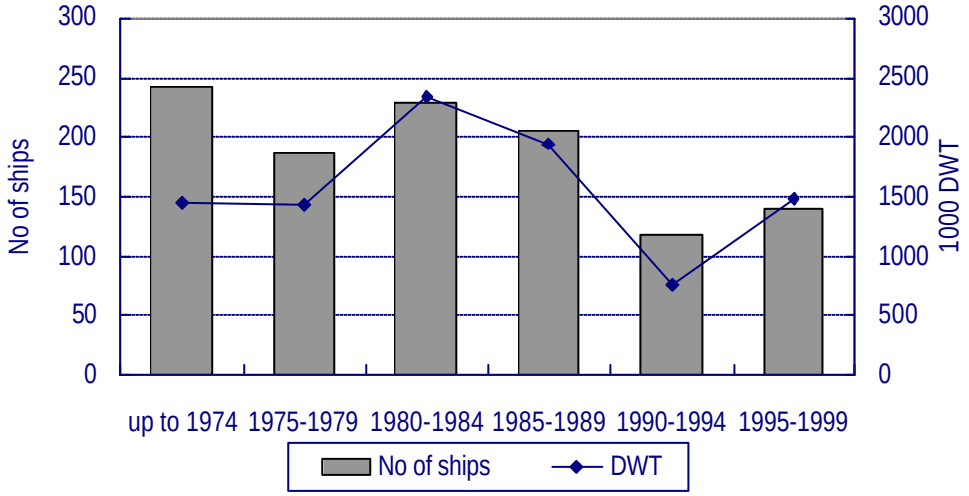


Source) Shipping Statistics Yearbook 2000, Institute of Shipping Economic and Logistics

Figure 2.3.11 Division of Age of Multi-deck Fleet

3) Special Fleet

Special fleet is used for the special goods such as livestock and large machines. The building of this kind of fleet is relatively stable and will be used even in the future because no alternative fleet exists.

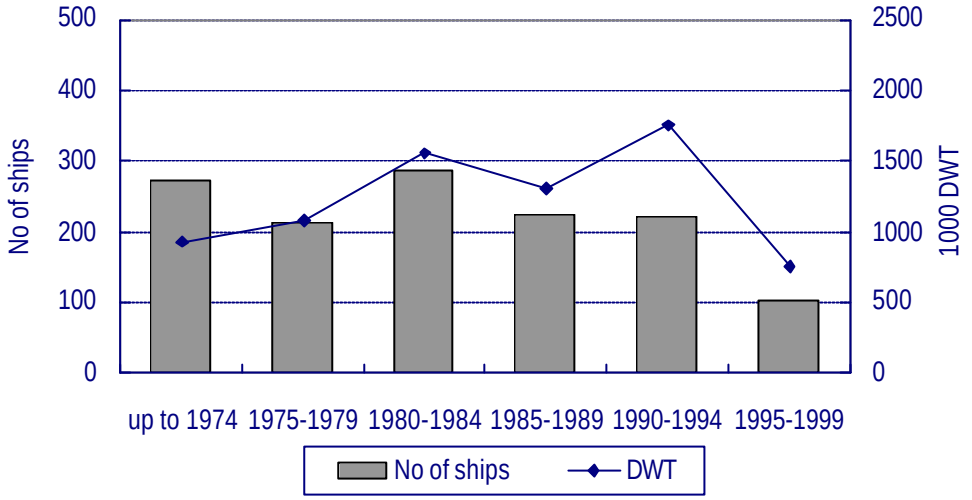


Source) Shipping Statistics Yearbook 2000, Institute of Shipping Economic and Logistics

Figure 2.3.12 Division of Age of Special Fleet

4) Reefer Fleet

Reefer fleet is decreasing in recent years because the reefer containers are used for this special transport.



Source) Shipping Statistics Yearbook 2000, Institute of Shipping Economic and Logistics

Figure 2.3.13 Division of Age of Reefer Fleet

In conclusion, the special fleet will remain even in the future but other types will become limited mainly for the use in feeder service of major container routes in the future.

(2) Combined Carrier

There is a trend that the single purpose fleet is becoming popular. This is the reason of the decrease of multi-deck general cargo carriers. By the same reason, combined carriers become unpopular. This fleet is converted to tankers, bulk carriers and other vessels. Combined carriers will be used in very limited situation and will be negligible in the future.

2.4 Land-Bridges

2.4.1 Euro-Asia Land Bridge

There are two large land bridges in the world. One is Euro-Asia Land Bridge, or Eurasian Land Bridge, that connects east Asia and Europe. Another is US Land Bridge that runs across the north America continent.

At present, US Land Bridge is working while the use of Euro-Asia Land Bridge is very limited. The US Land Bridge is old and the transit volume has almost reaches its capacity. And the use of it is limited to containerized cargo between Asia and central/east coast of America. This route is not so competitive to Suez Canal. Euro-Asia Land Bridge is not a competitor of Suez Canal now, but it may influence the transits of the Canal.

Therefore, the trend and future of Euro-Asia Land Bridge is surveyed and the possibility of the use is analysed by referring US Land Bridge. The detail of US Land Bridges is described in Appendix C of this ANNEX.

(1) Land Bridges at present

There are several alternative routes under consideration.

1) Siberia Land Bridge route

This route is typically between Moscow and Vladivostok through Ekaterinburg, Novosibirsk, Irkutsk, Chita and Khabarovsk. It is about 7,800km long from Moscow to Vladivostok and takes currently 7 days by train.

This route takes shorter time than the route through Suez Canal, but the use of this route is not popular. The problem of this route is the poor equipment and the uncertainty of schedule.

2) China Land Bridge route

This route is typically between Rotterdam and Lianyungang in China through Moscow, Samara, Karaganda, Druzhba and Urumqi. It is about 10,790km long from Rotterdam to Lianyungang and takes 23 days by train.

The operation of this route started at the end of 1992, but no train has connected China with Europe. International transportation agreement is said to be in confusion in CIS countries.

3) Silk Road Land Bridge route

This route is typically between Istanbul in Turkey and Lianyungang through Teheran, Tashkent, Almaty, Druzhba and Urumqi. It is about 11,450km long and is called “Silk

Road Railroad".

This route has a steep mountain section in Iran and Turkey. It is required to construct a new line with tunnels and bridges for faster service in this mountain area.

4) South Asia route

This route is typically between London and Bangkok through Moscow, Tashkent, Kabul, New Delhi, Dhaka, and Yangon. It is about 12,600km long. There is no direct railroad service now because of the railroad gauge difference.

(2) Perspective

Land Bridge has an advantage over sea-borne trade in that it is faster, but has a disadvantage in that it has less capacity and costs much more consequently.

Moreover there are severe condition areas for surface transportation on the middle of the continent, such as Tibetan Mountains, Gov Desert and Siberia Highlands. This physical restriction is also one of the big disadvantages for the Land Bridge.

Furthermore some borders are unable to be crossed because of the political or religious confrontations among countries, or if possible to be crossed, only with complicated procedures. There are some restrictions other than physical aspects within the present circumstances.

As mentioned above, any route from Europe or West Asia to Southeast Asia or East Asia has currently severe restrictions.
The most possible route will be Trans-Siberian Land Bridge

An international meeting to enhance the once active Trans-Siberian Service was held recently in Tokyo. It was the 9th Meeting of the International Coordinating Council on Trans-Siberian Transportation held on October 17-18, 2000. 172 representatives from 19 countries presented the Meeting and the major problems were pointed out to revive the TSR as follows:

.Regularity of service and guaranteed cargo delivery schedule by ensuring running block trains.
.Cargo security and prevention program for cargo damage
.Competitive freight rate against competing carriers in other mode of transportation
.Improvement of cargo tracing system

The Trans-Siberian Mainline is a double track electrified line, about 10,000km long, is said to be technically capable of carrying 100 million tons of cargo per year including up to 140,000 TEU from countries in the Asian and Pacific region to Europe and Central Asia. Comparing the container transport capacity of the Suez Canal, the TSR figure is small but when the North-South Korean Rail is connected in future and the Korean Rail connected to

TSR, the volume will increase substantially. The future outlook of break-bulk cargo might be slightly affected by TSR.

Compared to US Land Bridge, TSR has some issues. US Land Bridge has many destinations and origins along the route. It supports the stability of the management of the route. On the contrary, the origins and destinations along TSR are limited. It means that the profitability of TSR is relatively poor. The cooperation with other modes is also a big issue. US land bridge is not a competitor of ship operators but an co-operator. US land Bridge is one of links of sea-borne trade. TSR, however, will be a competitor of ship operators. TSR has to survive in the competition with the strong ship operators.

The Land Bridges should be paid attention to, but they will not be strong competitors of the Canal in the future.

2.4.2 Egyptian Inland Route

The container system is an international multi-modal transportation system. Ocean going container operators must cooperate with other mode operators, such as railroads and truckers. In North America, shipping lines are coexisting with railroads running many DST (Double Stack Train) on trans-continental routes, but in many other countries railroad companies are competing with ocean going container operators like TSR service.

For the Suez Canal, ENR (Egyptian National Railway) is a neighbor organization, but the relationship between SCA and ENR has been not so close. In August 1998, ENR started a new campaign to improve freight transport by introducing weekly/daily freight train with an accurate time schedule. An organization called CCA (Commercial Central Administration) is taking the lead in customer contact and marketing is being made by Business Managers in Business Management & Marketing Units. About the current container businesses by ENR are to be investigated.

However, the use of this route will be limited to domestic transportation. The containers from the Red Sea to Europe have to be transferred twice at a port of the Red Sea and a port of the Mediterranean. These transfers are the weak point of this route. US land Bridge is an example. It is used only for transportation whose origin or destination is in Central America or East Coast of America. No containers are transported from Asia to Europe across America.

In conclusion, the Egyptian Inland Route will not be used as a bypass route like the US land Bridge

2.5 Pipelines

2.5.1 Crude Oil pipeline

(1) Possible pipelines

A pipeline is one of the strongest competitive transportation modes of the Suez Canal.

Most crude oil passing through the Canal comes from Arabian Gulf to Europe. Competitive pipelines will be ones that run between Arabian Gulf to the Mediterranean or Suez Gulf to the Mediterranean. In this chapter, information on such pipelines is collected.

The major pipelines, which would give great influences on the transits of the Canal, will be the following lines:

Pipelines connecting Red Sea and Mediterranean
- 1) SUMED
- 2) TIP Line

Pipelines for Saudi Oil
- 3) TAP Line
- 4) Petroline (from the Gulf to Red Sea)

Pipelines for Iraq Oil
- 5) Iraq – Turkey Line
- 6) Iraq – Banyans Line
- 7) Iraq – Tripoli Line

The information on SUMED was surveyed by an interview to SUMED. The most of other information comes from the following data book.

"Arab Oil & Gas Directory 2000", Arab Petroleum Research Center
"Oil & Gas Journal"

1) SUMED

SUMED has a complementary role of the Suez Canal. It started the operation in 1977.The capacity of SUMED is now 2,400,000b/day after the expansion was completed. SUMED's main users are Saudi Arabia, Iran, and Iraq.

Tariff of SUMED is flexible and automatically reflects monthly changes in spot rate of VLCCs. SUMED is detailed in Appendix D.

2) TIP Line

TIP Line connects the point of Elat in the Gulf of Aqaba and the port of Ashkelon the Mediterranean. A governmental company "KATZ" operates this line. The information of this line is very limited.

At present the line is estimated carry small portion of crude oil compared to its capacity.

3) TAP Line

The Trans-Arabian Pipeline Company constructed TAP Line in 1950. It is 1,213km long from oil fields in Saudi Arabia to Zahrani on the Mediterranean seashore in Lebanon. The line passes through Jordan, Syria as well as Saudi Arabia and Lebanon. The original capacity was planned to send the oil only to refineries in Lebanon and Jordan, The reason of stopping exports is said be lower tanker rate. Direct shipping from the Gulf was some 2$/b less at that time, Lebanese section was handed to Lebanese government in 1983 and has been closed.

Furthermore, after the Iraq invasion to Kuwait, Saudi Arabia stopped supplying oil to Jordan. But Saudi Arabia is said to be considering reopening it for the purpose of delivering Saudi Crude to Jordan, Lebanon, and the Pakistan Territories.

4) Petro Line

Petro Line transports Saudi crude oil from oil fields to Yanbu terminal of Red Sea. It is 1,200km long and was opened in 1981 with the original capacity of 1.85mb/day after 2 expansions; its capacity has been 4.8mb/day since 1993. The end of the line is Yanbu terminal.

The crude oil terminal in Yanbu has 4 berths and only 2 berths can be used simultaneously. The maximum size of vessels at the terminals is 500,000DWT.

5) Iraq – Turkey Line

Under the UN's supervision, Iraq can export their crude oil only through the Iraq-Turkey pipeline and the port of Mina al-Bakr in Arabian Gulf.

The Iraq-Turkey pipeline receives crude oil from oil fields near Kirkuk and Baghdad and transports it to the Port of Ceyhan.

The desired capacity is 1,600,000b/day, but due to the damage of facilities, current capacity is said to be around 1,000,000b/day. Though Iraq tries to enhance the capacity, it is said that it will not be repaired soon. And the storage facilities at Ceyhan in Turkey have the smaller capacity than the designed level.

6) Iraq – Banias Line

This line links Iraqi oil fields around Kirkuk to Banias in the Mediterranean seashore in Syria. This line was built by the Iraq Petroleum Company in 1950s and Syrian part of which was nationalized by Syria in 1972. But in 1982, Syria closed the Syrian section because of political confliction with Iraq. Since then, this pipeline has never transported Iraq crude oil. This pipeline is now used for domestic transport.

In 1998, Syria and Iraq agreed to open the line, but the timing of reopening is not still clear. Iraq announced in 2000 the pipeline was completely rehabilitated. It is said the line could probably transport up to 1mb/day.

The export terminal at Banias has 3 berths and can handle up to 210,000DWT tankers.

7) Iraq-Tripoli Line

From the oil fields around Kirkuk, Iraq Petroleum Company built a pipeline to the Mediterranean port of Tripoli in Lebanon in1934. This pipeline ran across Syria. The capacity of this line was 450,000 b/day. And Tripoli oil terminal had 4 berth accommodating up to 250,000 DWT vessels.

However, after 1982, when Syria closed their pipeline in their territory, Toripoli terminal does not carry Iraq crude oil.

Table 2.5.1 Present Situation of Crude Oil Pipelines

Name of the Pipeline	Name of the Business Entity	Origin and Destination of the Pipeline		Situation of the operation	Throughput Capacity (million ton/year)	Actual volume transported* (million ton/year)	History and plan for expansion of the business
		Origin	Destination				
(1) SUMED	the Arab Petroleum Pipelines Co. (SUMED)	Ain Sukhna (Egypt, Gulf of Suez)	Sidi Kerir	Operating	120 (2.4mb/day)	105	*The throughput capacity was expanded from 80million tons per years to 117million tons in 1996.
(2) TIP Line	KATZ	Elat (Islael, Gulf of Aqaba)	Ashkelon (Israel)	Operating		6	*The throughput capacity may be expanded from 45 million tons to 60million tons per year in future.
(3) TAP Line	Trans-Arabian Pipeline Co.	Saudi oil fields	Zahrani (Lebanon)	Closed	25 (0.5mb/day, originally)	-	Supply to Zahrani was stopped 1983. Totally closed after the Gulf crisis: Re-exporting for Jordan, Lebanon market is considered.
(4) Petro Line	Saudi Aramco	Saudi oil fields	Yanbu (Saudi Arabia)	Operating	240 (4.8mb/day)	72	Capacity has expanded several times. The present capacity is since 1993.
(5) Iraq-Turkey	Petroleum Pipelines Company	Kirkuk (Iraq)	Ceyhan (Turkey)	Operating	50 (about1mb/day)	50 (1999) 38 (2000)	No expansion is planned.
(6)Iraq-Banias	Iraq Government	Iraqi oil fields	Banias (Syria)	Closed	60 (1mb/day)	-	It is announced this line will open. But the reopening is unclear.
(7)Iraq-Tripoli	Iraq Government	Iraqi oil fields	Tripoli (Lebanon)	Closed	23 (0.45mb/day)	-	This line is not used due to Syrian part is closed.

*) Actual volume is rough and uncertified

(2) Perspective

Pipeline operation is totally dependent on the peace conditions of the Mid-East. Crude oil pipelines from Saudi Arabia to Lebanon (TAP line), from Iraq to Syria (Iraq-Banias line) and from Iraq to Lebanon (Iraq-Tripoli line) are closed. However, after settlement of the Mid-East crisis and partial or full removal of the UN embargo against Iraq, these pipelines will respond and transportation of crude oil may return to the past capacity of other pipelines.

Consequently, the potential transportation volume through the Suez Canal and the SUMED pipeline will relatively decrease.

Transportation cost is one of key factors of the choice from tankers and pipeline between the Gulf countries and the Mediterranean.

There are three (3) alternatives to transport the crude oil from the Gulf countries to the Mediterranean.

Table 2.5.2 Transport route from the Gulf to Europe

Alternative	Transportation costs items*2
Transportation by Tanker	• Shipping cost from the Gulf countries to the Mediterranean. • Suez Canal due.
Transportation by pipeline	• Pipeline due. • Loading cost *1 of crude oil to Tanker at seaport of the Mediterranean
Transportation by tanker and pipeline	• Shipping cost from the Gulf countries to Ain Sokhna (Egypt, Red Sea) • Unloading cost*1 of crude oil at Ain Sokhna • SUMED due • Loading cost*1 of crude oil at Sidi Kerir (Egypt, Mediterranean).

Note *1) The loading and unloading costs consist of operation cost of handling the crude oil at seaport concerned and waiting and the handling time costs charged to the tanker concerned at the seaport.

Note *2) Along with the above-mentioned transportation cost items, the following sub item costs have to be added:

. Transportation cost of crude oil from the crude oil field to the port for loading crude oil to tanker, and loading cost to tanker in case of the transportation by tanker.

. Shipping cost from the seaport of the Mediterranean to final destination ports both in cases of the transportation by tanker and pipeline

However, almost all existing pipelines are operated by state owned enterprises. Accordingly, they can set the pipeline dues from standpoint of their national policy on exports of crude oil, ignoring the financial balance in the pipeline operation. Moreover, the price of crude oil is surely expected to increase in future, resulting in a relative decrease of the transportation cost share of the price.

Consequently, the pipeline dues over the transportation volume become relatively small. In the extreme case, the pipeline due will be negligible to the customers. So, the expected situation will work favorably for pipeline transportation rather than for the tanker transportation.

At an actual payment cost basis, not an accounting cost basis, there is a high possibility that the transportation cost by tanker becomes more expensive than the one by pipeline. As the result, the ratio of potential transportation volume of the crude oil by tanker from the Gulf countries to the Mediterranean will decrease.

2.5.2 Gas pipeline

The competitive facilities for liquid gas are listed in Table 2.5.3.

Table 2.5.3 Competitive Facilities in the Future

Country	Facility	Capacity
Algeria	pipeline to Italy	24 bil. cm/year 30 bil. cm/year (planned)
	pipeline to Spain	10 bil. cm/year
	liquid gas plants	30.5 bil. cm/year
Iraq	pipeline to Turkey	0.4 bil. cm/year (stopped since 1990)
Egypt	pipeline to Italy	planned
	liquid gas plants in Alexandria	planned

Pipelines from Algeria are competitors at present. If these pipelines and plants have more capacities, the volume thorough the Suez Canal will decrease.

The most serious competitors exist in Egypt. The facilities are still planned, and the construction schedule is unclear at present. But once these facilities are open, the Suez Canal will be less attractive as a route of LNG.

There is few possibility to increase liquid gas as Suez Potential Cargo except the increase by the economic growth.

Present situations of gas pipelines are described in Appendix D.

Chapter 3 International Maritime Transportation

3.1 Container Vessels

3.1.1 Latest Trend of Container Transportation Business

When it was finally announced on July 22 1999, the A P Moller-Maersk's acquisition of Sea-Land's International operations from parent CSX Corp. did not come as a surprise to most in maritime circles, as it had been anticipated for so long, but it did to many outside of those circles. The union of Maersk with Sea-Land to form Maersk-SeaLand creates a truly mega-carrier in every sense of the word. The new company will be twice as big as any other ocean carrier in terms of slots deployed. It will have 35 separate services, a string of 24 container terminals around the world and a fleet of over 500,000 containers.

It is unlikely, however, that this development will initially have quite the same seismic effect as the P&O-N merger or NOL's purchase of APL. Maersk and Sea-Land have been working together as partners for many years, first in the transpacific trade in 1991 and then since 1996 in a global alliance. Therefore, "the disintegration and reconstitution of several major groupings that occurred in the wake of the P&O-N and NOL/APL deals will not be an immediate issue on this occasion." (Containerization International, Editorial Comment, August 1999)

According to Maersk and CSX, it will take approximately four months to finalize the transaction as it is subject to due diligence and regulatory approval. A simple combination of each carrier's current market shares would produce a share of as much as 19 % between Asia and the US and 17 % between the US and North Europe for Maersk-SeaLand. These are, however, by no means dominant positions and both parties are confident that they will get the necessary regulatory nods from Washington and Brussels.

This case of Maersk-SeaLand symbolizes the latest trend of the shipping world, namely 1) merger of big shipping lines, and 2) international alliance. Table 3.1.1 and Table 3.1.2 show the scale of the new Maersk-SeaLand once the transaction is officially approved.

Table 3.1.1 Number of Ships and Container Slots of New Maersk

	Current	On Order	Total	Average Age
Number of Ships	146	21	167	10.2
Slots operated(TEU)	415,302	96,760	512,062	

Source) The Study Team

Table 3.1.2 Top Ten Container Operators (by slots operated)

	TEU	TEU on order	Vessels	Vessels on order	Average Age
Evergreen	287,513	112,940	116	31	10.9
Maersk	269,682	96,760	89	21	8.0
P&O-N	214,079	71,194	79	12	10.6
COSCO	203,054	20,800	115	13	11.7
Sea-Land	166,290	34,000	63	0	14.7
NOL/APL	156,701	4,160	50	4	9.6
Hanjin	129,368	0	34	0	5.9
NYK	118,441	0	47	0	8.4
Hyundai	109,339	32,000	31	5	5.5
MSC	108,986	12,168	52	3	17.6
OOCL	96,889	33,156	34	0	7.9
Total	1,860,342 (100)	417,178 (100)	710 (100)	89 (100)	
Maersk/SeaLand Post Merger	415,302 (22)	96,700 (23)	146 (20)	21 (23)	

Source) Fairplay

3.1.2 Container Business Trends as viewed by the Japanese Shipping World

A more detailed account of the International Shipping Trends viewed by Japanese Shipping World is given here. Ideas presented here are derived from "Yearly Report of Japanese Shipowners' Association 1998", Official Documents of Business Research Department of MOL (Mitsui O.S.K. Lines) and NYK (Nippon Yusen Kaisha).

(1) Imbalance of Containers

One of the biggest and most critical changes in 1997 was the fall-down of currencies in Asian countries and the economic crisis which followed throughout the entire region. 1998 was the year of structural change in Asian International Shipping as a result of the currency crisis and all container operating shipping lines without exception were trying to cope with the rough sea that this change brought. For instance, in Asia/North American Trade, the East bound cargo volume (Export cargo to North America from Asia) reached about 6.18 Million TEU, a 20% increase compared with the previous year. On the other hand, West bound cargo (Import cargo to Asia from North America) dropped greatly to about 3.62 Million TEU, an 11 % decrease from the previous year, because almost all Asian countries could not buy goods from North America. The imbalance in trade quickly reached a fatal level.

Focussing on the change in Asia/US trade volumes, we see that exports from Asian countries to the US registered 5.80 Million TEU, while exports from the US to Asia

registered only 2.85 Million TEU, and thus the imbalance ratio of the ocean going containers in Asia/US trade became 49%, quickly worsening from 71% in 1997. Under this situation, empty containers are piling up in the US region, while a keen shortage of available containers for export cargo is being experienced in Asia. The most important means of cost saving to any container operator is to minimize the number of sleeping piles of containers and to minimize positioning cost. However, rather than improving in 1998, imbalance problem became even worse. Rectifying this imbalance will become even more difficult if Asian countries do not recover from their current economic slump.

(2) Larger scale of new Container Ships

In the first quarter of 1999, the world container fleet was comprised of 3,500 vessels with a capacity of 4.60 Million TEU. This is the third consecutive year since 1996 that growth has exceeded 10%. In 1998, in particular, 280 container ships, with total capacity of 540,000 TEU, were built , the most ever in one year. The average size of new ships is 1,914 TEU, and the size is getting larger every year. What was most noteworthy in 1998 was the increase in the number of larger container ships with a capacity of 4,000 TEU or more. The increase rate of such ships reached 26 %, while the overall increase rate was just 11 %.

1) Container ship-size and deployment

It is often said that the growth in vessel size is having a 'cascading effect ' on the smaller trades, meaning older tonnage is finding its way onto the North South trades as carriers rush towards post-Panamax vessels of ever increasing dimensions. This trend is apparent, but so to is the fact that the Panamax fleet is also growing.

After Maersk invested in vessels of 6,000+TEU the shipping industry seemed to hold its breath, waiting to see if this size of vessels was viable. That waiting now appears to be over, with several more shipping lines ordering vessels of 6,000 TEU and above. The doubt now concerns the next generation of container vessels and how big they will be. Although there are several clues as to what the size may be, there is no known order to construct the next generation of containership.

2) The current world fleet

The following data on the total world containership fleet comes from Containerization International and DYNAMAR.

Table 3.1.3 Summary of World Fully Cellular Container Fleet (as of November 1998)

TEU Capacity	Under 1,000	1,000-1,999	2,000-2,999	3,000-4,499	4,500+	Total
1996						
Slots	303,018	913,143	806,798	880,467	185,397	3,178,823
Ships	793	654	319	237	36	2039
1997						
Slots	431,336	1,005,458	877,173	954,156	295,128	3,563,251
Ships	861	724	347	256	57	2245
1998						
Slots	431,336	1,005,458	877,173	954,156	295,128	3,563,251
Ships	969	783	386	312	85	2,535
1998 average % per vessel size						
Slots	12.1	28.2	24.6	26.8	8.3	100.0
Ships	38.2	30.9	15.2	12.3	3.4	100.0

Source) Containerization International, JICA Study Team

Table 3.1.4 Breakdown of Full-Containerships (as of Jan. 1 1999)

	Under 1,000 TEU		1,000-1,999 TEU		2,000-2,999 TEU	
	Vessel	TEU	Vessel	TEU	Vessel	TEU
1999	1,836	765,922	851	1,117,368	426	1,060,460
(1998)	1,751	714,155	807	1,117,310	381	956,349
	3,000-3999 TEU		4,000 TEU+		Total	
	Vessel	TEU	Vessel	TEU	Vessel	TEU
1999	205	711,498	188	889,982	3,506	4,605,230
(1998)	189	653,444	152	704,559	3,230	4,145,817

Source) DYNAMAR, JICA Study Team

3) Trends in fleet growth

As is well known, the growth rate among the vessel size groups is far from even. The focus of new builds is very much on the larger vessels. The growth rates from January 1998 to January 1999 in each TEU class are as follows:

Table 3.1.5 1998 Capacity Growth in Vessel Size

Under 1,000 TEU	7.2%
1,000-1,999 TEU	5.4
2,000-2,999 TEU	10.9
3,000-3,999 TEU	8.9
4,000+TEU	26.3

The boom area is clearly that of vessels above 4,000 TEU. Of the new capacity delivered in 1998, vessels over 4,000 TEU accounted for almost one third of the total. This is quite remarkable considering how long it took shipping lines to cross the Panamax divide.

In the early 1970s, the first container vessels of 3,000 TEU entered service on the Europe Far-East Trade, operated by then OCL. These vessels had a beam of 32.2m, giving them the ability to store containers 13 across deck. They had a draught of 13.0m. While other lines followed suit, it was almost a decade before 500 TEU was added by Hapag Lloyd in 1981. Still within Panamax dimensions, USL employed 4,300 TEU vessels in 1984.

A ship of post-Panamax dimensions presented a greater challenge to shipping lines than shipbuilders, as considerable flexibility is lost. APL met the challenge in 1988, introducing vessels with a beam of just under 40m, making them the first post-Panamax vessel. They store containers 14 across, and have a capacity of 4,340 TEU. APL's move did not result in a rush from other shipping lines; it was not until the early 1990s that others began to follow suit. In 1992 HMM introduced a 4,400 TEU vessel storing containers 15 across, followed by a 4,850 K class vessels, the Regina Maersk. P&O Nedlloyd received a 6,000+TEU capacity vessel in 1998. The dimensions of the Maersk and P&ON vessels, the largest vessels currently in service, are set out below.

Table 3.1.6 Largest Vessels (M-SL and P&O-N)

Vessel	Date of delivery	Length (m)	Draft (m)	Beam (m)	Deck storage	Capacity (TEU)*
Maersk K	1996	318.2	14.0	42.8	17	6,000
Maersk S	1997-1999	347	14.5	42.8	17	6,600
P&ON	1998	347	13.0	42.8	17	6,690
Maersk C	2000					8,700

Note)* Declared capacity

Source) JICA Study Team

It is widely regarded that Maersk has under declared the capacity of its Kand S class ships. The first 6 vessels are considered to hold between 7,500 and 7,600 TEU. The next three S class vessels will be longer at 346.7m, giving them a theoretical capacity of up to 8,500 TEU including empties. Draft is increased to 14.5m. Whatever the mix of full/empty containers, the 8,000 TEU vessel is a reality.

Almost all top 20 carriers now operate post-Panamax ships. With the boom in the growth of larger vessels, the 182 vessels in the over 4,000TEU class has become too big to deal with in one statistical category. The reason for using a single category is

no doubt the Panamax divide.

However, there are other factors that are just as important to a shipping line as the Panama Canal. The difficulty filling the larger vessels without relying on one's competitors is a prime reason why not all lines are rushing to build 6,000+TEU monsters. The world's fleet over 4,000 TEU vessels is almost exclusively in the hands of the top 20 carriers and can be broken down as of the end of 1999 as follows:

Table 3.1.7 Vessels over 4,000 TEU owned by the top 20 carriers

Line	4,000-4,999	5,000-5,999	6,000+
Maersk-Sealand	25		15 + (8)*
Evergreen	20	10 + (5)	(5)
P&ON	12	+ (9)	(4)
MSC			(10)
Hnajin + DSR	19	7	
COSCO		6 + (6)	
APL (NOL)	22	4 + (9)	
NYK	3	2	(5)
Mitsui OSK	6		(5)
Hyundai MM	6	7	(5)
CP Ships			(8)
Zim			
CMA-CGM	0 (5 at 3,961)		
Hapag Lloyd	11 + (3)		(4)
OOCL	6	3 + (6)	
K Line		(12)	
Yangming		(7)	
UASC			
Total	130 + (3)	39 + (54)	24 + (54)

Note) ( ) on order or being built

*Declared capacity-8,700 TEU

Source) Containerization International, JICA Study Team

As the above table shows, most of the vessels over 4,000 TEU have capacities of between four and five thousand TEU. This picture will change quite drastically over the next two years as new builds come on line. Containerization International notes that there is evidence that the total growth in the world's fleet is slowing down; it predicts 7% growth in 1999 and just 4% in 2000. This follows an 11% + growth rate in 1998. There is also expected to be an increase in the capacity being scrapped.

The Asian crisis slowed the momentum in the growth in the number of larger vessels

in 1997, when just 14 were ordered. In 1998 interest returned to the 4,000 TEU + category with 43 orders being placed. According to NYK's calculations, this represents 56% of the total new vessel orders, and the average size of a containership ordered in 1998 increased to 2,746 TEU. At the time the 1999 Containerization International Yearbook was compiled, there was still time for owners to order vessels for delivery in 2001. NYK's data is more recent, it gives the breakdown of remaining orders for 1999 to 2001 as follows:

Table 3.1.8 Vessels on order in 1999 by year of completion

	Under 1,000 TEU		1,000-1,999 TEU		2,000-2,999 TEU	
	Vessel	TEU	Vessel	TEU	Vessel	TEU
1999	73	38,464	71	105,105	33	76,849
2000	16	8,144	20	31,662	18	41,770
2001	0	0	4	6,472	5	11,600
Total	89	46,608	95	143,239	56	130,219
	3,000-3,999 TEU		4,000 TEU +		Total	
	Vessel	TEU	Vessel	TEU	Vessel	TEU
1999	2	7,974	23	124,744	202	353,136
2000	12	42,800	46	241,888	112	366,264
2001	7	23,600	4	21,728	20	63,400
Total	21	74,374	73	388,360	334	782,800

Source) NYK Research Department data

In addition to Maersk-Sealand (8 x 8,700 TEU vessels), P&ON (4 x 6,788 TEU vessels)and NYK (5 x 6,200 TEU vessels), the following lines have placed orders for vessels over 6,000 TEU (as of the end April 2000):

Table 3.1.9 Additional lines crossing the 6,000 TEU barrier

Shipping Line	
Hapag-Lloyd	4 x 7,200 TEU vessels on order
MSC	10 x 6,700 TEU vessels on order
CMA-CGM	8 x 6,500 TEU vessels on order
Hyundai MM	5 x 6,400 TEU vessels on order
Evergreen	5 x 6,046 TEU vessels on order
Mitsui OSK	5 x 6,000 TEU vessels on order

Source) Fairplay, Containerization International

At the time of researching, Evergreen had just cancelled its order for an 18th U type 5,634 TEU vessel in favor of a K class 6,046 TEU vessel. Four more have been ordered for delivery in late 2001. In addition to the monsters listed above, lines

continue to invest in 'smaller' post-Panamax vessels. The following orders have been reported in the media:

Table 3.1.10 Post-Panamax vessels below 6,000 TEU on order

Shipping Line	Order
Maersk-Sealand	2 x 4,300 TEU vessels on order
- ditto -	5 x 5,500 TEU vessels on order
P&ON	5 x 5,000 TEU vessels on order
Evergreen	4 x 5,364 TEU vessels on order
Hanjin	7 x 5,600 TEU vessels on order
APL	6 x 5,500 TEU vessels on order
K Line	6 x 5,500 TEU vessels on order

Source) Faiplay, Drewry, JICA Study Team

Despite all the talk about the disadvantages of larger vessels from shipping lines that do not have them, the fact remains that three more competitiors will look to do the same. In January 1999 Containerization International presented an analysis of the costs associated with running various size vessels on a weekly basis. Shipping lines are never going to divulge their entire cost structures and, therefore, any analysis must be regarded as an estimate only. The value of Containerization International's analysis is that it serves to show that carriers save money from operating bigger ships:

Table 3.1.11 Costs per TEU according to vessel size

Vessel size on weekly service	Average cost per TEU (US$)
Mega carrier, 6,000 TEU ships	$ 800
Large carrier, 4,800 TEU ships	$ 850
Medium carrier, 3,200 TEU ships	$ 1,000
Small carrier, 2,400 TEU ships	$ 1,550

Source) Containerization International

Another point to note is that the vessels need not be full to achieve economies of scale. An 8,000 TEU vessel is widely considered to still offer savings in operating costs until its capacity gets below 80%.

4) How big will vessels get?

As is shown in the above, the 8,000 TEU vessel is, in fact, already a reality. Future 8,000+ TEU vessels could see the number of containers stored on deck increase from 17 to 18. Designs for vessels greater than 8,000 TEU run into the problem of the limitations of modern diesel engines, though there is a report that P&ON is

considering the introduction of a 12,500 TEU ship.

The maximum current power output of ship engines is around 95,000 HP. Building a bigger vessel with such an engine reduces speed below 25 knots and increases fuel consumption to a level where it would be uneconomical to operate. Putting two engines in one vessel is possible, but this requires a capacity of 15,000 TEU for maximum efficiency. Shipbuilders consider that there is no technical constraint to building a ship of 15,000 TEU, or even 18,000 TEU. Such vessels are envisaged to serve a network of 'mega-hubs'. There would be only four or five at most, all on the main East-West trade routes. The dimensions of such a vessel, according to Dr. Payer, a Dutch scholar of shipbuilding, are set out below:

Table 3.1.12 15,000 TEU Mega Ship

Length	Draft	Beam	Deck box width
400.0m	14.0m	66.0m	24

The most recent mega-ship design comes from Professor Niko Winjolst of the Netherland's Maritime Network and is for an 18,154 TEU vessel. The extra capacity is obtained by increasing the draught to 21m, chosen because it is the shallowest point in the Malacca straight on the Europe/Asia route. Although such a draft is beyond the present depth of the Suez Canal, Winjolst calculates that the current dredging program will see the Suez Canal able to handle such a vessel by 2009. The dimensions of Winjolst's design are set out below:

Table 3.1.13 18,000 TEU Mega Ship

Length	Draft	Beam	DWT	LWT	Deck box width
400.0m	21.0m	60.0m	242,800	70,771	24

Achieving economies of scale has pushed shipping lines towards vessels of 8,000 TEU, and it seems likely to push them towards even bigger vessels. Winjolst calculates that his 18,514 TEU vessel represents cost savings of 16% over a current 8,000 TEU vessel. While no one is quite sure, or at least not letting on, what the next ' jump' will be, many commentators are speculating on 10,000 TEU, despite the problem with engine size. Lloyd's List refers to the 10,000 TEU design as being " probably not that far away ". Dr. Payer sounded a warning at TOC 99 that if the shipping industry wants such vessels shipbuilders will respond:

"It may be assumed that further progress will be made in the development of containerships and ports, beyond the 8,000TEU vessels. Naval architects and marine engineers will no doubt be in the position to meet the requirements of the market for even larger units. Container ships have always been developed close to the limits of what was considered to be technically feasible."

5) Breaking-up of old container ships / building new ships

On the other hand, the breaking-up of old ships jumped up to a high level in 1996 and after as follows:

1995	5 ships	
1996	18 ships	20,000TEU
1997	31 ships	40,000TEU
1998	70 ships	100,000TEU

Judging from the above two tendencies, it is clear that many shipping lines are replacing older ships with large scale new ships. New-building orders reflects the change of the quality of fleet in advance. The order trend in the past showed a constant yearly increase during the period of 1990 to 1996. In 1997, the increase speed toned down to almost half of the previous year. In 1998, it revived back to the average level of 390,000TEU. The predominant new-building orders for 1999 and 2000 are for 350,000TEU and 370,000TEU respectively. Because the breaking of old ships is forecast at the level of 100,0000TEU every year for 1999 and 2000, the demand/supply balance for container cell onboard is expected to be relatively harmonized for the same period, namely a slight increase of about 5% is anticipated every year. The size of the newbuilding orders is getting larger each year and the largest on order is 100,000TEU by Maersk Line. It is difficult to predict how large vessels will become in future.

6) International alliances movement

The international alliance movement which began in 1997 continued through the year 1998. The buying and mergers, which occurred among shipping lines in 1998 were as follows:

April 1998 P&ON bought BSL (Blue Star Line)

May CP Ships (Canadian Pacific) bought Ivaran (Norway)

July Hamburg-Sud bought South Sea and its Alliance (USA)
Evergreen bought LT (Lloyd Triestino di Navigazinoe SpA-Italy)
D'Amico (Italy) bought Italia Di Navigazione
CGM (Compagnie General Maritime-France)

September CP Ships bought ANZDL (Australian-New Zealand Direct Line USA) With this acquisition, CP Ships became the owner company of 6 lines of Cast, Canada Maritime, Contship, Lykes, Ivaran and ANZDL

.

February 1999 AP Moller bought Safmarine.

After the above buying and mergers, the new map of international alliances can be drawn as follows:

Table 3.1.14 Carrying Capacity of International Alliances at the End of 1999

Alliances	Asia/N. Am.	Asia/Eu. Med	N. M/Eu. Med	Total TEU/Year	Vessel Used			
					VSL (%)		TEU (%)	
Grand	947,765	1,395,593	147,071	2,490,429	93	18.8	376,500	20.1
New World	1,730,653	832,982	264,348	2,827,983	95	19.2	356,650	19.0
United	1,235,716	43,697	291,997	2,471,410	94	19.0	327,350	17.4
MSL*	913,920	1,001,003	664,695	2,579,618	79	16.0	321,650	17.1
Cosco/K/Y	1,004,143	570,490	229,482	1,804,115	65	13.1	214,450	14.2
Ever/Lloyd	1,049,140	785,426	424,847	2,259,413	70	14.9	280,700	15.0
Total	6,881,337	4,628,891	1,992,440	14,452,968	496	100	1,877,300	100

Note) Grand Alliance Hapag-Lloyd, NYK, OOCL, P&ON
New World Alliance APL, Hyundai, NOL, MOL
United Alliance Hanjin, Cho Yang, DSR-Senetor, UASC
COSCO/K/Y COSCO, K-Line, Yangming
* MSL Maersk-Sealand Line

Source) Containerization International, Drewry, JICA Study Team

3.1.3 OECD Maritime Transport Report 1997

The total volume of containerized cargoes traded worldwide rose by approximately 11 percent in 1995, to around 35.5 million TEU, compared to some 32 million TEU in 1994. In other words, container carryings reached an estimated 55 percent of the total liner trades, compared to 31 percent ten years earlier. Trades involving Africa and Latin America accounted for most of the remaining break bulk carryings, although continued containerization is also apparent in these trades. The coming 21st century will see the most active movement of containers in the regions to and from these continents.

Most noticeable among 1995 developments was a 16 percent rise in container traffic within Asia and approximately 8 percent increase on important east-west lanes. 1995 trade movements were a continuation of a longer-term upward trend in container movements, which doubled between 1985 and 1995. Coinciding with this growth was an increase in the number of container vessels. In 1994, the global carrying capacity of the container fleet stood as slightly above four million TEU (two-thirds of which – 2.7 million TEU – were fully containerized vessels), compared with 2.2 million TEU ten years earlier. The following tables, Table 18.1.15, 16 and 17 illustrate the above trend.

Table 3.1.15 Evolution of Container Trades

	1980	1985	1990	1995 (est.)	1999 (est.)
Miscellaneous Goods (million ton)	527	552	673	740	
Including Containerized Goods (mt)	120	172	269	408	
% Containerized	23	31	40	55	70

Source) Drewry Shipping Consultants

Table 3.1.16 Evolution of Container Capacities

	1970	1975	1980	1985	1990	1994	1997
Capacity (million TEU)	0.2	0.6	1.3	2.2	3.1	4.1	4.9
Capacity (Index)	100	300	650	1,100	1,550	2,000	2,500

Source) Containerization International

Table 3.1.17 Latest Container Capacity by Size of Vessel

	1999		1998	
	Vessel	TEU	Vessel	TEU
Under 1,000 TEU	1,836	765,922	1,751	714,155
1,000 – 1,999 TEU	851	1,177,368	807	1,117,310
2,000 – 2,999 TEU	426	1,060,460	381	956,349
3,000 – 3,999 TEU	205	711,498	189	653,444
4,000 TEU Over	188	889,982	152	704,559
Total	3,506	4,605,230	3,280	4,145,817

Source) MOL Business Research Dept. based on Lloyd's List data

3.1.4 Journal of Commerce/ Kaiji Press Data/Freight Conference Data

To have a clearer picture of all containers in service throughout the world is essential for prediction of container moves through the Suez Canal. Also, an analysis of general trends of container movements, especially the imbalance of containers in trade, is indispensable for the study.

(1) World total of containers in service

According to the Journal of Commerce data, the total number of containers in service in the world doubled between the end of 1985 (4,800,000 TEU) and the end of 1995 (9,600,000 TEU). Containers increased by approximately 800,000 TEU in 1995 and slightly less in 1996. 10 million TEU mark was reached in 1997 (10,542,000 TEU) and it is expected that the total number of containers will reach 13.0 million TEU by the year 2000.

1,200,000 new containers were brought into service and 450,000 were withdrawn in 1995, which was a record high. Nearly half of these containers were ordered by

leasing companies. These companies' shipping forecasts and a more efficient use of their fleet of containers led them to cut back container orders at the end of 1995, and in 1996 carriers purchased more new containers than leasing companies. The increase in container orders drove prices up by some 15 percent in 1994/1995. The replacement cost of the current fleet of containers is estimated at around US$28 billion per year.

In 1995, 20' containers accounted for 40 percent of the total (compared with 48 percent in 1990), while 40' containers had risen to 14 percent of the total (compared with 7.5 percent in 1990). This trend is expected to continue because of the decreasing density of cargo carried on trades between Asia and North America. Standardized dry cargo containers accounted for 88 percent of world total (with 84 percent of throughput based in Asia). The remainder of throughput (primarily based in Europe or the United States) consisted of special dry containers such as 45' or 48' etc. (5 percent), refrigerated containers (6 percent) or tank containers (1 percent).

2) Imbalance of Containers in detail

The imbalance of containers has been a long-time headache to container operators. Table 18.1.4-1 shows the imbalance of boxes in the trade route between North Europe and Far East. About sixty percent of this trade is understood to be in the hands of members of the Far East Freight Conference (A, B and C in the Table).

Table 3.1.18 Imbalance in North Europe/Far East Trade(in 1000 TEU)

	1993	1994	1995	1996	1997	1998
Eastbound						
A	840	953	1,001	1,341	1,382	1,323
Westbound						
B	781	849	1,070	1,358	1,532	1,923
C	298	297	305	320	350	409
B+C	1,079	1,146	1,375	1,678	1,883	2,332
Imbalance	- 239	- 193	- 374	- 337	- 501	- 1,009
Grand Total	1,919	2,099	2,376	3,019	3,264	3,655

Source) DYNAMAR 1999 Liner Trades Review, JICA Study Team

Based on A: Eastbound Management Agreement (EMA)
B: Asia Westbound Rate Agreement (AWRA)
C: Japan/Europe Freight Agreement (JEFA)

The total containers of the trade including all members of FEFC and all non member lines is calculated about 6,100,000TEU per year. All of these containers are transported through Suez either Northbound or Southbound. The imbalance of the trade used to be less than 400,000TEU per year but jumped up to 501,000TEU in 1997 and further to one million TEU in 1998 due to Asian c

The above table shows all difficulties the shipping lines are facing in the container business. Take the example of the year 1998, to carry back one million empty containers piled up in North European Ports, about 334 x 3,000TEU ships or 2,00 x 5,000 TEU ships just as sweepers.

The imbalance in the Trans-Pacific Trade is severer as is shown in Table 18.1.4-2 and because of this big imbalance gap, some major shipping lines are trying to strengthen their service route from East Coast of North America to Asia via Suez. At the time of reporting nearly 95 percent of Asia/East Coast of North America containers are transported either by Trans-Pacific Route then via DST (Double Stack Train) to East Coast or deep sea direct service to East Coast via Panama.

Table 3.1.19 Imbalance in US/Far East Trade (in 1000 TEU)

Eastbound to US direct ports from the Far East				
	1999	1998	1997	1997
To East Coast	941	787	642	597
To Gulf	4	5	4	3
To West Coast	4,744	4,242	3,604	3,200
Total	5,689	5,034	4,250	3,800
Westbound from US direct ports to the Far East				
From East Coast	631	561	636	599
From Gulf	13	7	9	9
From West Coast	2,216	2,188	2,514	2,495
Total	2,860	2,756	3,159	3,103
Imbalance	2,829	2,278	1,091	697
Grand Total	8,549	7,790	7,409	6,903

Note) Period covered from October 1998 to September 1999

Source) DYNAMAR (figures calculated from PIERS US Container Report)

Latest data of Far East / US, US / Far East at the end of the third quarter of 2000 is:

Far East / US 1.95m TEU (7.80m TEU per year equivalent), up 19.2% from the same period of 1999.

US / Far East 0.78m TEU (3.12m TEU per year equivalent), up 13.3% from the same period of 1999)

Eastbound/Westbound Imbalance: 1.17m TEU (4.68m TEU per year equivalent)

3.1.5 Through Statistics of Containerization International

Containerization International Yearbook 1999 includes an overview of demand and supply of container fleet and onboard container space in 1998. Here is a summary of the detailed explanation in the Yearbook:

"There is increasing evidence to suggest that the rate of growth in the world containership fleet is slowing down and that over the next couple of years box slots and cargo demand will be better balanced. On the basis of shipboard slots in service and on order, total containership capacity is projected to grow by 7% in 1999 (including orders still outstanding for delivery in 1998) and much slower 4% (254,143TEU) in 2000. Although there is still time for owners and operators to order tonnage for phasing into service in 2001, the backlog for this year comprises just 40,373TEU, equivalent to less than 1% of the fleet currently in operation." (see Table 3.1.4).

Table 3.1.20 New Buildings by Year of Delivery

Delivery Date	Total TEU	Vessels
1998	101,876	90
1999	307,403	203
2000	254,143	100
2001	40,373	14
unknown	8,347	12
Total	712,142	419

Source) Containerization International

"In terms of who controls the world's containership fleet, Table 3(here in this report Table 18.1.21) ranks the top 20 carriers, on the basis of slots deployed. It also gives a breakdown of these carriers' order backlogs and projected 1998 cargo liftings." "Maersk now controls 25% more capacity than its nearest rival, Evergreen, and over five times more slots than 20th placed Safmarine Container Lines(which was bought by Maersk in February 1999)".

"The world's leading carriers now control 53% of orders for delivery over the next two years. Annually, they lift approximately 35.7 million TEU. This compares with equivalent figures of 50.7% for slots in service, 46% of the orderbook, and 31.3 million TEU liftings by the then top 20 in 1997. Moreover, their control of the industry is increasing, as further mergers, take-overs and strategic alliances take place. In 1998, for instance, P&ON strengthened its position in the South American and Austlarian markets by acquiring Blue Star Line, CP Ships added to its expanding portofolio of shipping companies by purchasing Ivaran Lines and Australia-New Zealand Direct Line (ANZDL), and CGM (Compagnie Generale Maritime) took over Adelaide-based ANL (Australian National Line) "

Table 3.1.21 Top 20 Container Carriers Ranked by TEU Capacity Deployed

Rank TEU		Carrier	TEU	TEU	TEU	Projected
1998	1997		In service	On order	Total	Liftings in '98
1	1	Maersk	346,123	81,256	427,379	3,300,000
2	2	Ever/Uni.	280,237	89,404	369,641	3,488,000
3	3	P&O/N	250,858	39,630	290,488	2,500,000
4	8	MSC	220,745	20,250	240,995	1,600,000
5	6	Hanjin	213,081	5,300	218,381	2,000,000
6	4	Sea-Land	211,358	31,000	242,358	3,200,000
7	5	COSCO	202,094	24,684	226,778	3,500,000
8	7	APL	201,075	0	201,075	2,100,000
9	9	NYK	163,930	0	163,930	1,670,000
10	10	Mitsui OSK	133,681	10,000	143,681	1,410,000
11	11	Hyundai	116,644	0	116,644	1,500,000
12	12	Zim	111,293	0	111,293	1,050,000
13	16	CP Ships	105,322	0	105,322	1,100,000
14	14	CMA-CGM	91,600	4,400	96,000	1,100,000
15	18	Hapag Lloyd	90,879	33,600	124,479	1,300,000
16	15	OOCL	90,063	22,000	112,063	1,600,000
17	17	K-Line	89,717	6,912	96,629	1,000,000
18	13	Yangming	79,840	26,000	105,840	1,170,000
19	23	UASC	59,331	0	59,331	475,000
20	20	Safmarine	55,584	0	55,584	675,000
Top 20 Capacity			3,113,455	394,436	3,507,891	35,738,000
Proportion of World			53%	55%	53%	

Source) Containerization International Yearbook 1999

3.2 Tanker

3.2.1 Latest Trend of Crude Oil Transportation Business

Oil prices have been flirting recently with the US$30-35 per barrel level, almost reminiscent of the oil shocks of the 1970s. While US and EU countries are having a series of heated discussions with OPEC, tanker rates are sky-rocketing almost to the highest level in the past.

World Scale Rate (WSR), tanker rate of 200,000DW-VLCC in Gulf-Far East route, was around 50 in the first quarter of 2000. It hit the 100 mark in May and reached the line of 130 in August, which is the highest ever recorded in peace time. (It reached 145 in the days of the Gulf War).

This high WSR is largely due to the surge in crude oil prices. In particular, it should be noted that the demand for oil by Asian countries has recovered to the level before the Asian Crisis. In addition, the demand for oil from mainland China (PRC) is quickly increasing.

The crude oil import of PRC in 1999 was 35 million tons (equal to 700,000 barrel per day) and in 2000 the import volume has already reached 32.4 million tons in the period of January-June, which is almost double the volume in the same period of the previous year. Some observers site that China is intentionally increasing crude oil import to feed its refineries, while others say that it is part of its strategy to keep a national oil reserve. Currently coal is the biggest energy resource in China but the Government is trying to decrease its use of coal for environmetal reasons. It is therefore likely that oil imports will quickly increase, regardless of whether it is refined or crude.

Apart from the demand/supply of oil, another factor in the strong demand for tankers is a structural problem peculiar to the tanker business. For many years in the past, single hull tankers have been standard and dominant. However, there have been many tanker accidents all over the world. As result, double hull tankers are becoming the norm, and this will work as a restrictive factor for the supply of tanker space.

It goes without saying that double hull tankers are much more costly than single ones and this prompted many tanker owners to form a unified group. By conducting joint marketing activities tanker operators hope to secure a stable market. Just as is in the container shipping business, the tendency here is towards oligopoly.

In December of 1999, a heavy oil spill from a crude oil carrier occurred off the coast of Northern France. With this as a turning point, EU decided to introduce severer

conditions for operating older tankers in EU waters. An international conference on " rules and conditions for operating older tankers " will be held in the fall of 2000 to present EU regulatory proposals to non-EU operators in the tanker business world.

3.2.2 VLCC/ULCC Fleet Development

In 1997 and after, the VLCC/ULCC market has faced a number of challenges, particularly in light of the surge in new building activity, and disrupted demand growth in Asia due to widespread economic problems. The storm is almost over and the sunshine is back again. Rapid economic growth in Asia over the 1980s and 1990s supported a shift in VLCC demand patterns, with eastbound shipments from the Middle East exceeding westbound movements to the Atlantic Basin. Economic recovery within Asia quickly affected VLCC/ULCC supply and demand balances producing the highest market rate in peace time (WSR 135) in the past 30 years.

While demand for crude oil in Asia is becoming high, increased crude supply within the Atlantic Basin, from the North Sea, Latin America and West Africa, is set to weaken demand growth for long-haul VLCC/ULCC shipments from the Middle East. It is obvious that VLCC/ULCC long-haul will continue to dominate the crude oil transportation business in years to come. The crucial theme of VLCC/ULCC, however, lies in the single hull/double hull problem.

Large scale fleet expansion was observed during the mid-1970s. Now in 2000, a large question mark hangs over the fate of single-hulled VLCCs reaching 25 years of age. According to a report by Ocean Shipping Consultants of London, older vessels over 20 years of age made up around 45% of the VLCC/ULCC fleet in early 1999, with the bulk of mid-1970s VLCCs (43.8 million dwt) due to reach 25 years of age over 1999/2001, equivalent to just over a third of the current VLCC/ULCC fleet. As is shown in Table 3.2.1, most of the VLCCs owned by the top ten companies are young, less than 10 years of age. This means that most of the older tankers near or over 25 years are owned by smaller scale owners and this makes the replacement of single hull tankers with double hull tankers more difficult and complicated.

Table 3.2.1 Top ten VLCC Fleets (end April 2000)

Owners	Units	Value:US$M	Aver. Build	Total MDwt	Average wt
MOL*	33	1,424.17	1994	8.74	264,848
NYK**	26	1,070.48	1993	6.62	254,615
Golden Ocean	24	1,587.50	1999	6.98	290,833
Vela	19	736.47	1992	5.60	294,737
NITC	18	967.26	1996	5.46	303,333
World-Wide	18	661.57	1991	4.04	224,444
AP Moller	17	883.31	1996	4.95	291,176
Bergesen	15	236.70	1980	4.37	291,333
Frontline	12	548.20	1994	3.54	295,000
Tanker Pacific	11	281.43	1984	3.01	273,636
Total	193	8,397.09		53.31	276,218

Note) * MOL figure includes ex-Navix

**NYK figures includes ex-Showa

Source) Drewry Shipping Consultants, JICA Study Team

3.2.3 Other Size Fleet Development

Other tankers include Suezmax, Aframax, Panamax and Handy (Products tankers). Although there is no strict definition for each kind worldwide, the Japan Maritime Research Institute (JAMRI) categorizes these tankers by size as per Table 3.2.2.

The top ten fleets of Suezmax, Aframax Panamax and Handy are listed in Tables 3.2.3 through Table 3.2.6. Most of the owners of those fleets are tanker specialized owners or operators or owner/operators. At one time in the mid-1970s the oil majors operated significant fleets, but most have since moved out of tanker ownership, preferring to take vessels on long-term charters. Generally, it could be concluded that oil majors decided to leave the shipping business of oil to professional shipping lines along an old saying "every man to his trade" but it cannot be denied that the accidents of the Exxon Valdez and Exxon Houston ignited the dramatic cut back.

But Exxon is not the only oil major who has cut back on fleet size. BP Amoco, Shell have also reduced their fleets as well. Chevron adopted a different policy by reducing the majority of its fleet but still managing to maintain some scale of fleet by building up its Suezmax tankers. Mobil is following a similar policy to that of Chevron. Texaco formed a company with Stena AB called Stenex to act as owner/manager for a vastly reduced fleet.

Table 3.2.2 Tanker Categorization by JMRI

Category Class	DW (10,000 tons)
Handy	1 – 6
Panamax	6 – 8
Aframax*	8 – 12
Suezmax**	12 – 20
VLCC/ULCC	20 – 50 and over

Note * Historical calling for tankers of 80,000 – 100/120,000 tons originated by London Tanker Brokers Association (Average Freight Rate Assessment)

** According to the in-house rule of ships category of SCA (Suez Canal Authority), Suezmax DWT ceiling is 180,000 tons

Source) JICA Study Team

The average age of the 85 Suezmax vessels is about ten years. There are three age groups : 22-23 years – 18 vessels (21%), 11-12 years – 14 vessels (16%) and less than 10 years – 53 vessels (63%). The average dead weight tonnage is 146,706 tons and the total dead weight tonnage is 12.47m, about 30% of the world total of this category.

Table 3.2.3 Top Ten Suezmax Fleets (as of the end of April 2000)

Owners	Units	Value:US$M	Aver. Build	Total MDwt	Average wt
Frontline	17	501.80	1995	2.53	148,824
Dynacom	12	65.32	1976	1.72	143,333
N. F. Tapias	9	271.65	1994	1.35	150,000
Metrofin Ltd	8	222.24	1993	1.21	151,250
Fred Orsen	8	149.84	1988	1.13	141,250
Navitankers	7	281.63	1998	1.11	158,571
Tenamaris	6	139.64	1989	0.85	141,667
Sovcomflot	6	128.09	1991	0.84	140,000
Keystone	6	37.92	1978	0.87	145,000
Essar	6	130.77	1992	0.86	143,333
Total	85	1,928.90	1990	12.47	146,706

Source) Drewry Shipping Consultants, JICA Study Team

The average age of the total 183 Aframax vessels is about 13 years. The vessels can be classified into four groups of build age: 21-25 years – 33 vessels (18%), 14-19 years – 54 vessels (30%), 9-11 years – 78 vessels (43%) and 5 years – 18 vessels (9%). The average dead weight tons is 95,574 tons and the total dead weight tons is 17.49m, about 33% of the world total of this category.

Table 3.2.4 Top Ten Aframax Fleets (as of the end of April 2000)

Owners	Units	Value US$M	Average build	Total MDwt	Average wt
Teekay	51	794.90	1991	5.03	98,627
Neptune Orient	18	387.67	1995	1.81	100,556
Polembros	17	122.74	1979	1.58	92,941
OSG	17	323.65	1989	1.68	98,824
Dynacom	16	60.22	1975	1.49	93,125
Ermis	15	98.30	1981	1.33	88,667
Tanker Pacific	14	160.69	1986	1.28	91,429
SCI	13	195.01	1985	1.22	93,846
Tascos	12	136.98	1985	1.13	94,167
PDVSN	10	148.77	1991	0.94	94,000
Total	183	2,428.93	1987	17.49	95,574

Source: Drewry Shipping Consultants, JICA Study Team

The average build of the total Panamax fleet is about 16 years. The vessels can be classified into three groups build age: 20-28 years – 18 vessels (23%), 10-19 years – 57 vessels (71%) and 4 years – 5 vessels (6%). The average dead weight tons is 63,875 tons and the total dead weight tons is 5.11m, about 27% of the world total of this category.

Table 3.2.5 Top Ten Panamax Fleets (as of the end of April 2000)

Owners	Units	Value US$M	Average build	Total MDwt	Average wt
Peraticos	14	105.41	1981	0.84	60,000
SCI*	11	110.81	1984	0.74	67,273
Tsakos	10	175.79	1988	0.64	64,000
Pleiades	8	98.05	1986	0.47	58,750
Novoship	8	75.93	1984	0.54	67,500
BT Shipping	6	36.50	1978	0.41	68,333
China Tanker	6	67.97	1980	0.37	61,667
China Shipping	6	98.13	1990	0.37	61,667
Transpetro	6	106.38	1972	0.37	61,667
Eletson	5	135.57	1996	0.36	60,000
Total	80	1,010.54	1984	5.11	63,875

Remarks: * SCI – Shipping Corporation of India Ltd.

Source: Drewry Shipping Consultants, JICA Study Team

The average build of the total Handy Type Tanker Fleet is 16 years. The vessels can be classified into three groups of build age: 22-23 years – 96 vessels (34%), 11-18 years – 166 vessels (58%) and four years – 24 vessels (8%). The average dead weight tons is 31,014 tons and the total dead weight tons is 8.87m, about 21% of the world total of this category

Table 3.2.6 Top Ten Handy Type Tanker Fleets (as of the end of April 2000)

Owners	Units	Value US$M	Average build	Total MDwt	Average wt
China Shipping	42	229.90	1977	1.04	24,762
Novoship	34	488.92	1989	1.03	30,294
Latvian	34	296.57	1982	1.03	30,294
Trans Petrol	31	431.38	1987	0.87	28,065
Pertamina	28	137.14	1978	0.63	22,500
Gemarfin	26	138.41	1977	0.82	31,538
A. P. Moller	24	588.38	1996	1.47	61,250
Primorsk	23	319.52	1987	0.57	24,783
Georgian Int.	23	173.65	1985	0.52	22,609
Vamina	21	433.30	1989	0.89	42,381
Total	286	3,227.17	1984	8.87	31,014

Source) Drewry Shipping Consultants, JICA Study Team

.Table 18.2.7 outlines the world tanker fleets. It is obvious that the main stream of tanker fleet is VLCC/ULCC. About 78% of the total fleets are included in the top three categories

Table 3.2.7 World Tanker Fleet (as of the end of April 2000) ('000 dwt)

	Handy (10-50)	Panamax (50-80)	Aframax (80-120)	Suezmax (120-200)	VLCC (200 +)	Total
1994	37,483	18,601	44,499	38,049	122,411	261,044
1995	37,869	18,026	45,000	38,073	121,927	260,896
1996	39,002	18,152	46,070	38,060	124,542	265,826
1997	39,818	18,221	47,422	39,195	125,122	269,778
1998	41,320	18,075	50,328	41,163	126,013	276,899
1999	42,629	18,506	52,336	39,841	123,311	276,623
2000*	42,790	19,060	53,171	41,027	128,434	284,482
2000 %	15.0	6.7	18.7	14.4	45.2	100.0

Note) *Including estimates

Source) Drewry Shipping Consultants, JICA Study Team

3.2.4 World International Sea-borne Trade of Crude Oil in 1998

According to Fearnleys of Norway, world international sea-borne trade in crude oil increased by 0.4% in volume from revised1,519Mt in 1997 to 1,524Mt in 1998, after an increase of 3.6% in 1997. There was a peak volume of 1,497Mt in 1979. It is to be noted that there was some increase in certain pipeline and short sea trades not included in Table 3.2.8, which shows the main crude oil trades in the world. In the table, on the export side, Red Sea is included under Middle East and North Africa. Trades between North Sea countries and some other local trades are excluded. Middle East exports exclude pipeline exports to Near East, which are counted as sea-borne exports from Near East to final destinations. Middle East exports through

the SUMED pipeline are included under Middle East origin. In 1998, the development on the export side was characterized as follows:

1. Middle East Gulf showed a decrease of 1.1% to 774mt
2. Near East increased strongly from 20mt to 50mt
3. Exports from other areas showed mixed developments
4. Caribbean was stable at 229mt, but West Africa decreased from 167mt to 160mt
5. South East Asia dropped from 68mt to 63mt
6. Sea-borne exports from North Sea to other areas were reduced from 66 to 59mt

The development on the import side was as follows:

1. North America registered a growth of 3.5% to 443mt
2. North West Europe and Mediterranean together increased by 5.5% to 412mt
3. Japan decreased by 6.4% to 212mt and other Asia decreased by 5.1% to 330mt, as results of the economic crisis
4. Shipments to South America were about stable at 67mt

Comparing 1998 with 1997:

1. The total of 1524.4m tons is a 5.9m ton increase from 1997
2. North American import increased by 14.8m from 427.7m in 1997 to 442.5m in 1998
3. Japanese import decreased by 14.6m from 427.7m in 1997 to 212.2m in 1998.

Table 3.2.8 Crude Oil Total Sea-borne Trade 1998 (Figures in million tons)

To:	N/W Euro.	Med.	North Am.	South Am.	Japan	Other Asia	Others	Total 1998	Total 1997	Total 1999
From:										
Middle East	90.8	67.3	113.1	13.5	182.4	273.6	33.3	774.0	782.7	
Near East	11.4	38.3	0.1	-	-	-	0.6	50.4	19.9	
North Africa	9.5	70.8	6.7	5.2	-	1.2	3.2	96.6	93.1	
West Africa	9.4	28.7	82.9	15.3	1.0	19.1	3.9	160.3	166.7	
Caribbean	9.8	8.8	183.4	16.0	1.8	7.3	1.6	228.7	228.8	
S/East Asia	-	-	9.0	0.3	24.9	1.7	11.9	63.1	68.1	
North Sea	5.5	10.4	38.4	0.2	-	1.9	3.0	59.4	65.5	
Others	24.1	27.0	8.9	16.0	2.1	9.9	3.9	91.9	93..7	
Total 1998	160.5	251.3	442.5	66.5	212.2	330.0	61.4	1524.4		
Total 1997	151.5	239.0	427.7	67.0	226.8	347.6	58.0		1518.5	
Total 1999										

Source) Fearnleys- World Bulk Trades 1999, 2000

Table 3.2.9 is Ton-Miles of Crude Oil Sea-borne Trade in the same period with Table 3.2.8. In 1998, on the export side, Middle East Gulf has an overwhelming 70.1% of the year's total of 7,793b ton miles. However the ton-miles were reduced by 52b to 5,464b (1998) from 5,516b (1997). On the import side, the total 7,793b in 1998 was almost the same as of the previous year. North America is the only major area that increased the crude oil import ton-miles, rising from 2,145b in 1997 to 2,322b in

1998, which represents 29.8% of the total 7,793b. Import ton-miles to Japan decreased by 71b from 1,401b in 1997 to 1,330b in 1998.

Table 3.2.9 Crude Oil Total Sea-borne Trade (Ton-Miles, Figures in billion)

Exporting areas	1998	1997	1996	Importing areas	1998	1997	1996
Middle East Gulf	5,464	5,516	5,208	N/W Europe	1,043	1,058	1,086
Near East	113	34	31	Mediterranean	692	702	621
North Africa	166	170	177	North America	2,322	2,145	2,040
West Africa	855	912	835	South America	290	305	320
Caribbean	548	560	517	Japan	1,330	1,401	1,353
South East Africa	226	223	260	Other Asia	1,941	2,050	1,905
North Sea	216	228	261	Others	175	169	170
Others	205	187	206				
Total	7,793	7,830	7,495	Total	7,793	7,830	7,495

Source) Fearnleys-World Bulk Trades 1999

According to Fearnleys report, Crude oil shipments through the Suez Canal remained at a low level, with a slight increase from 13.0m tons in 1997 to 16.4m in 1998. Northbound shipments of crude oil increased from 13.0 to 16.4m tons, whereas southbound shipments decreased from 0.5 to nil. Shipments of oil products through Suez decreased 13.7m tons to 10.2m tons. Tankers going southwards in ballast through the Canal increased from 80m DWT in 1997 to 106m DWT in 1998. Transports through the SUMED pipeline remained at a high level in 1998.

Generally, the ton-mile development for individual areas is often quite different from the ton development due to changing trade patterns and vessel routings, as well as the changing use of vessels below the size limit assumed in a survey.

Table 3.2.10 shows oil shipments classified by vessel size. For exporting from the Middle East Gulf, shipment volumes by vessels over 2000,000 DWT accounted for 82% of the total shipments. There were substantial individual differences for the for the different loading areas. The cargo share of vessels over 200,000 DWT decreased from 41.5% to 38% for West Africa, rose from 35% to 44% for Red Sea, and decreased from 24.5% to 23% for North Sea.

Table 3.2.10 Oil Shipments, Size Distribution 1998 (Figures in %)

Size groups of vessels in '000 dwt						
	50-100	100-150	150-200	200-300	3000+	Total
Exporting areas						
M.E. Gulf	10	6	2	61	21	100
Red Sea	35	19	2	35	9	100
N. East	36	40	12	9	4	100
N. Africa	40	28	11	9	11	100
W. Africa	3	43	16	33	5	100
Carribean	77	17	5	1	0	100
S/E Asia	69	24	3	4	0	100
Black Sea	55	34	12	0	0	100
North Sea	39	24	15	14	9	100
Others	76	20	3	2	0	100
Importing areas						
N/W Europe	25	18	7	31	19	100
Mediterranean	42	39	13	5	1	100
North America	50	19	7	12	13	100
C/S America	38	18	9	23	12	100
Japan	15	4	1	78	2	100
Other Asia	27	12	2	49	9	100
Others	16	12	3	34	35	100
Total 1998	33	18	6	32	11	100
Total 1997	34	17	6	32	12	100

Source) Fearnleys-World Bulk Trades 1999

On the import side, shipment volumes to Japan by vessels over 200,000 dwt accounted for 80% of the total shipment, while that to North America by vessels between 50,000 and 150,000 DWT reached 69%, and the Mediterranean by vessels of the same class 81%. Shipment to North/West Europe can be divided into two size classes of vessels i.e., 50,000-150,000 DWT which accounted for 43% of the total shipment, and over 200,000 DWT which accounted for 50%. It is worth studying which size of vessels are deployed for shipment from where to N/W Europe.

3.3 Car Carriers

3.3.1 Latest Trend in Car Carrier Business

Some 56 million cars were produced in 1998, an increase of 1.8 million over the previous year. This means even more component parts and knock-down vehicles to move, although exactly what percentage of the total volume is added to those complete cars is not known. The supply chains are lengthening and becoming even more complex with the continuing trend towards globalization, a process enhanced by the establishment by major car producers of factories all over the world. With the vehicle manufacturers setting up plants in emerging markets there is more than ever a constant flow of materials, components and complete vehicles across the world.

According to the press release of some major car producers, Nissan and Honda have established "transplant" operations in the UK while Ford and VW built plants in Spain, partly to avoid heavy import duties and take advantage of lower labor costs, but also to produce "cars of internationally high standards for export in a increasing degree".

Table 3.3.1 is the yearly change of the new registration of 1995 through 1997 worldwide. The global market place for cars is becoming more complex. For car makers, there has always been an over capacity issue which has prompted industry consolidation. The industry is seeing car manufacturers "outsource" or "transplant" operations to low cost base areas. This is creating new trade and shipping needs both of domestic and international routes. The trades from Japan to North America and Europe remain dominant but this is likely to change in the coming years.

Table 3.3.1 New Registrations of Passenger Cars('000 units)

	1995	1996	1997
West. Europe	12,253	13,032	13,725
Germany	3,314	3,496	3,528
UK	1,945	2,025	2,171
Italy	1,745	1,735	2,112
France	1,931	2,132	1,713
Spain	834	911	1,016
Netherlands	446	473	478
Belgium	359	397	396
Others	1,679	1,863	2,311
Eas.Europe	1,401	1,689	1,893
Former USSR	767	841	907
Poland	264	374	481
Others	117	199	300
Latin America	2,215	2,237	2,551
Brazil	1,411	1,401	1,575
Othes	804	836	976
Asia	7,432	7,904	7,763
Japan	4,444	4,669	4,492
South Korea	1,074	1,247	1,159
India	394	465	480
China	433	390	470
Taiwan	415	363	356
Malaysia	228	280	315
Others	444	490	491
Middle East	464	449	540
Africa	458	550	525
Oceania	568	583	558
World	34,211	35,880	36,900

Source) Society of Motor Manufactures and Traders, Drewry

Table 3.3.2 shows the regional distribution of final users of cars in the world. There will be no big change in this picture for a considerable period of time, judging from world economic trends. However, areas of production will greatly change from the current distribution.

Table 3.3.2 Regional Distribution of Table 18.3.1 (Figures in %)

	1995	1996	1997
Western Europe	35.8	36.3	37.2
Eastern Europe	4.1	4.7	5.1
NAFTA	27.6	26.2	25.2
Latin America	6.5	6.2	6.9
Asia	21.7	22.0	21.0
Middle East	1.3	1.4	1.5
Africa	1.3	1.6	1.5
Oceania	1.7	1.6	1.5
World	100.0	100.0	100.0

Source) Drewry, JICA Study Team

3.3.2 Emerging Production Area

With less manufacturing going on in the traditional markets the distance traveled by a component or finished vehicle is rising unstoppably as the supply chains become more intricate and demanding. While it is good news for the car carrier operators and transportation industry in general, the shaded side is that the supply lines become more fragmented so that finished cars and other vehicles often have to be shipped in smaller quantities. This naturally made it necessary for car carriers to call more ports, more often for a given volume of vehicles. From a view point of car carriers, the best interests is to make fewer port calls with a greater number of cars, thus in the field of car carrier business again, a hub and spoke system has to be introduced, producing a trend towards more transshipment of cars and more feeder services.

What does it take for car manufacturers to switch from a current factory to a new factory? The biggest factor is the producing cost and the decision as to where to build car plants is greatly influenced by local labor costs. Another important factor in deciding in which country to build is the degree of “localization” demanded under the contract with a relevant country’s government.

Generally, the new sites are remote from traditional manufacturing areas and the major markets. The greater the distances traveled, the more cost effective it becomes to ship rather than use road or rail transport. These are the characteristics of car carrier industry of 2000 and after.

The emerging car production areas are Latin America, China, India, Malaysia, The Philippines, Indonesia, Thailand, South Korea and South Africa. An outline of each region follows.

(1) Latin America

The geographical position of South America is attractive to car carriers as it allows them conveniently to load return cargoes onto their ships that have delivered vehicles to North America – at the fairly modest cost of a deviation south. Traditionally, car carriers delivering vehicles to North America from Japan and Europe have had to return more or less empty.

According to Japan Automobile Manufacturers' Association (JAMA), the passenger car production in Latin American countries was 2,188,000 units in 1988. Table 18.3.2-1 shows country-wise break-down from 1996 through 1988:

Table 3.3.3 lists of the announced investments in the Brazilian auto industry from 1997 through 2000. Total of 16 major car producers are investing or plan to invest a staggering US$16,231m in Brazil.

Table 3.3.3 Latin American Passenger Car Production ('000 units)

	1996	1997	1998
Argentina	227	269	366
Brazil	1,303	1,467	1,676
Chile	5	5	4
Colombia	48	52	59
Uruguay	5	3	5
Venezuera	43	34	77
Total	1,630	1,830	2,188

Source) JAMA

Table 3.3.4 Announced Investments in the Brazilian Auto Industry 1997-2000

	'000 Units per year	Vehicle type	Location	US$m	Start-up date
Chrysler/BMW	40.0	Pick-ups/Motors	Parana	815	98-6
Fiat	120.0	Cars	Minas Gerais	2,500	1988
Ford	100.0	Cars	Rio G. do Sul		
GM	120.0	Cars			
Honda	15.0	Cars			
Hyundai	20.0	Vans			
Iveco	20.0	Trucks			
Kia	10.0	Light Trucks			
Mercedes-Benz	70.0	Cars			
Mitsubishi	8.0	Pick-ups			
Navistar	1.2	Trucks			
Peugeot-Citroen	100.0	Cars			
Renault	160.0	Cars			
Toyota	15.0	Cars			
VW/Audi	160.0	Cars			
Volvo	13.0	Trucks/Busses			
Total	1,032.2				

Source) Drewry, JICA Study Team

(2) China

China's car output has risen from under 30,000 in 1989 to over 500,000 units in 1998; or about the same as Argentina, which has less than 5% of China's population. China's car manufacturing industry is still in its infancy in terms of productivity and quality compared with those of the advanced countries. It is reported by industry sources that it takes about four times as many man hours to build a car in China compared to Japan and about three times more than in Europe.

The following is a summary of the recent movements of the four major car producers in China:

Table 3.3.5 Recent Major Movement in China

Peugeo	1997	Pulled out of its 12 year-old car making venture with the Guangzhou's Junda group. Peugeot line managers identified various operational problems including the lack of financial or marketing awareness and the absence of an industrial infrastructure or culture. The output had fallen to 3,000 cars a month from a peak of 20,000.
Honda	1997	Subsequently acquired the business from Peugeo and aims to restart production with a new model.
Toyota	1997/1999	Has acquired a components plant in Tianjin for US$30m in addition to other investments in the same area. Further, it plans to invest an additonal US$250m to build an engine plant.
Audi-VW	1998	The management of Audi-VW's executive car subsidiary (First Auto Works of Changchun) starts producing independently an Audi look-alike and selling it under Red Flag's bland name
Ford	1999	Has recently increased its stake in Jiangling Motors by US$55m. The plant currently produces minibuses and Ford plans to extend production to make cars as well.

Source) Industry sources, JICA Study Team

It is estimated that a manufacturer needs to build more than 150,000 cars a year in China to make a reasonable return on investment. Only Shanghai Volkswagen, a joint venture between the German manufacturer and Shanghai Automotive Industry Corporation (SAIC), has reached that level. The company sold 200,000 Santana cars in 1998, nearly half the total Chinese car market.

China is seen as a long-term investment by the car manufacturers. Despite considerable improvements, the economic forecasts for the country indicate that it is unlikely that per capita incomes will rise sufficiently to support a significant number of imported cars in the next ten years or so.

(3) India

The current bird's eye view of Indian car producers is shown in Table 18.3.2-4. In 1998, the total output capacity of seven existing car manufacturers is 527,000 units. Five new producers are planning to enter the market by 2001 with an investment of about US$2,235m. This comes as a result of the Indian government's removal of central control over the direction of investment and encouragement of state governments to create their own investment climates.

Table 3.3.6 Indian Car Manufacturers' Map

Company	Current Capacity ('000)	Planned Increases by 2001 ('000)	Likely Cost (US$m)
Existing Manufacturers			
Maruti Udog	300	150	550
HM*1	65	24	80
PAL*2	30	30	130
Daewoo	72	110	1,000
PAL-Peugeot	30	30	180
HM-GM	25	100	100
T-Mercedes	5	15	100
Proposed Prospects			
Telco	0	150	475
M&M-Ford*3	10	100	420
SEIL-Honda	0	30	300
Hero/BMW	0	20	340
Hyundai	0	120	700
Total	537	879	4,375

Note) *1 Hindustan Motors
*2 Premier Autos
*3 Mahindra & Mahindra

Source) Association of Indian Auto Manufacturers

Other major makers not listed above :

1) Honda is building a new plant near Delhi.
2) Hindustan Motors is producing Mitsubishi Lancers under license from Japanese company.
3) Toyota will also produce 50,000 units per year

The effect of all the above investment will be to raise the output of cars in India from about 300,000 in 1995 to more than 1 million by the end of 2000, making India's car market look very overcrowded in the short term.

(4) Malaysia

Vehicle sales climbed from some 50,000 in 1987 to about 365,000 in 1996 then fell dramatically by 65%, year by year, as the recession hit in Asia. Total vehicle sales were about 165,000 units in 1998, only 45% of peak production. The Malaysian Motor-traders' Association has forecast a 22% increase in the industry's total volume in 1999 compared with 1998. That would push sales of new passenger cars in Malaysia to about 168,000 units and sales of new commercial vehicles would rise to

21,000 units from some 17,500 in 1998. Usually in this region, new car sales lag a few months behind the general economy and it is expected that the earlier improvements would be followed by a full recovery during 2000, as the key economic indicators in Malaysia improved.

Among the recent developments in the regional shipping industry, NYK's movement is worth watching. NYK Bulkships started an intra-Asian service in 1997, with three medium size vessels, that includes calls at Jakarta. Although the trade has been dominated by project cargoes (often feedered from NYK's Euro-Asia Ro-Ro Connect service) car liftings have increased in 1999 and are expected to continue to do so as the Asian economies recover from recession.

(5) The Philippines

There are some 21 car producers in the Philippines and in 1996 sales reached a peak of 160,000 units. Total industry sales fell 44% in 1998 as results of the Asian economic crisis to just under 84,000 units or just over half the level in 1996. The latest market situation is not bright. In early 1999 there were fewer signs of recovery in car manufacturing than in other Asian countries such as Thailand and Malaysia. According to the Chamber of Automobile Manufacturers of the Philippines, sales were continuing to decline and in April 1999 industry sales recorded an eight-year low of just 1,922 – about a quarter of the average 6,000 to 8,000 cars a month recorded in 1997.

As in other ASEAN countries, the government of the Philippines is committed to the WTO agreement to remove the local content rules with requirements that car makers must export a percentage of their output to qualify for reduced tariff levels on imports. The government is reportedly considering allowing the import of semi-knocked down kits in return for export growth.

Table 3.3.7 shows the market share of the car producers in the Philippines in 1998. The total share of the big three, Mitsubishi, Toyota and Honda is dominant at 61.7%. It is forecasted that the big three will hold their share even after the government allows the import of semi-knock down kits. Instead, this will hit the local manufacturers, because the semi-knocked down kits are essentially complete cars with only batteries and tires added locally.

Table 3.3.7 Major Car Makers Market Share in 1998

(Car all kinds)

Car Makers	Share
Mitsubishi	24.0
Toyota	21.2
Honda	16.5
Isuzu	7.9
Nissan	7.5
Colombian Motor	7.0
Others	15.9
Total	100.0

Source) Chamber of Automobile Manufacturers of the Philippines

(6) Indonesia

Due to the Recession, car sales fell to about 60,000 units in 1998 from some 370,000 in 1997 and in mid 1999 were still at that level. As sign of a general recovery in the Far Eastern economies began to be more widespread in mid-1999 there was some outlook that domestic sales of cars would rise above the 5,000 per month level, subject to reduced local content. Even at that level, output represented only 13% of production capacity. Table 3.3.8 shows Indonesia's car sales and production. At the time of the end of 1999, even the cars that were being produced were reported to be loss making.

Table 3.3.8 Indonesian Car Sales and Production

Sales	1996	1997	1998
Cars local	332,000	386,700	56,300
Cars export	-	-	8,300
Car-Production	325,000	389,000	58,100

Source) Association of Indonesian Automotive Industries

(7) Thailand

Thailand car manufacturing industry was built up by the US companies, particularly General Motors, in the 1960s. The Japanese companies steadily took over from American interests and currently hold 90% of Thai sales. General Motors has sought to regain market share in recent years with plans for a new plant, about 150km south of Bangkok to be opened in 2000, producing up to 40,000 cars per year.

It is significant that GM has declared that parts for the assembly line will be sourced globally " with strong local " or intra-Asia content. This can be seen to imply an international supply chain where parts will be sent from wherever is cheapest at the time.

Car sales in Thailand halved successively in 1997 and 1998 and were not expected to return to their 1996 peak levels of 590,000 again until 2006 according to the industry sources, despite some improvement in the mid-1999. Production capacity was then about one million units per year. Therefore the forecast for about 165,000 sales in 1999 represents only 16.5% of capacity.

The Japanese car carrier operators have an advantage in attracting exports from Thailand because of their strong rinks with the predominantly Japanese owned manufacturers. MOL is known to be particularly optimistic of substantial growth in the number of cars that will be exported from Thailand.

(8) South Korea

Domestic car sales drastically dropped, in common with other Far Eastern car making countries, to 780,000 in 1998 from 1.5 million in 1997. In mid-1999 they began to pick up and were forecasted to continue to improve and surpass their peak of about 1.6 million units in 2001.

Hyundai and Daewoo, South Korea's big two, have been seeking strategic partnership overseas. Hyundai approached Ford and Daimler Chrysler with an offer of issuing at least US$1.6bn in convertible bonds while Daewoo held discussions with GM on an equity stake reported to be in the region of US$2bn.

(9) South Africa

Volkswagen is the dominant car producer in South Africa. VW's South African subsidiary has contracted to assemble 68,000 third generation Golfs from knocked down parts for export to Britain. The plant, which has previously been producing Golfs for the bcal market, is forecast to produce a total of about 120,000 cars per year.

It is beyond a traditional shipping way of thinking that South Africa is able to be a car manufacturing country. South Africa is far remote from established car manufacturing plants and yet VW still expects to find it worthwhile to ship parts there, mostly from Central Europe, for assembly and then for export to UK as fully built cars. Labor cost is the main reason for this decision. The Eastern Cape's economy is suffering badly with massive unemployment and very low wages for those lucky enough to find work.

The inbound VW cargo through Port Elizabeth is expected to consist of about 3,000 TEU per year. According to VW South Africa, they will continue to use Mediterranean Shipping Company (MSC) as its carrier.

The route from Port Elizabeth to Southampton (the nominated port in the UK) is not attractive to the major car carriers. HUAL calls at Port Elizabeth en-route to Japan but there is no equivalent return service as the ships are always fully loaded on the return leg from the Far East and have to use the Suez Canal to minimize transit time.

It is observed that if MSC does secure the export business and decides to containerize the export cars it will be because it has an imbalance of empty containers, as is usual on any African trade. There has been extensive development of various container ramps and a new " high cube " container is being developed that will allow four cars to be carried in a 40ft container. With some investment in this area, MSC could be in an ideal position of having a balanced container trade in and out of Port Elizabeth.

3.3.3 The Growing Importance of the Component Suppliers

Apart from lower wages, the other main attraction of building car plants in those countries and regions above is the relative ease with which " green-field " sites can be acquired. In Latin America, Malaysia, India, China, Indonesia and Vietnam it has been possible to design assembly plants from scratch with adjoining supplier factory of component manufacturers.

In Europe and Japan, by contrast, this is much more difficult to achieve and is one of the reasons why BMW, for example, has been reluctant to invest in the Rover plant at Londonbridge, England. The suppliers are no longer simply supplying parts to order, but instead entire and often very complicated modules from complete suspension units to drive train (gearbox and engine) assemblies.

The reasons for the growing importance of the component suppliers in the car manufacturing industry are described below.

(1) From the Side of Car Manufacturers

1) Car manufactures increasingly see their role as modular assemblers of such units, produced by a small number of global suppliers such as TRW/Lucas, Delphi, Lear, Varity, Rockwell and Bosch. There are only two or three big firms in each component area and only those companies have the extensive technological and financial resources needed to design, develop and produce these modules.

2) If a suppliers plant is conveniently located adjacent to an assembly plant, it will become possible for a car manufacturer to get an enormous amount of profit

through an ideal logistic management. Although those regions are limited in the world, it is still possible to look forward to higher returns on capital by investing in a green-field site in an emerging nation with a much lower cost basis.

(2) From the Side of Component Suppliers

1) The ability of the leading component suppliers to spread their resources across a number of large car producing companies is vital in surviving the severe competition in this area. Creation of " supplier parks " has become a must condition to both car manufacturers and component suppliers.

2) Supplier parks, allowing the optimum in just-in-time delivery, can be seen as completing a process that is transforming the economics of car manufacturing and hence the trade routes of the car carriers.

How some major car producers are reacting is shown below:

Table 3.3.9 Concentration of Resources by Some Major Car Makers

Volkswagen	In the process of reducing the bulk of its production of VW, Audi, Seat and Skoda branded cars to four from sixteen
Ford/Volvo	Take over of Volvo cars in April 1999, eventually extend the same Ford standard power train and platform parts into 400,000 cars that currently Volvo produces. It is likely that more components will be supplied from outside Sweden and possibly even Europe.
Volvo/Mitsubishi	It is probable that Ford will choose to switch more Volvo production outside Sweden. The plan seems unlikely to include the production facility that the Volvo Group shares with Mitsubishi in the Netherlands.
Volvo/Hyundai	Hyundai Merchant Marine (HMM) is unlikely to continue to provide a service to Gothenburg that involves a considerable deviation from the main route, if Volvo's production in Sweden is cut.

Source) JICA Study Team

3.3.4 Car Carrier Service Route via Suez

World market of car carrier exports at the end of 2000 is summerized as follows:

Table 3.3.10 World market of car carrier exports

Exports from Japan	3,700,000 cars (60%)
Exports from Korea	1,500,000 cars (16%)
Exports from Other Areas	2,000,000 cars (24%)
World Total	7,200,000 cars (100%)

Source) JAMA

Car exports from Japan are still dominant in terms of car transportation by ocean going car carriers. Table 18.3.4-1 shows the destination-wise breakdown of Japanese car exports (excluding trucks and busses) in 1998.

Table 3.3.11 Japanese Car Exports by Destinations (1,000 units)

Destination	cars	%
Asia	183	5.0
Middle East	286	7.8
Europe	1,193	32.4
North America	1,420	38.6
Cent. & South America	292	7.9
Africa	68	1.8
Oceania	238	6.5
Total	3,680	100.0

Source: JAMA

About 33 percent of the total cars exported from Japan (about 1.2 million units) are destined for Europe. Assuming that cars exported from Korea have a similar tendency (and so it is reported by JAMA), another 500,000 units are headed for Europe (1.5m x 33%). Although there is no available break down data by destination regarding the remaining 2 million cars, it would be safe to conclude that approximately 1.7m cars are exported from Japan/Korea to Europe every year.

Assuming the average capacity of car carriers as being 5,000 units, about 340 car carriers are passing the Suez Canal every year one way (northbound), and because most of those ships simply shuttle between Asia and Europe, the figure can be doubled. However, it is difficult to verify, through SCA statistics, the number of car carriers operated by Japanese and Korean shipping lines, because many of those ships are operated under third nation flags such as Panama or Liberia etc.

340 car carriers per year is about 28 ships monthly. The four major Japanese Carriers (NYK, MOL, K and Nissan) are maintaining about 15-20 monthly sailings from Japan, thus the remaining 8-13 sailings are assumed to be Korean.

The main car carrier services and main calling ports of the four major Japanese shipping lines through Suez (Mitsui O. S. K. Lines, NYK Line, K Line and Nissan Motor Car Carrier) are listed below.

(1) Mitsui O. S. K. Lines

1) Japan-Far East / North Europe (about 4 sailings per month)

Table 3.3.11 Main Calling Ports of Japan-Far East/N. Europe

Algier	**26 days**
Barcerona	**25 days**
Valencia	**26 days**
Lisbon	**28 days**
La Goulette (T/S from Barcelona)	**30 days**
Casablanca (do)	**30 days**
Las Palmas (do)	**30 days**
Tenerife (do)	**30 days**
Dublin	**29 days**
Bristol	**30 days**
Sheerness	**33 days**
Antwerp	**33 days**
Ghent	**33.days**
Rotterdam	**34 days**
Bremerhaven	**35 days**
Copenhagen	**37 days**

2) Japan-Far East / Mediterranean Sea (1 sailing per month)

Table 3.3.12 Main Calling Ports of Japan-Far East/Med. Sea

Alexandria	**21 days**
Beirut	**22 days**
Mersin	**24 days**
Istanbul	**26 days**
Piraeus	**28 days**
Koper	**30 days**
Livorno	**34 days**
Savona	**34 days**

3) Europe / Japan (3 voyages / month)

4) Europe / Far East (1 voyage / month)

(2) N. Y. K. Line

1) Asia / North Europe (4 sailings per month)

North European ports: Lisbon, Leixoes, Cherbourg, Sheerness, Bristol, Dublin, Ghent, Antwerp, Rotterdam, Bremerhaven, Frendericia, Copenhagen, Malmo, Walhamn, Drammen, Gdynia, and Hanko

2) Asia / Mediterranean(2 sailings per month)

Mediterranean ports : Tartous, Beirut, Alexandria, Benghazi, Valetta, Tripoli, Tunis, Algier, Casablanca, Mersin, Larnaca, Limassol, Piraeus, Istanbul, Ilychevsk, Koper, Livorno, Savona, and Barcelona

Asian ports: Keelung (2 calls per month), Hong Kong (4), Bangkok/Laem Chabang (5), Singapore (5), Port Kelang (5), Manila (2), Ho Chi Minh City (1), Haiphong (1), Yangon (1), Chittagong (1)

(3) K Line

1) Far East / Europe / Mediterranean

(4) Nissan Motor Car Carrier

1) Japan / North Europe via Arabian Gulf

3.4 Product Carriers

3.4.1 Iron Ore Carrier

World production of iron ores, according to UNCTAD data, decreased by 0.7% in 1998 to 906mt, down from 912mt in 1997.

World steel production decreased from 799mt in 1997 to 776mt in 1998, while pig iron decreased from 545mt in 1997 to 538mt in 1998. World production of *direct reduced iron* continued to increase. In 1998, the total output reached 36.7mt, 4.1% more than the previous year.

Regional developments in pig iron production from 1997 to 1998 were as follows:

Table 3.4.1 Regional Production of Pig Iron

Region	1998 Production	97/98 %
China	118.2 mt	+3.2
EU (15)	96.3 mt	-1.1
Japan	75.0 mt	-4.5
USA	48.2 mt	-2.8
S. Korea	23.3 mt	+2.6
Former SU	57.9 mt	-4.1
Others	119.1 mt	-
Total	538.0 mt	-1.3

Source) UNCTAD, JICA Study Team

Iron ore was the second largest dry bulk commodity measured in volume in 1998 according to Fearnleys' " World Bulk Trades 1999 ", almost 12% lower than coal, and 4.7% lower than coal measured in ton-miles.

The pattern of seaborne trade is shown in Table 3.4.2. On the import side, Europe decreased by 0.6mt to 145.9mt, Japan saw a decrease of 5.3mt to 121.4mt. Other Far East decrease3d by 8.5mt to 104.8mt, US imports decreased by 0.7mt to 14.9mt, whereas imports to other areas increased to 30.1mt from 29.4mt.

On the export side, South America Atlantic increased by 1.3mt to 151.8mt, Australia/New Zealand decreased by 11.5mt to 137.9mt. Export from Asian countries decreased by 0.4mt to 36.4mt. Africa decreased by 0.6mt to 32.0mt. North America decreased by 2.6mt to 27.2mt, while exports from Europe increased by 0.3mt to 20.9mt and South America Pacific increased by 0.4mt to 10.8mt.

Table 3.4.2 Iron Ore Total Sea-borne Trade 1998 (Figures in million tons)

From/To	UK/ Cont	Med.	Other Euro.	US	Japan	Other F.East	Others	Total 1998	Total 1997
Scandinavia	11.3	0.6	2.9	0.3	0.0	0.4	2.5	18.1	19.1
Other Europe	1.3	0.4	0.5	0.1	0.0	0.5	-	2.7	1.5
West Africa	6.5	3.7	0.5	-	-	-	0.7	11.4	11.9
Other Africa	4.9	1.2	3.2	-	4.5	6.6	0.1	20.6	20.8
N. America	16.1	1.3	0.3	5.7	0.8	2.4	0.5	27.2	29.8
S. America (A)	46.9	10.8	11.6	7.2	27.3	26.5	21.4	151.8	150.3
S. America (P)	0.4	-	-	0.1	4.1	5.5	0.7	10.8	10.5
Asia	1.5	0.8	0.6	0.4	19.6	11.2	2.4	36.4	36.8
Aust/NZ	16.0	1.9	0.6	1.0	65.0	51.8	1.7	137.9	149.5
Total 1998	104.9	20.6	20.4	14.9	121.4	104.8	30.1	417.0	
Total 1997	108.1	20.6	16.6	15.6	126.6	113.3	29.4		430.2

Source) Fearnleys, JICA Study Team

3.4.2 Coal Carrier

Based on BP's (British Petroleum) data, world production of coal, including brown coal and lignite decreased by 2.4% when measured in tons oil equivalent to 2231mt. This corresponded to 63% of the oil output. According to IEA (International Energy Agency) total hard coal output in 1998 amounted to 3656mt, whereas brown coal stood at 892mt. There is a considerable difference between these two kinds of data, possibly caused by classification of coal. The largest producers of coal were China 1236mt, USA 936mt, India 303mt, South Africa 223mt and Australia 219mt.

International sea-borne coal trade in 1998 increased by 2.9% to 473mt, as against a growth of 5.8% in 1997. Coal was the largest dry bulk commodity measured in volume in 1998, 14% ahead of iron ore, and measured in ton-miles coal was almost 5% higher than iron ore. Table 3.4.3 and Table 3.4.4 show the trading pattern of hard coals and notable changes by region.

Table 3.4.3 Coal Total Sea-borne Trade 1998 (Figures in million tons)

From/To	UK/ Cont.	Med.	Other Euro.	S. Am.	Japan	Other F.E.	Others	Total 1998	Total 1997
N. America	20.5	7.8	8.1	9.6	23.8	10.9	7.0	87.7	95.8
Australia	18.4	4.8	4.2	7.1	71.5	46.9	13.9	166.7	157.0
S. Africa	21.1	5.8	10.9	2.1	4.2	8.0	15.0	67.1	63.8
S. Am. Carib.	16.0	3.3	5.7	0.0	0.4	0.0	8.4	33.9	29.0
China	1.3	0.7	0.0	0.0	13.5	15.8	0.9	32.2	30.4
Former Sov. U.	0.9	5.1	3.6	-	4.0	1.0	-	14.5	11.7
Other E. Euro.	9.1	0.1	8.4	0.3	-	-	0.6	18.5	17.8
West Europe	1.0	0.0	0.9	0.0	-	-	0.0	2.0	2.3
Others	2.9	0.1	4.2	1.7	13.8	22.7	5.4	50.9	52.5
Total 1998	91.1	27.8	46.1	21.0	131.1	105.3	51.2	473.5	
Total 1997	83.3	26.8	51.0	21.1	134.1	105.1	38.8		460.3

Source) Fearnleys, JICA Study Team

Table 3.4.4 Notable Changes in Coal Sea-borne Trade 1998

Export side		97/98 %
Australia	Up 9.7mt to 167.7mt	+ 6.2
South America/Caribbian	Up 4.9mt to 33.9mt	+16.9
North America	Down 8.1mt to 87.7mt	- 8.5
Import side		
Japan	Down 3.0mt to 131.1mt	- 2.2
UK/Continent	Up 7.8mt to 91.1mt	+ 9.0
Others	Up 12.4mt to 51.2mt	+32.0

A break-down of the figures in the above Tables into separate importing countries gives sea-borne trade as per Table 3.4.5.

Table 3.4.5 Importing Tons by Countries (except Japan)

(million tons)

Country	1998	1997
South Korea	50.2	49.4
Taiwan	36.4	36.3
Netherlands	24.6	21.0
Italy	16.7	15.9
UK	20.2	17.6
France	18.2	13.3
India	15.3	13.3
Denmark	6.1	13.4
Spain	13.1	10.8
Brazil	13.2	13.2
Belgium/Luxembourg	11.0	12.5
Germany	17.2	19.0
Hong Kong	7.6	6.4

Source) Fearnleys, JICA Study Team

3.4.3 Grain Carrier

In the shipping business, the term " grain " generally comprises wheat, maize, barley, soybeans, sorghum(corn), oats and rye. World production of these commodities in 1998 reached a total of 1594mt, as compared with 1605mt in 1997. The individual figures for various grain commodities in 1998 were as shown in Table 3.4.6.

Table 3.4.6 Individual Figures of Grain

Kind of Grain	1998	1997	change
Wheat	585	610	-4.1%
Maize	603	576	+4.7%
Barley	138	155	-11.0
Soybeans	158	145	+9.0%
Sorghum	63	61	+3.3%
Oats	26	33	-21.3%
Rye	21	25	-16.0

Source) Fearnleys, JICA Study Team

International sea-borne grain trade in 1998 amounted to 196mt, or 3.3% less than in 1997. It is unavoidable that the volume of sea-borne grain trade fluctuates yearly more than other commodities. For natural reasons, it reached a peak of 207mt in 1984, and fell to a low of 165mt in 1996. Grain is the third largest dry bulk commodity at less than half of the coal and iron ore volumes.

Table 3.4.7 shows the trading pattern of grain trade in 1998. The sea-borne grain trade in 1998 comprised the following commodities and quantities:

Wheat 81mt, Maize 60mt, Soybeans 36mt, Sorghum 7mt, Others 12mt.
* the above figures do not include rice, tapioca

Table 3.4.7 Grain Total Sea-borne Trade 1998

(million tons)

From / To	USA	Canada	South America	Aust.	Others	Total 1998	Total 1997
UK/Continent	5.7	0.7	5.6	-	1.1	13.1	12.6
Mediterranean	3.9	0.9	3.1	0.4	2.2	10.6	12.1
East Europe	0.5	0.0	0.4	-	1.7	2.6	2.8
Other Europe	0.4	0.3	1.0	-	0.5	2.1	2.3
Africa	11.5	3.0	3.6	2.0	10.5	30.7	27.7
Americas	22.5	3.8	10.6	0.1	1.8	38.7	3.2
Near East	2.1	0.0	0.8	0.1	1.9	5.0	5.8
Indian Ocean	4.1	1.6	2.4	7.1	5.4	20.8	28.9
Japan	22.7	1.8	3.3	1.9	1.0	30.8	31.8
Other Far East	20.4	3.2	4.3	6.0	7.1	41.1	46.3
Others	0.0	0.0	-	0.3	0.1	0.6	0.6
Total 1998	94.0	15.6	35.1	17.9	33.5	196.2	
Total 1997	100.5	22.5	30.1	22.9	26.9		202.9

Source) Fearnleys, JICA Study Team

3.4.4 Bauxite Alumina Carrier

According to the data "World Bulk Trade 1999" by Fearnleys, the production of world's Bauxite (except ex-Soviet Territory) was as follows.

Table 3.4.8 Bauxite & Alumina Sea-borne Trade 1998

(1,000 tons)

To / From	UK/ Cont.	Other Europe	North Ameri.	Japan	Others	Total 1998	Total 1997	Total 1996
Mediterranean	120	737	133	7	364	1,361	1,944	938
Africa	1,065	9,131	4,678	-	304	15,178	14,475	12,983
Jamaica	789	1,311	4,912	-	164	7,176	7,269	7,509
Other Americas	668	2,290	5,327	26	429	8,740	8,983	11,002
Asia	-	275	505	894	406	2,080	1,996	3,211
Australia	400	3,459	4,664	1,123	6,056	15,702	16,123	12,764
Others	471	1,021	1,121	17	222	2,852	2,885	2,413
Total 1998	3,513	18,224	21,340	2,067	7,945	53,089		
Total 1997	3,911	18,474	20,905	2,101	8,284		53,675	
Total 1996	2,924	16,825	22,579	2,972	5,520			50,820

Source) Fearnleys

The figures in the above Table 3.4.8 comprise metallurgical bauxite (aluminium ore) as well as metallurgical alumina (aluminium oxide). Generally, 4-5 tons of bauxite are said to be reduced to about 2 tons of alumina, before being melted to 1 ton of aluminium. Sea-borne trade in bauxite and alumina in 1998 decreased 53.7mt in 1997 to 53.1mt. Imports to North America 20.9mt to 21.3mt, and Imports to Japan were about steady at 2.1mt, whereas imports to Europe decreased from 22.4mt to 21.7mt, and other import areas experienced a decrease from 8.3mt to 7.9mt.

Total Sea-borne Trade in ton-miles is shown in the following table:

Table 3.4.9 Bauxite & Alumina Sea-borne Trade

(billion ton-miles)

To / From	UK/ Cont.	Other Europe	North Ameri.	Japan	Others	Totalo1 998	Total 1997	Total 1996
Mediterranean						3	4	3
Africa						60	57	51
Jamaica						-	-	-
Other America						45	46	55
Asia						7	7	11
Australia						84	85	70
Others						6	7	6
Total 1998	17	85	79	5	19	205		
Total 1997	19	84	76	6	20		206	
Total 1996	15	77	83	8	12			195

Source) Fearnley

Total sea-born trade figure decreased from 206btm (billion ton miles) in 1997 to

205btm in 1998. Table 3.4.9 lacks " from/to " figures for each window because of insufficient data. However, of the trade, the most important single trades were 36btm, Australia-Europe 36btm, Australia-North America with 29btm, and Africa-North America 23btm. These four trade routes together accounted for about 60% of the total ton-miles in sea-born trade in bauxite and alumina. The average haul of the four routes were about 3870 miles. In ton-miles, bauxite totaled 123btm in 1998, as against 119btm in 1997. The average haul for bauxite increased from 3840 miles to 4020 miles. These figures are included in Table 18.4.5 but not shown separately.

Also it is not shown separately in the Table 3.4.9, sea-born trade in bauxite in quantity decreased from 30.9mt in 1997 to 30.6mt in 1998. The figures showing inter-movement between the exporting regions and the importing regions are gradually accumulated due to better availability of information. The most important bauxite exporters were Guinea in West Africa with 14.3mt, Australia 5.0mt, Brazil 3.8mt, and Jamaica 3.8mt. Major importers were USA with 11.2mt, Former Soviet Union regions 3.1mt, Canada 2.6mt.

Shipments of bauxite and alumina by bulk vessels over 50,000dwt is shown in Table 3.4.10. the participation of bulk vessels over 50,000dwt in bauxite/alumina trading increased from 44% in 1997 to 55% in 1998.

Table 3.4.10 Bauxite & Alumina Shipments by Bulk and Combined Carriers
(Vessels over 50,000dwt, Figures in 1,000 tons)

To / From	UK/ Cont.	Other Europe	North America	Japan	Others	Total 1998	Total 1997
Mediterranean	-	-	-	-	-	-	-
Africa	990	8710	4170	-	110	13980	10910
Americas	70	750	5820	-	200	6840	5880
Asia	-	-	-	-	-	-	-
Australia	400	3050	1500	200	3000	8150	6960
Others	-	-	-	-	-	-	-
Total 1998	1460	12510	11490	200	3310	28970	
Total 1997	1020	10540	9000	260	2930		23750

Note) " Other Europe " includes Mediterranean

Source) Fearnley

Further size distribution shows that 45% of total sea-born trade was carried by vessels below 50,000dwt, 7% by vessels 50-60,000dwt, and 48% by vessels 60-80,000dwt. The share of shipments by vessels below 50,000dwt has in recent years fluctuated around 55-60%.

3.5 Pipelines

3.5.1 Characteristics of Pipelines and Tankers

In this section, characteristics of pipelines and tankers are described together with a tendency of crude-oil transportation by service routes from the Gulf, i.e. SUMED, via Suez and via Cape.

In view of the great variety of conditions determining the competitive merits of tankers and pipelines any comparison should be related to the specific geographical, technical and economic circumstances of each case, as well as to the political considerations. Each and every case must be analyzed on its own merits and there is no general answer to the question whether or when oil pipelines are economic features. However, some general statement can be made which give an indication of certain factors relevant to such a comparison.

The difficulty in making comparisons is due to the fact that, generally speaking, the cost per ton-mile of transport by pipeline decreases rapidly with the tonnage transported, but is not much influenced by the distance. On the other hand, in the case of all other forms of transport of oil, the cost decreases with distance but not with quantity.

Flexibility is a special and strong attribute of ocean tanker transport. Tankers can be moved to any of the trade routes where they may be needed. They can carry any type of oil and are able to cope with the varying seasonal demands for transport of oil such as increased fuel-oil requirements in winter.

In sharp contrast to tankers, pipelines lack this flexibility; they are permanent fixtures and once a large-diameter trunk pipeline system is laid, it cannot be re-routed even if conditions change and a different pattern of transport becomes desirable. Therefore, unlike the investment in tankers, pipelines are generally designed right from the beginning with their ultimate capacity in calculation, and the construction of a pipeline has to be based on broad forecasts as to the flow of oil over a particular route for many years ahead.

The oil-carrying capacity of a pipeline increases with the size of its diameter. Theoretically the throughput capacity increases proportionately to the square of its diameter but in practice it increases somewhat more, owing to the higher speeds at which oil can be moved through the larger line. A doubling of diameter gives in practice a five- or six-fold increase in capacity. However, the maximum pipeline capacity is limited by the practicable pipeline diameter which corresponds to 110 to 120 million tons per annum for the case of SUMED* at the beginning of the year 2000, but this may increase in future. It is a dramatic jump from 30 to 35 million ton

level in 1957.

The capacity of a pipeline varies not merely according to its diameter, but also according to the terrain and the number of pumping stations. The throughput of an established pipeline can be increased by the addition of pumping stations but limiting factors are the diameter, thickness and quality of the pipeline system, its inter-relationship determines the maximum safe pumping pressure.

Pipelines are not, generally, suitable for heavy fuel oils as with high viscosity products the capacity drops very rapidly and at very low temperature the flow may be completely stopped. They are however suitable for any lighter oils from gasoline down to gas oil or so-called light or " domestic fuel oil ". In the United States, production pipelines are used on a wide scale because the demand for fuel oil in inland areas is relatively small since natural gas is used on such a large scale. In Europe, however, most inland markets call for considerable quantities of heavy fuel oil. Since all the types of crude oil currently imported to supply the European markets are pumpable, it is a natural trend that efforts are being made to locate the refinery in the consuming area and bring the crude oil to it by pipeline.

3.5.2 Pipeline Impact on Tankers and Suez Canal

The VLCC/ULCC is undeniably much more economical than the smaller tankers. It is estimated that the cost of transport in a VLCC of 200,000dwt is about 40 percent or even less of the cost in a Aframax tanker. Contrary to tankers, a pipeline is usually destined to a particular region and it is meaningless to compare costs of it with another different pipeline system.

In relation to the analysis of the impact to tankers and Suez Canal, there are two types of pipelines:

(1) Pipelines which are basically complementary to ocean-going transport of oil by tankers and without which there would be no transport at all. These pipeline, which form the majority, are not competitive with tanker transport because pipeline itself is a part of total oil transportation system. Instead they create tanker employment either by bringing oil from inland regions to the loading seaports or by transporting oil from a discharging seaport to an inland refinery in an oil consuming area.

(2) Pipelines which compete with tanker transport by shortening substantially the alternative sea route when very large quantities of oil are to be transported over a fixed route for a long period. The best example of this category is the SUMED pipeline. The effect of existing and planned pipelines in Western Europe is far less important than the change in the supply pattern resulting

from the emergence of SUMED.

In the Middle East, pipelines are, in most cases, the only possible means of transport to carry crude oil in large quantities from oilfields situated in inland regions to seaport for onward transport overseas by tankers. Generally, the pipelines in the Middle East support the ocean transport of oil by tankers and both tankers and pipelines will be cooperative in the future. The particular problem in terms of the Suez Canal operation is a competitive element of the category 2 pipeline, namely SUMED pipeline. Table 3.5.1 (in quantity) and Table 3.5.2 (in ton-mile) show the break down of Middle East oil transportation classified by sea-borne routes.

Table 3.5.1 Middle East Oil Transportation by Sea-borne Route (in quantity)

From Middle East To	Route	1998		1999	
		Million tons	%	Million tons	%
N.America (Atlantic)	SUMED	0.47	8.9	0.89	21.4
	Via Suez	0.55	10.4	0.17	4.1
	Via Cape	4.26	81.7	3.09	74.5
	Total	5.28	100.0	4.15	100.0
N. America (Mexican Gulf)	SUMED	0.00	0.0	0.26	0.3
	Via Suez	1.48	1.8	0.78	0.9
	Via Cape	79.73	98.2	86.05	98.8
	Total	81.21	100.0	87.09	100.0
Europe (Near North Sea)	SUMED	41.69	51.1	6.96	54.3
	Via Suez	1.83	2.2	0.26	2.0
	Via Cape	38.00	46.7	5.59	53.7
	Total	81.52	100.0	12.81	100.0
Europe (Baltic Sea)	SUMED	1.10	36.7	1.13	40.6
	Via Suez	0.07	2.3	0.00	0.0
	Via Cape	1.83	61.0	1.65	59.4
	Total	3.00	100.0	2.78	100.0
Europe (Mediterranean)	SUMED	4.63	98.1	36.85	91.5
	Via Suez	0.09	1.9	3.32	8.2
	Via Cape	0.00	0.0	0.09	0.3
	Total	4.72	100.0	40.26	100.0
Europe (East Med/ Black Sea)	SUMED	4.63	98.1	4.63	100.0
	Via Suez	0.09	1.9	0.00	0.0
	Via Cape	0.00	0.0	0.00	0.0
	Total	4.72	100.0	4.63	100.0
South & Central America (Caribbean Sea)	SUMED	0.00	0.0	0.26	2.7
	Via Suez	0.00	0.0	0.06	0.6
	Via Cape	10.64	100.0	9.29	96.7
	Total	10.64	100.0	9.61	100.0
South America (Pacific)	SUMED	0.00	0.0	0.00	0.0
	Via Suez	0.00	0.0	0.00	0.0
	Via Cape	0.31	100.0	0.00	0.0
	Total	0.31	100.0	0.00	0.0
South America (Atlantic)	SUMED	0.00	0.0	0.00	0.0
	Via Suez	0.00	0.0	0.02	0.3
	Via Cape	6.90	100.0	6.18	99.7
	Total	6.90	100.0	6.20	100.0
North Africa	SUMED	1.42	33.9	2.73	62.8
	Via Suez	2.77	66.1	1.62	37.2
	Via Cape	0.00	0.0	0.00	0.0
	Total	4.19	100.0	4.35	100.0
Others	SUMED	0.00	0.0	0.00	0.0
	Via Suez	0.00	0.0	0.00	0.0
	Via Cape	0.00	0.0	0.28	100.0
	Total	0.00	0.0	0.28	100.0
Total	SUMED	89.57	36.5	75.39	34.6
	Via Suez	11.02	4.5	6.78	3.1
	Via Cape	144.56	69.0	135.78	62.3
	Total	245.15	100.0	217.95	100.0

Source) JAMRI, JICA Study Team based on Lloyd's List Data

Table 3.5.2 Middle East Oil Transportation by Sea-borne Route (in ton-mile)

From Middle East To	Route	1998		1999	
		mtm	%	mtm	%
N. America (Atlantic)	SUMED	3,810	6.4	7,236	15.9
	Via Suez	4,599	7.8	1,385	3.0
	Via Cape	50,832	85.8	36,953	81.1
	Total	59,240	100.0	45,575	100.0
N. America (Mexican Gulf)	SUMED	0	0.0	2,421	0.2
	Via Suez	14,407	1.3	7,577	0.7
	Via Cape	1,059,003	98.7	1,143,002	99.1
	Total	1,073,410	100.0	1,153,000	100.0
Europe (Near North Sea)	SUMED	263,051	37.3	180,723	35.1
	Via Suez	11,974	1.7	5,319	1.0
	Via Cape	429,475	61.0	329,501	63.9
	Total	704,500	100.0	515,547	100.0
Europe (Baltic Sea)	SUMED	7,325	25.2	7,484	28.1
	Via Suez	459	1.6	0	0.0
	Via Cape	21,259	73.2	19,191	71.9
	Total	29,042	100.0	26,675	100.0
Europe (Mediterranean)	SUMED	178,332	78.0	163,232	90.8
	Via Suez	19,804	8.7	15,542	8.6
	Via Cape	30,631	13.4	1,002	0.6
	Total	228,767	100.0	179,776	100.0
Europe (East Med./Black Sea)	SUMED	17,904	98.1	17,905	100.0
	Via Suez	356	1.9	0	0.0
	Via CAPE	0	0.0	0	0.0
	Total	18,260	100.0	17,905	100.0
South &Central America (Caribbean Sea)	SUMED	0	0.0	2,374	2.1
	Via Suez	0	0.0	563	0.5
	Via Cape	129,014	100.0	112,617	97.5
	Total	129,014	100.0	115,553	100.0
South America (Atlantic)	SUMED	0	0.0	0	0.0
	Via Suez	0	0.0	210	0.4
	Via CAPE	14,785	100.0	51,787	99.6
	Total	14,785	100.0	51,997	100.0
North Africa	SUMED	6,997	32.8	13,448	61.7
	Via Suez	14,325	67.2	8,365	38.3
	Via Cape	0	0.0	0	0.0
	Total	21,323	100.0	21,814	100.0
Others	SUMED	0	0.0	0	0.0
	Via Suez	0	0.0	0	0.0
	Via Cape	0	0.0	1,680	100.0
	Total	0	0.0	1,680	100.0
Total	SUMED	477,419	21.0	394,525	18.5
	Via Suez	65,921	2.9	38,961	1.8
	Via Cape	1,734,999	76.2	1,695,734	79.6
	Total	2,278,339	100.0	2,129,220	100.0

Source) JAMRI, JICA Study Team based on Lloyd's List Data

Appendix A An Idea of Setting the Future World Economy Scenario

A.1 Introduction.

A.1.1 Objective and contents of this chapter

This Appendix aims at providing an idea to set economic development scenarios by worldwide regions, based mainly on which the potential cargo flow matrices of the Suez Canal, can be forecasted.

This chapter consists of the following three parts:
Part1: Key factors that will basically influence the World Economy, Societies and Policies.
Part2: World Economic Development Scenarios.

Part1 provides the backgrounds to the World Economic Development Scenarios. Part2 presents numerical expression of economic development.

A.1.2 Procedure

The following scenarios have been examined that are described in documents" the World in 2020 - towards a New Global Age -, OECD 1997 " and " Global Economic Prospects and the Developing Countries, World Bank 1997".

Scenario 1: High Growth scenario (High Performance scenario)
Scenario 2: Baseline Scenario
Scenario 3: Low Growth Scenario (Business - as - usual scenario)

OECD arranges the Scenario 1 and 3, while the World Bank arranges the Scenario 2. Along with the three scenarios, Lower growth scenarios are discussed in both the documents.

To select the scenario from these three scenarios as a base scenario for forecasting, the following procedure is carried out.

Procedure l : Review and evaluation of assumption based on which the scenarios were drawn.
Procedure 2: Evaluation of realization possibility of the scenario based on another fundamental factors that would give a great influence on the possibility

The procedure 1 is performed based on mainly the contents related to the issues discussed in the two documents, while the procedure 2 based on the fundamental factor " National sovereignty " that is nominated with expertise.

On the evaluation, a method by which many fundamental factors are abstractly synthesized for the evaluation is adopted, resulting in that the method can not be

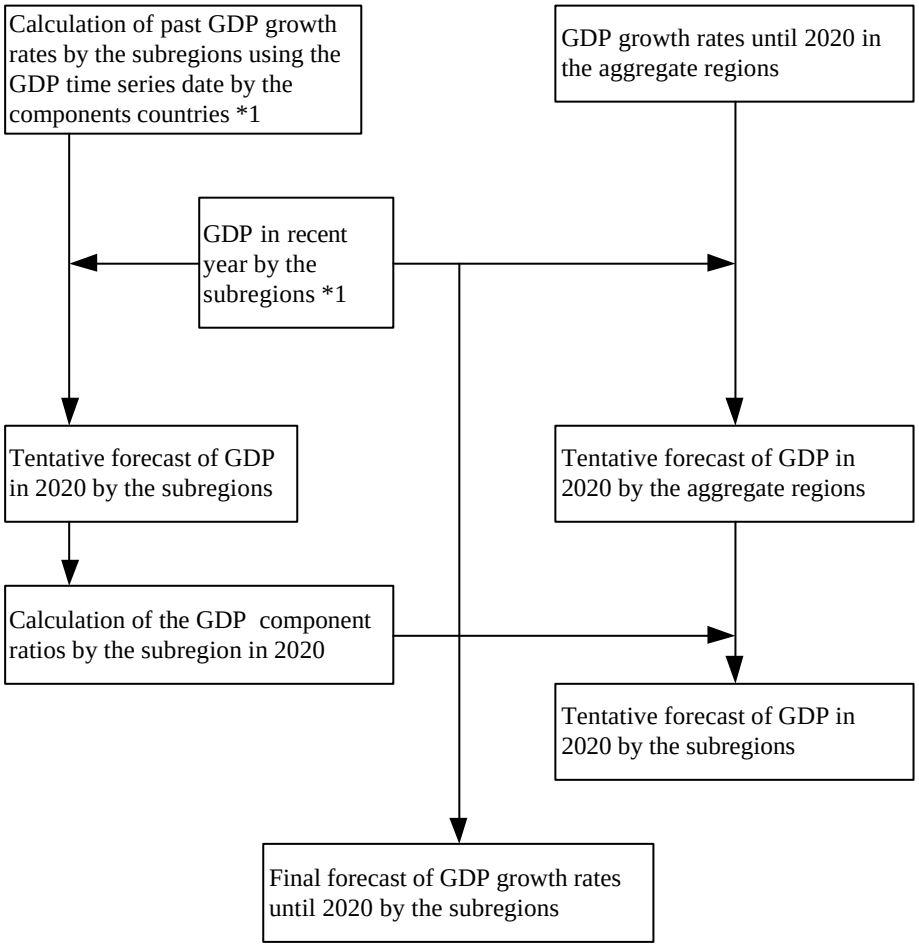
expressed in form of concrete evaluation procedures like the ones adopted in the Economic Evaluation on project nor in forms of equations. Accordingly, the scenario to be selected may vary among staffs in charge depending on their evaluation methods and their results of the evaluation.

A.1.3 GDP growth rates by sub-region and countries

The World Bank report does not present the GDP growth rates until our target year for the all regions. But the growth rates are necessary for forecasting the commodity flow matrices. Accordingly we have to supplement the lacking GDP growth rates in the following way:

1) Review of the GDP growth rates in the regions/sub-regions that are related to the region/sub-regions to be supplemented and are presented in the World Bank Baseline Scenario as well as in the OECD's two scenarios.
2) Addition of our expert knowledge on the future economic development of the lacking regions/sub-regions /countries
3) Final setting of the GDP growth rates in the lacking region.

- Applied for "EU(15)" and "Middle East and North Africa" -



Note) *1:Date sources: *Economic Indications, OECD statistics.
*World Development Indicators, World Bank statistics.

Figure A.1.1 Method for Setting the Economic Development Scenarios by sub-regions

A.1.4 Forecast " and " Scenario "

The World Bank report uses the terminology "Forecast" for period 1997-2006 and "Scenario'" afterwards to the year 2020, while the OECD report "Scenario" through the whole period.

The difference in the concept of two terminologies would be understood as follows:
The "Scenario" shows a future economic situation based on several assumptions on fundamental factors of the future economy. So, there exist many scenarios depending on the assumption on the fundamental factors. On the other hand, the "Forecast" shows a future economic situation that has a high occurrence probability. Accordingly, there exist a few case of forecasts, usually, high, plausible and low cases, depending on the occurrence probability, not on the assumptions. As the result, the target year of the "Forecast" is nearer than the ones of the "Scenario".

A.1.5 The base data

In case of the World Bank, constant 1992 US dollars using market exchange rates is used for measuring the GDP in real term that is used as the base data, while in OECD, the purchasing power parity term (PPP) is adopted. The PPP is the rate of currency conversion that eliminates the differences in price levels between countries. This means that a given sum of money, when converted into different currencies at these rates, will buy the same basket of goods and services in all countries. Therefore, the GDP in the PPP term is effective than the GDP in the constant US dollar basis for comparative analysis on the poverty issues among countries. The total amount of GDP in the PPP term becomes larger than the one in the constant US dollar basis because price levels in the developed countries are higher by several folds than the ones in the developing countries.

As the conclusion, the differences in the two bases do not make any effect of the calculation of GDP growth rates in spite of differences in the amount of the GDPs in the base year for the calculation.

A.2 Key Factors affecting the World Economy Societies and Politics.

A.2.1 Past trends in the World Economy, Societies and Environment until 1990s

A.2.1.1 Key factors that have greatly altered the world trends in the economy politics and environment since the 1980s

The following factors can be enumerated:

Factor l: The increasingly widespread acceptance of democratic institutions and market economic development among almost whole countries in the world
Factor 2: Rapid technological advances, particularly in information and communications technologies
Factor 3: Rapid economic growth of several non - OECD economies, especially in the Asia Pacific region
Factor 4: The emergence of Brazil, China, India, Indonesia, and Russia (hereinafter referred to as the " Big Five") as major players in the world economy, policy, and environment
Factor 5: The unprecedented increase in the worldwide trade and investment

The Factor 1 has underlain the Factors 3,4 and 5 along with a great and radical changes in the economic development policies in the countries concerned, and the Factor 2 has underpinned the Factor 5 through decrease in the transmission and transportation cost of cargoes, and easy and fast access to market information over the world.

A.2.1.2 Key factors, phenomena and points at issue in the world economy and trade

Permeation of the market economy system and promotion of trade liberalization have been observed at basis of the world economy and trade. Along with the above-mentioned emergence of the Big Five countries into the world economy and trade, the following regional decisions can be especially enumerated among the many existing regional economic blocks and agreements:

1) APEC (Asian - Pacific Economic Co-operation) has adopted the goal of free trade and investment in the Asia - Pacific region by 2020.
2) The 34 democracies of the western hemisphere agreed to devise a Free Trade Agreement of the Americas (FTAA) by 2005, building on the North American Free Trade Agreement (NAFTA)
3) The European Union (EU) has also agreed with 12 Mediterranean countries ' (Euromed) to establish free trade by 2010

In addition, the OECD Development Assistance Committee (DAC) has selected goals for economic well-being, social development, and environmental sustainability and regeneration in developing countries (mostly for the year 2015).

The above-mentioned decisions will surely promote more profoundly the worldwide liberalization of trade and investment. However, it should be pointed out that several economic blocks could lead to "protectionism" in the event of the Lower Growth scenario discussed later.

In the processes of the world economic development and the liberalization of the world trade, the following points at issue have to be solved or mitigated in future:

. Unsustainable utilization of natural and environmental resources
. Poverty problem in the developing countries
. Social and economic structure reforms in the OECD countries

The first point at issue is a worldwide issue. The second has been substantially improved, but is still a big problem for both the developing and developed economies. The third issue has generated in the process of strengthening of the mutual economic co-operation between the OECD and non-OECD countries. Adjustment of the industrial structures in the OECD countries to a higher-technology used ones and unemployment issues can be representatively nominated as subjects of the structure reforms

A.2.1.3 Problems in the world societies

Problems that have occurred in the process of the world economic development and whose solution or mitigation have become more difficult are as follows:
. Immigration issues mainly between the OECD countries and non-OECD countries
. Excessive concentration of population to metropolitan cities in the developing countries

The poverty issue underlies the above two problems. The first problem has become explicit mainly due to insufficient or shrinking allowance for accepting the immigration in the OECD countries. The second problem has generated, caused by income gap between urban and rural areas in the countries concerned.

A.2.1.4 Problems in the global environment

Problems in the global environment that have occurred in same situation and have the same characteristics as ones in the problems in the world societies are as follows:
. Environment issues at areal, national, regional and global levels

The problems have stemmed mainly from industrial and daily economic activities in countries concerned. Nature at the above mentioned levels have a limited absorption capability for emitted exhausts. When the latter exceeds the former, the problems turn explicitly. Excess deforestation, land solicitation caused by excess irrigation and excess emitted exhausts are identified as contributing factors.

A.2.2 A long-term World Economic Development Vision and its Realization

A.2.2.1 What is the Vision?

In the OECD document "The World in 2020 - towards a New Global Age", the world economic development vision is as follows:
The "Vision" that the move towards a "New Global Age" could be completed in less than a quarter century with all artificial barriers to trade and exchange removed and free cross boarder flows of goods, capital and technical know- how at low or close to zero cost

This vision encompasses the entire community of nations, more and more closely bound together by growing economic interdependency, sharing a commitment to a multilateral system of rules - based competition and governance institution, and united in their common concern to safeguard the earth's natural wealth and global environment for the benefit of present and future generations.
In addition to that, the '"New Global Age" is explained to have the following contents in it:

. All societies have the potential of participating actively in the world economy
. The benefits of liberalized world trade and investment could flow to all people
. The misery and poverty of much of the developing world could become a closed chapter of sad history, no longer a reality of the present

A.2.2.2 Strategy for enhancing the capability for solving/mitigating the points at issue

In Figure A.2.1 the strategy and causality among the factors/items related to the strategy are depicted

The best way or way to have to be installed for enhancement of the capability for solving or mitigating the points at issue at the individual country’s, regional and global levels is the precedence of the world economic development rather than challenge directly to the political and social issue in the world. This is the strategy for enhancing the capability. Accordingly, the strategy is not a direct one for solving/mitigating the points at issues but an indirect strategy, i.e. the ore for solving/mitigating the points at issues through enhancement of the capabilities required for the solution/mitigation.

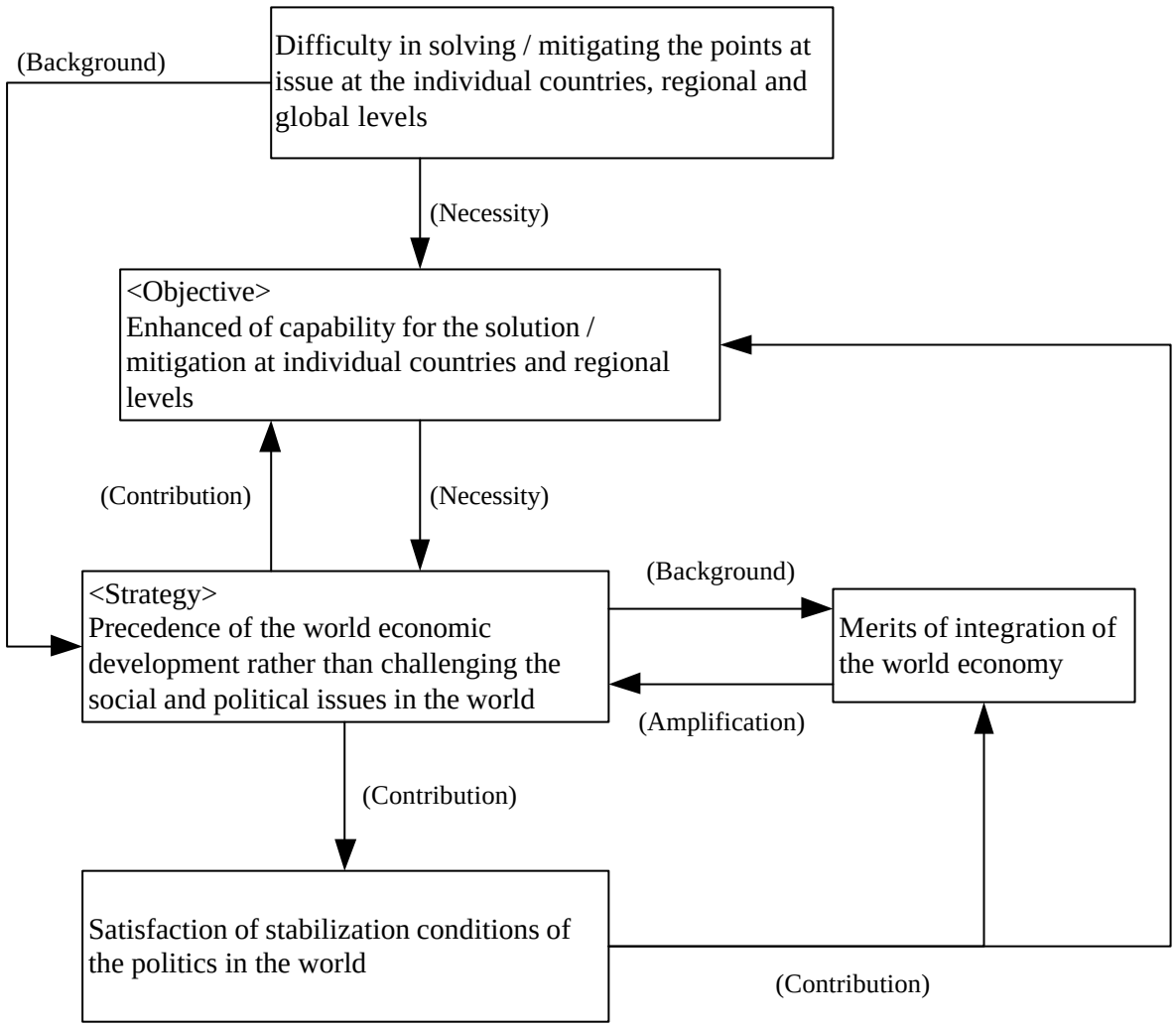


Figure A.2.1 Strategy for enhancing the capability for Solving/Mitigating the Points at Issue

The further integration would bring about largely four types of merits through severer competition in the world trade and spatial distribution of production based on the comparative advantages in the world:

Group 1 merits: Benefits that would be enjoyed by all countries in the world such as:
. Increase in consumer benefits,
. Increase in pressure for upgrading industrial structures and quality of labor.

Group 2 merits: Merits that industries in both the OECD and non-OECD countries would enjoy, such as:
. Expansion of export markets for the OECD countries in the non-OECD countries
. Enlargement of investment portfolio for the OECD countries in the non-OECD countries
. Promotion of upgrading the industrial structures in the non-OECD countries

Group3 merits: Merits that economies in both the OECD and the non-OECD countries would be able to enjoy, such as:
. Establishing of basis for upgrading the industrial structures in the OECD countries
. Further economic development in the non-OECD countries

Group4 merits: Reduction effect of charges to environment in both the OECD and non-OECD countries

As to the items entered in Figure A.2.2, the following comments have to be supplemented:

1) The " Increase in consumer benefits" has been and would be realized through decrease in import prices.
2) Classification of the "Increase in pressure for upgrading industrial structures and quality of labor" as one of the merit is questionable in the following sense: Though the pressure has to be favorably evaluated from the standpoint of upgrading the industrial structure, the increase in the pressure would accompany social and economic issues e.g. conflict between the skilled and unskilled labors especially in the OECD countries.
3) As to the "Existence of endowment of deferent resources among the OECD and non-OECD countries", the OECD report points out broadly: 'the non-OECD countries have comparative advantage natural resources and labor with low and middle levels of skills, while the OECD countries have advantage in technology with high level and funds. The difference in the spatial distribution of resources will roughly decide the international trade pattern between the two regions.
4) Industries in the OECD countries would enable to enjoy not only the increase in their export value but also an economy of scale through the increase by means of the "Expansion of export markets for the OECD countries in the non OECD countries".
5) The "Mature economic development stage in the OECD countries" implies

generally that margin/profit ratios of industries in the OECD countries have been lower than the ones in the non-OECD countries.

6) The "Enlargement of investment portfolio for the OECD countries in the non-OECD countries" will surely bring about an increase in Foreign Direct Investment (FDI) from the OECD countries to the non-OECD countries.
7) The "Increase in export of high-tech commodities, and transfer of the high-technology and management know-how from the OECD to the non-OECD countries will surely occur. However, it has to be pointed out that in order for the industries in the non-OECD to digest the high-technology and management know-how transferred from the industries in the OECD countries and make them their own technology and know-how, the industries in the non-OECD countries have to have already some levels of the technology and know-how. A big difference in the two levels will make the digestion impossible.
8) The non-OECD countries could solve/mitigate the poverty issue through the further economic development in the non-OECD countries.

The progress of the integration of the world economies, in the other words, closer interdependency in their economic activities among countries and regions in the world through further liberalization of trade and investment would not bring about the merits stated above without any costs.

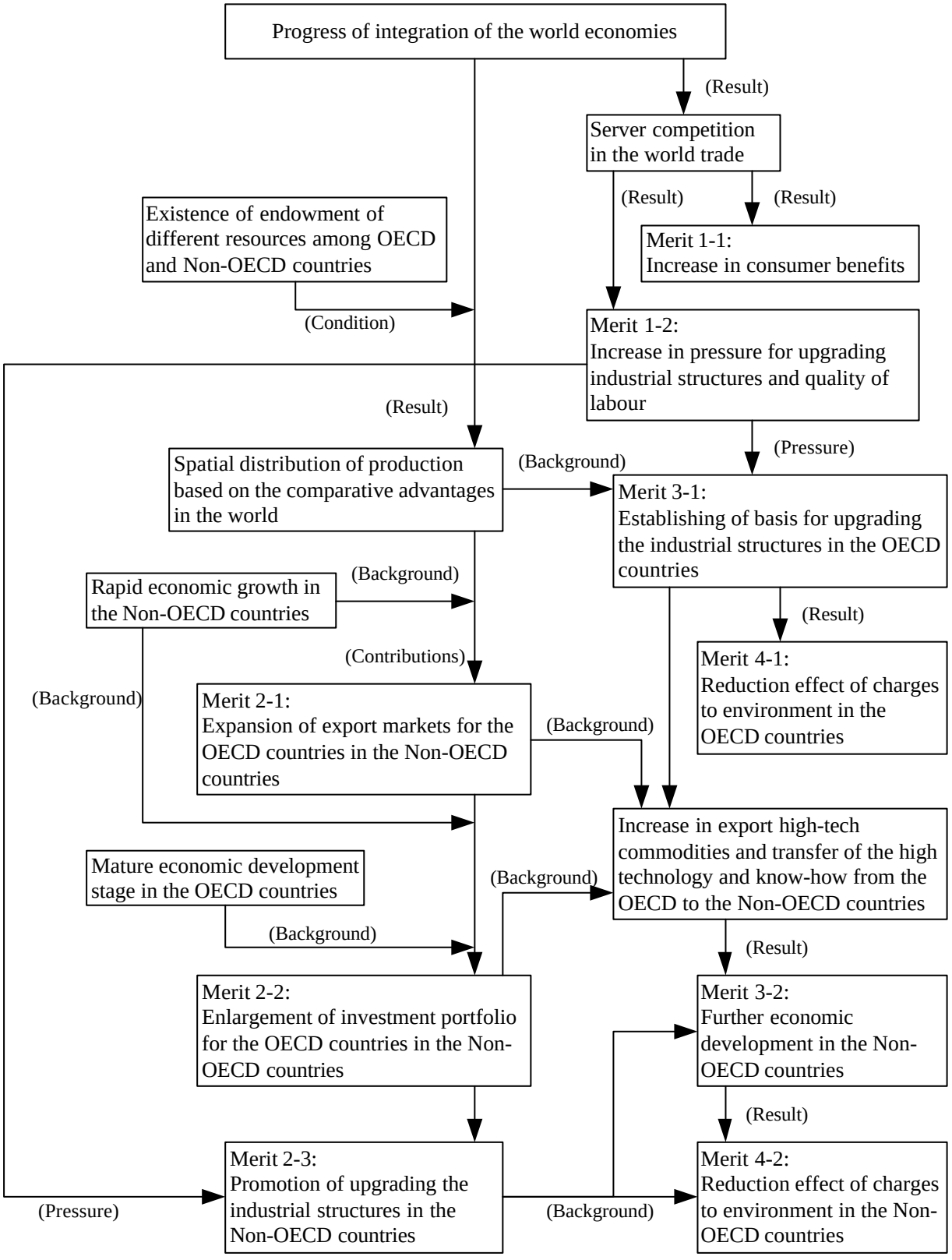


Figure A.2.2 Merits brought about by Integration of Economies whose Levels are different in the World

A.3 World Economic Development Scenarios

A.3.1 OECD and World Bank World Economic Development Scenarios

A.3.1.1 OECD Scenarios

OECD has two Scenarios. Basic Assumptions of these scenario is in Table A.3.1

Table A.3.1 Basic Assumptions introduced in World Economic Scenarios

	HG (High-performance scenario)	LG (Business-as-usual scenario)
Policy Assumption		
*Trade barriers.	Tariff-equivalents fall to zero by 2020.	Tariff-equivalents reduced to 50% of their1992 levels.
*Export taxes/subsidies.	Decline to zero by 2020	Decline to 50%of 1992 level.
*Fiscal consolidation.	Achievement of targets.	No achievement of targets
*Labour market related reform	Implementation of the OECD job strategy.	No major improvement with respect to labour-market flexibility.
Technical Assumptions		
*Population growth	Same assumptions as embodied in the latest version of the UN "Medium variant" projection dating from 1996.	
*Energy efficiency.	Increase of 1% per annum in OECD countries and 2% per annum elsewhere	0.8% per annum in OECD countries and 1.5% per annum elsewhere.
*World oil price	Increase of 2% per annum in real terms between 1995 and 2010 and 1% per annum between 2010 and 2020.	1995-2010: 1.5% per annum. 2010-2020: 0.8% per annum
*Crude oil and natural gas extraction rates.	No differences between the two scenarios.	No differences between the two scenarios.
*Decline in trade and transport margin	Decrease of 1% per annum	Decrease of 0.?% per annum

Source) OECD Development center, 1997

The lower-growth scenario corresponds to a case where one of the following situations would occur:

a. The OECD countries cannot successfully adjust their industrial and employment structures to accommodate technical change and shifting comparative advantage, resulting in a resurgence of protectionism, or
b. Domestic policy failures occur in some of the large non-OECD economies, or

c. The global environment was to experience rapid and severe deterioration through, for example, the collapse of global fisheries, agricultural productivity declines and/or more frequent and severe natural disasters.
(Source: the World in 2020, OECD, p61)

A.3.1.2 World Bank Scenario

(1) A. Baseline Scenario

Assumption 1: There are assumed a considerable trade liberalization over and above Urguay Round:

- Developing countries cut tariffs an manufactures to industrial country level by 2020, while tariffs on agricultural products are assumed to be cut by a half worldwide
- The Agreement on textiles and clothing, which phased out the Multifibre Arrangement, is implemented on schedule in 2005
- China joins the WTO

Assumption 2: Continued substantial declines in the price of transport and communications are reflected in a 2 % annum decline in transport cost

Assumption 3: Within this increasingly open world trading and investment environment, most developing countries and regions are assumed to achieve sustained progress across a broad range of structural and macroeconomic reforms

Assumption 4: The scenario assumes that the Big 5 (China, Indonesia, India, Brazil and Russia) achieve GDP growth of 5.5-7.0 % per annum between 1992-2020, underpinned by growth in the capital stock of 5-10 % per annum and total productivity growth clustered in 1.5-2..0 % per annum range.

(1) Low-case Scenario

Assumption: Failure to sustain reforms, trade frictions and maintenance of high trade barriers between each of the Big 5 and other countries. (Source: Global Economic Prospects and the Developing countries, World Bank 1997, P 22)

A.3.2 Selection criterion of the economic development scenario

Unfortunately, numerical judgment is impossible, because these items are highly conceptual ones.

In Figure A.3.1 Main factors that will affect the future world economy, societies and politics are depicted.

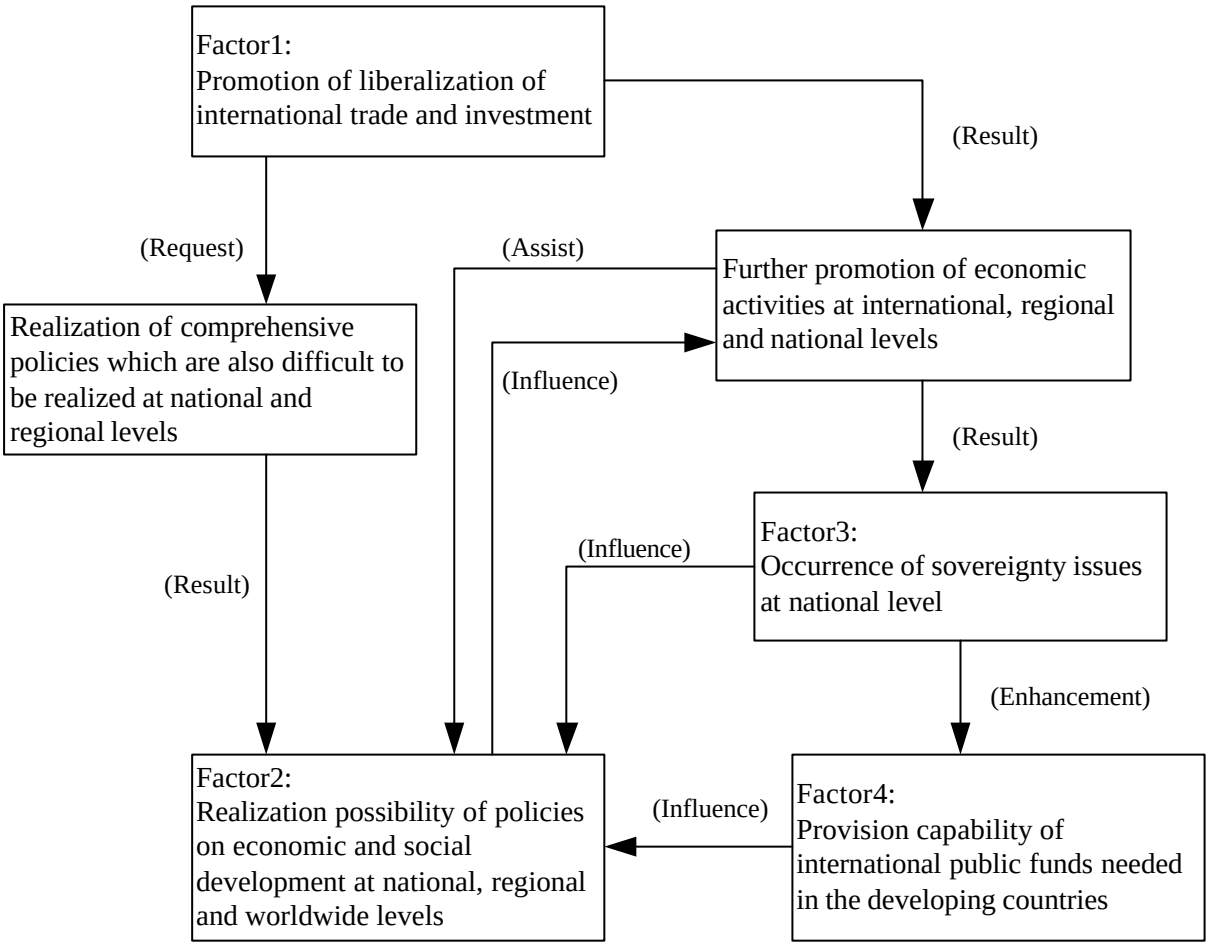


Figure A.3.1 Main Factors that will make Great Influences on the world Economy, Societies and policies

Objectives of the policies are:

. Maintenance of social justice in the countries concerned
. Continuation of high economic growth supported by maintaining stable and sustainable macroeconomic conditions and a broad range of social and economic structure reforms in the countries concerned
. Harmonization between the economic activities and natural environment that covers national, regional and global levels
. Enhancement of counter-measurable capacities for solving/mitigating problems difficult to be solved or mitigated directly at national, regional and global levels
. Completion of borderless world through free flows of commodities, services, capital and technologies worldwide

Policies are on:

. Poverty issue and rescue of dropped-out layers in the economic field
. High aged issue especially in the developed countries

. Excess populated cities issue
. Industrial structure reforms including privatization issue
. Improvement of skill and technology
. Arrangement of legislation scheme so as to realize a desirable economies and societies.
. Promotion of efficient use of endowed resources
. Protection of natural environment from its deterioration

The OECD Lower-Growth scenario and the World Bank Low-case scenario discussed above correspond to a case with low realization possibility of the policies and the economic and social development at national, regional and worldwide levels. Therefore, the Factor 2 works to the further promotion of economic activities at international, regional and national levels favorably or unfavorably, depending on the level of the realization possibility.
As discussed before, in reverse, the further promotion of economic activities heighten the realization possibility.

The issue of national sovereignty (Factor 3) has to be discussed from the following standpoints:
Standpoint 1: Protection of national sovereignty from being invaded by international agreements
Standpoint 2: Maintenance capability of the national sovereignty in severe economic situation

The OECD and World Bank seem to discuss the issue only from Standpoint. In reality, the agreements offered by the WTO (World Trade Organization) and articles in the MAI (Multilateral Agreement on Investment) guarantee superficially the national sovereignty. But, this situation refers to the issue at only the potential level, not actual level. Therefore, discussion from Standpoint 2 is different from the one from Standpoint 1.

It is unavoidable that the further economic integration over the world produces not only economically successful nations but also economically failed nations simultaneously, even though the international agreements provide a fair competition situation and give the latter nations chances of exercising the safeguard articles.

The latter nations are nations whose economies have been or will be controlled by foreign economies and which have not been or will not be able to manage their economies by their effort. Nations that don't have resources with comparative advantages in the world become easily the economically failed nations under the circumstance of the further economic integration.

The following domestic situation in the latter nation can be easily foreseen:
. Confrontation of their economic activities with their original culture
. Identity issue
. Frequent occurrence of political conflicts
Emergence of the later nations in the world will surely lower the realization possibility

(Factor 2) and at worst case, will destroy the worldwide system of the further economic integration in itself.

As for Factor 4, the following can be pointed out:
According to the OECD report, net financial flows to non-OECD countries in the forms of equity, debt and foreign direct investment (FDI) have increased since 1990, but the flow in form of official finance has decreased.

The following increase has been brought about by the following factors:
. Diversification of supply side of the funds in the OECD countries
. Low interest rate in 1990's
. Improvement in the demand side's capability for the refund

The former type of the investment has been basically made in profitable sectors. However, there are many non-and/or very low profitable sectors, so to speak, public sectors, in almost all countries in the world. The developing countries need more investment in the their public sectors than the OECD countries. The need will be enhanced so as to cope with the expected economic integration and not to fall into the nation economically failed . Accordingly, Factor 4 will have a great influence on Factor 2.

A.3.2.1 Evaluation of the OECD and World Bank Scenarios

Applying the selection criterion discussed in the previous paragraph, the OECD Scenario 1 and 2 and World Bank Scenario 1 are evaluated. The final scenario for forecasting the commodity flow matrices is selected hereinafter.

(1) OECD Scenario 1:

As shown in Table A.3.1 attached later, the world economy is supposed to grow at 4.8% per annum during 1995-2020, 2.0 % points higher than observed during 1987-1996. Therefore, it cannot help being concluded that this Scenario is a too optimistic or ambitious one. Because the scenario corresponds to a case where the "New Global Age" defined in the previous paragraph 21.3.2 is challenged. Accordingly, the realization possibility of policies on economic and social development at national, regional and worldwide levels (Factor 2 shown in Figure 21.3-1) is supposed to be very high. However, the points at issue to be solved or mitigated that are objectives of the policies are very complicated and difficult to be dealt with, meaning that establishing such policies by themselves becomes difficult and moreover, realization of the policies is judged to be more difficult even if the establishment is possible. Consequently, it can be easily foreseen that a small part of countries in the world will be able to cope with the above-mentioned situation.

As the results, the strategy for enhancement of capability of solving or mitigating the points of issue will not work well than expected. This situation will entail a lower world economic growth than expected in this Scenario.

In addition, possibilities of "Occurrence of sovereignty issue at national level" (Factor 3) and "Provision capability of international public funds issue", (Factor 4) are not sufficiently taken into consideration..

(2) OECD Scenario 2:

Unless the degrees of the Factor 3 and Factor 4 are substantially high, the realization possibility of this scenario is substantially high. However, the scenario is very pessimistic.

Grounds of the evaluation:
In this Scenario 2, future movement of the liberalization of world trade and investment is supposed based on just the actual movement observed in the world and another actions for the further liberalization is not expected. As shown in table 21.3.1, the world economy is supposed to grow at 3.1 % per annum until the year 2020 and the rate is higher by just 0.3 % points than that observed during 1987-1996. This setting supports the above supposition.

The three policy assumptions of this Scenario are judged to be easily realized when, compared with the actual movements related to the assumptions observed in the world. Accordingly, Scenario 2 seems to be a very pessimistic one because the Scenario is established on the assumption.

In addition, possibilities of the Factor 3 and Factor 4 are also not sufficiently taken into account. The situation is the same as the one in OECD Scenario 1.

(3) World Bank Scenario 1:

Unless the degrees of the Factor 3 and Factor 4 are substantially high, the realization possibility of this Scenario is high.

In this Scenario 1, future movement of the global integration is supposed to be the same as the one observed in the world in 1980s and 1990s. The supposition is superficially almost same as the one in OECD Scenario 2, however, the supposition is judged to be a little optimistic compared with the one in OECD Scenario 2.

Strength of the Assumption 3 is almost same level as the Policy Assumptions supposed in OECD Scenario l, and the Assumption 2 seems to be exceptional because the Assumption is more optimistic than the corresponding Assumption in the OECD Scenario 1. However, the contents of the Assumption 1 and Assumption 4 on which the World Bank Scenario put a much importance are moderate ones because they are between the ores in the OECD Scenario 1 and Scenario 2. In particular, the economic growth rate of the Big 5 is supposed to be 5.8 % per annum, which is lower by 1.3 % points than the one of OECD Scenario l, though the growth is considered to play a very important role in the world economy in World Bank Scenario 1.

Conclusion of the evaluation of the Scenario is as follows:
We supposes that unfavorable situations of the Factor 3 and Factor 4 may occur in the coming second decade, and destroy the system for promoting the global integration in itself. And both the OECD and World Bank seem to imagine, but do not quantify such situations in the OECD Lower-Growth Scenario and the World Bank Low-case Scenario. Unfortunately, we cannot express the Scenarios in numerical term because the quantification requires various analytical works that exceed ore capability. Accordingly we would ignore the Factor 3 and Factor 4 in our study.

In conclusion, based on the results of the evaluation of the three Scenarios respectively, we adopt the World Bank Scenario 1 as a basis for forecasting the commodity flow matrices.

A.3.3 Numerical Expression

A.3.3.1 Outline of the World Bank Scenario 1 "Baseline Scenario"

In Table A.3.1 GDP growth rates until the year 2020 by regions and countries as for the World Bank Baseline Scenario, and the OECD Scenario 1 "High-Growth Scenario (High Performance Scenario)" and Scenario 2 "Low-Growth Scenario (Business-as-usual Scenario)" are presented as well as the past GDP growth rates during l987- 1 996.

The world economy is expected to grow at 3. l % per annum. The growth rate is a little higher than the past (2.8 % per annum during (1987 - 1996) and almost same as that of the OECD Low-Growth Scenario, but fairly below than that of the OECD High-Growth Scenario (4.8 %per annum during 1995-2020).

It can be foreseen that the world economy is expected to grow at a faster rate during the coming first decade than during the second decade. This phenomenon may mean that the present worldwide movement of the economic integration is regarded to be stable and the impact of the movement on the world economic growth will be large and strong in the first decade and then the impact will be absorbed over the world in the second decade. It must be noted that in the World Bank report the world economic growth rate is written as "2.9 % per annum", not "3.1 % per annum". We modifies the growth rate, judging that the "2 9 % per annum" is inconsistent with other values related to the growth rate.

GDP share of the OECD countries in the world GDP expressed in current 1992 US dollars and 1987 prices using market exchange rates will decrease to 66.7% in 2020 from 81.5 %. in 1992, while the GDP share of the non-OECD countries will rise to 33.3 % in 2020 from 18.5 % in 1992. This is a substantial and unprecedented change in the composition of the world GDP. A Large portion of the big change will be brought about by the high economic growth in the Big 5 that are classified as the non-OECD countries. Their GDP share will jump up to 16.1 % in 2020 from 7.8 % in 1992, more than twofold increase.

Among the major regions, the GDP share of East Asia that include China and Indonesia (member of the Big 5) will rise at the highest speed, followed that of the South East Asia which includes India, the Latin America and the Caribbean's which includes Brazil, the Europe and Central Asia, and Middle East and North Africa and Sub-Saharan Africa. The same order can be observed in the OECD Scenario.

Table A.3.2 Forecast and/or Scenarios of GDP Growth Rates by Regions and Countries

Regions and Countries	1987-1996 (%/annum)*1	Forecast and Scenarios						WB Baseline, Share of world real GDP(%)	
		2000-2010(%/annum)			1995-2020(%/annum)				
		OECD HG*2	WB*3 Forecast	OECD LG*2	OECD HG*2	WB*4 Forecast	OECD LG*2	1992	2020
World	2.8	5.0	3.4	3.1	4.8	3.1*7	3.1	100.0	100.0
High-income economies	2.8		2.8			2.5		84.2	70.9
OECD	2.6	3.0	2.7	2.3	2.8	2.4	2.1	81.5	66.7
EU(15) and EFTA		2.7		2.0	2.4	2.2*8	1.8		
USA		2.7		2.1	2.6	2.3*8	1.9		
JAPAN		2.9		2.0	2.7	2.3*8	1.9		
Pacific OECD		4.7		4.0	4.5	3.6*8	3.8		
Newly industrialized	8.0		5.6			4.9		2.3	3.8
Hong Kong	8.5					4.0		0.3	0.4
Non-OECD	2.8	6.5	5.4	3.7	6.7	5.4	4.2	15.7	29.1
East Asia	9.2		7.6			7.0*8		2.8	7.8
China *5	10.7	8.2		5.3	8.0	7.0	5.6	1.4	3.9
Indonesia *5	7.2	7.0		4.1	7.0	6.9	4.4	0.6	1.5
Other East Asia	6.4	7.0		4.8		7.1		0.8	2.4
South Asia	5.4		5.9			5.6*8		1.3	2.7
India *5	5.5	7.2		4.3	6.8	5.8	4.3	1.0	2.1
Rest of South Asia	4.7	5.9		3.2		5.2		0.3	0.6
Latin America	2.3		4.2			4.5*8		3.8	5.4
Brazil *5	3.0	6.1		3.0	5.6	4.6	3.1	1.7	2.5
Rest of Latin America	2.1				5.3	4.2	3.1	2.1	2.9
Europe & Central Asia *6	-2.6		4.5		4.9	4.5*8	3.0		
Newly Independent States *5,6	-2.1	6.0	4.6	4.2	5.8	5.5	3.5	3.2	6.0
Middle East North Africa	2.2	7.1	3.6	2.2	6.6	4.2	2.2	2.3	3.1
Sub-Sahara Africa	2.0		4.1		5.2	4.2	2.7	1.2	1.7
Rest of World	2.5	6.5		3.7	6.3	5.6	3.7	1.2	2.3
(Big 5)	2.9	7.3		4.5	7.1	5.8	4.6	7.8	16.1

Note 1: Calculation and/or estimation based on the GDP time series data or information entered in the document published by the World Bank shown below.

Note 2: Source: OECD '"the World in 2020- towards A New Global Age" 1997, P92.
Scenario, not forecasting

Note 3: Source: World Bank "Global Economic Prospects and the Developing Countries" 1997. P8
Forecast, period 1997-2006

Note 4: Source: the World Bank's document, P23 "Baseline scenario", the period 1992-2020
The study team adopts the Baseline scenario as a basis for forecasting the commodity flow matrices

Note 5: The "Big 5" member country

Note 6: Some countries are accounted twice in those regions due to citation of the regions and countries into this Table from the above-mentioned two different documents

Note7: The World Bank cited, "2.9 % annum" as the economic growth rate. However, we regards the "2.9%." a miscalculation based on:
. Explanation on the Baseline scenarios in the documents that induces a higher world GDP growth rate than the past (2.8 % per annum, 1987-1996)
. Comparison with the growth rates in the OECD scenarios.
The Study Team has recalculated the growth rate of "3.1 % /annum", using the following data:
. GDPs of World and High-income group countries in 1995 expressed at current 1995 US dollars and 1987prices and exchange rates (source: the document, P92)
. The world GDP growth rate between 1991-1995: 2 %/annum
. Shares of the GDP of the High-income economies in the World GDP in 1992 and 2020 entered in this Table
. GDP growth rate of the High-income economies, period 1992-2020: 2.5 %/annum entered in this Table

Note 8: The World Bank Baseline Scenario does not provide the growth rates.
The Study Team supplements the growth rates for forecasting commodity flow matrices by referring to the GDP growth rates in the regions/sub-regions concerned that are provided by the Baseline scenario and the GDP growth rates provided by the OECD scenarios.

A.3.3.2 Outline of economic development perspective by regions

(1) Common phenomenon in the almost all developing countries

Main external influence common to all regions which will effect regional economic development in the coming next decade are as follows:

. Stable world macroeconomic conditions can be expected
. The world trade is expected to grow at a solid 6-7 % per annum until the year 2006
. Expanding flows of private capital to countries that will maintain sound policies.

Most of the countries face their macroeconomic imbalances or financial sector weakness, which result in an increase in exposure vulnerability to external shocks.

It can be, therefore, concluded generally that the growth performance of individual countries will be largely determined by their domestic factors, especially policy development, not by the above-mentioned external environment.

As the result, the following issues bring about differences in the future economic development among the countries concerned. And finally the regions where the countries belong:

Factor 1:Degree of complicatedness of the economic structure reform issues that is reviewed from their own standpoint of the countries concerned

Factor 2: Status quo capability of the countries concerned for solving the issues.

In light of the above discussion, the outlines of perspective by region are presented hereinafter.

(2) Outline of economic development by regions.

OECD countries

The economies of the OECD countries have already entered into the mature stage About 70 % of GDP in each country have been generated by their service sector industry, not by the manufacturing industry. This industrial structure implies that the OECD countries will not be able to expect a high economic growth in future. Though development of more energy and resource-saving products have to be promoted in their manufacturing industry field and information service supported by the recent information technology (IT) will be expanded in their service sector industry, the development and expansion are not so strong as to lead the OECD economies to high and sustainable growth in the long run. Along with the inevitable limitation on the economic growth caused by their industrial structures, the countries have and will face the following issues:

. Aging population

." Labor skill adjustment issue.

The first issue has and will generate the following effects on the economies:
Shrinking labor force, reduced private savings, and increased net government debt on taxes to finance higher government expenditures on pension and health care as well as decrease in the labor productivity. There will hamper their ability of potential economic growth.

Adjusting the labor skill structure in the OECD countries to an appropriate one that the Non-OECD economies will require causes the second issue.

The Non-OECD economies are expected to promote actively export of their labor-intensive products to the OECD economies. Under the worldwide circumstance of promotion of the trade liberalization, the OECD economies have to allow the requirement from the Non-OECD economies. This means the adjustment of the labor skill structure into a higher skilled labor structure.

However, this issue is difficult to be solved, and may be a big social issue in future.

Based on the issues discussed above, the potential economic growth rate in future is estimated at 2-3 % per annum, no more than that

Propelling and maintaining sources of the OECD economies are in:

. Improvement on their production technology
. Reformation of the present social and economic structures
. Expansion of markets for their products, and technologies and know-how over the world

The expansion will become possible through the promotion of the economic integration over the world and then further economic development in the Non-OECD countries.

(3) East Asia

This region is faced with the following economic and financial structure issues:

. Reduction of their national current account deficit to prudent levels
. Management of a continued transition to higher value added and more skill-intensive production
. Implementation of other financial sector reform

In China, the followings remain high on the agenda:

. Further development of the institutional framework
. Reform of the state-owned enterprise sector and financial sector
. Infrastructure development

The economies in the East Asia region are forecasted at 7.6 % per annum until the year 2006, the highest growth rate among the regions.

The following factors lead the highest growth:

. Despite the financial crisis in 1997, the economic performance in the region has exceeded expectations. Domestic saving ratio was improved and the overall external debt and debt service-to-service ratios are lower. This situation implies that the regional policymakers are able to adept quickly to changing circumstances and that they can manage such issues by themselves to a large extent.
. While the world trade is expected to grow at 6-7 % per annum until the year 2006, exports from the region are expected to grow at 9-10 % per annum, around 3 % points above the world average.
. The high growth and relatively open economies in the region induce a large inflows of private capital to the region

(4) South Asia

Points at issues that have to be taken into consideration in forecasting the economic development in the region are as follows:

. Large fiscal deficit issues
. Institutional weakness
. Low level of improvement in infrastructure and service sector productivity
. Political instability in Sri Lanka and Bangladesh

The World Bank forecasts that the regional economy will grow at 5.9 % per annum until the year 2006. On our estimation, Indian economy, the biggest one in the region, will grow at 6.0-6.5 % per annum during the same period. The following economic and social situations underpin the second highest economic growth among the regions:

. The economic structure reforms are judged to have taken root. Rationalization and restructuring of their state-owned enterprises have started as a prelude to privatization. Though the Indian enterprises are exposed in the international severe competitions, economic structure reforms started in 1991 have and will work favorably for strengthening the competition power, and promote privatization in their infrastructure sectors and finally domestic and foreign investment to the region is expected to increase
. Sub-regional economic cooperation among India, Bangladesh and Nepal has established.
. The military-political tensions have been reducing. This situation implies increase in possibilities of lowering their country risks, increase of capital inflows from abroad, and allocating their domestic funds to the economic developments much more than the past.

(5) Latin America.

The main weak point in the regional economies is their macroeconomic imbalance or financial sector weakness, which is common among the all regions. Macroeconomic instability issues still persist in Brazil and Mexico which are major countries in the region. In order to improve the weak point, i.e., main objective of the economic policies in the region, to raise the domestic saving ratios and convert a part of the domestic consumption to the domestic investment are essential.

The regional economies are expected to grow at 4.2% per annum until the year 2006. The growth rate is almost twofold the past one during 1987-1996, but a relatively moderate one, compared with the ones of East Asia and the South Asia.

The following economic situations underpin the economic development:

. Macroeconomic reforms have been promoted in spite of differences in the promotion among the countries in the region, e.g. Chile has substantially promoted the reforms while Brazil is in relatively early stage in the reforms. Accordingly, the main weak point mentioned above is expected to be clear during the coming decade.
. The regional economies have already been integrated into the world economy during the last decade. This situations implies that the countries have accumulated know-how for coping with changes in the world economy
. The region has already established regional economic cooperation agreements, Mercosur (common market formed by Argentina, Brazil, Paraguay and Uruguay) and the trade within the region and between the NAFTA (North American Free Trade Agreements) region has increased. The regional economy will utilize the economic blocks as bases for further economic integration with the world economy.

(6) East Europe and Central Asia

The regional economies could not recover in 1997 to level of the one in 1996 for the following causes in spite of the worldwide favorable economic circumstances:

. Stagnation of the exports to EU market
. Stagnation in production in Russia and Ukraine
. Macroeconomic and financial crisis in Bulgaria and Albania

Along with the stagnations and crisis, the regional economies also encounter the macroeconomic imbalance issues or financial sector weakness. Therefore, the following issues will become key points for setting the regional economies on a stable and progressive path during the coming decade:

. Further reforms of the domestic economic structures, especially fostering their private sectors
. Further inflows of foreign investment. In particular, countries in Central Asia need agriculture and energy resources developments

. Improvement in domestic economies and technologies

The regional economies are expected to grow at 4 5 % per annum during the coming decade. This is a surprising change, compared with the past trend of shrinking economies (minus 2.6 % per annum during 1987-1996). Though the regional economies encounter now the above-mentioned points at issue, the following factors underpin the economic growth:

. Further accession to EU economies and joint to the EMU (European Monetary Union). This accession implies that the regional economies will be able to induce more easily than in the past investment and technology from the EU countries
. In the countries of Baltic States such as Check Republic, Hungary, Poland, the economic fundamentals have been already improved and the exports have an increasing tendency. The tendency is expected to continue in future and it will contribute on the regional economic expansion,

(7) Middle East and North Africa

The regional economies are now in the following situations that are worse than the ones in East Asia, South Asia, Latin America and Caribbean and East Europe and Central Asia:

. Lack of basic political and macroeconomic conditions for acquiring investor's confidence
. High population growth and unemployment (Unemployment ratio in the early 1990s is about 15 % that is the highest among the regions). As the result, in some countries in the region, the poverty issues are going worse and may lead to serious social problems.

The following favorable symptoms can be observed in the regional economies as a whole:

. The economic and social reforms are moving ahead and becoming consolidated in some countries, though not to an extent sufficient to generate the desirable major improvement in growth. As examples of such the symptoms, the followings can be enumerated:
. Egypt started the economic structural reforms in the early 1990s and the effect from the reforms can be observed in an increase of foreign direct investment and portfolio.
. Algeria has promoted trade liberalization and privatization.
. Economic cooperation between the countries in North Africa and the EU and within the region has been enhanced. As an example of the latter, Free Trade Agreements have been signed among Morocco, Tunisia, and Jordan under the EU's Mediterranean Initiative
. The per capita GDP can be expected to grow at 1.3 % per annum during the coming decade. This is a big change for the regional economies because a negative rate of 0.8 % per annum was registered during the last decade. This situation will allow

governments to realize the economic and social policies.

The regional economies are expected to grow at 3.6 % per annum during the coming decade, which is the lowest one among the all regions. The serious economic situations mentioned above will work for downturn of the future economic growth. On the contrary, the favorable symptoms will work for upturn of it.

The World Bank report points out that it is too early to say whether stable development of the regional economies can be achieved

(8) Sub-Saharan Africa.

The regional economies are now in the following situation where degree of the seriousness may be higher than the one in the Middle East and North Africa:

. Lack of basic political and macroeconomic conditions for acquiring investor's confidence
. Policy weakness
. Institutional impediment
. Inadequacies in transport

As the results, the domestic enterprises are put outside the international markets, promotion of privatization and improvement of incentive system for private producers, private saving ratios can not b improved so much, and finally some countries received reduction of their external debt under the HIDC (Highly Indebted Poor Countries) initiative.

On the whole, the societies and economies in the region are moving toward political stabilization and economic liberalization.

On the contrary, the following favorable symptoms can be observed in the regional economies as a whole:

. Spread of gradual painful economic development over the region (though still modest) and firming of commitment to economic reform over the past decade can be observed. Countries in the CFA launched a major revitalization of reforms in 1994 and achieved around 5 % growth in 1995-1996
. Further political stabilization in Southern and Central Africa can be observed
. The per capita GDP can be expected to grow at 1.2 % per annum during the coming decade. This is a big change for the regional economies because a negative rate of 0.8 % per annum was registered during the last decade

The regional economies are expected to grow at 4.1 % per annum during the next decade. The growth rate is higher than the one in Middle East and North Africa, mainly because the lower economic development level in the region than the one in Middle East and North Africa is reflected.

Appendix B World Economic Growth, Environment and Energy

B.1 GDP and energy

B.1.1 Trends of relations

The relationship between GDP growth and energy growth in regions is depicted in Figure B.1.1.

a. The "World economic growth" determines the total amount of demand on energy through the following elasticity of the energy demand to the economic growth:

The conventional wisdom for a long time was that energy/GDP ratios were approximately 1-to-1, however, after the oil price shocks, they seemed to decline, particularly in the advanced industrial economies, leading many to resort to assumptions of lower, and falling, ratios. In the developing economies, however, there was still a strong correlation and the ratio appeared to be above 1-to-1, especially in some of the high-growth countries like South Korea in the 1990s. As Figure B.1.1 shows, it is commonly expected that the LDCs will remain close to 1-to-1, while the "transition economies" (former Communist nations of China, Eastern Europe, and the Soviet Union) will be achieving greater efficiencies.

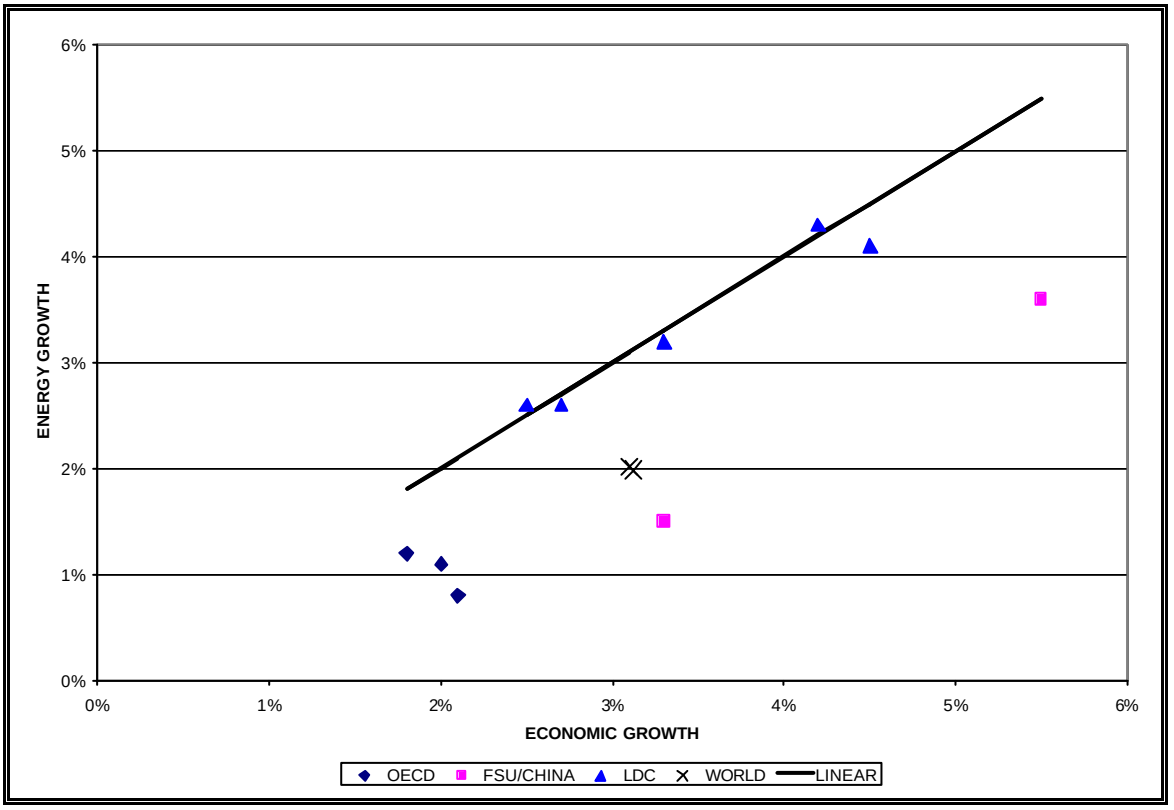


Figure B.1.1 Forecast of Energy/GDP Ratio,1995-2020

But these relations remain highly uncertain historically as well as in the future. Past measurements often are affected by currency distortions, the most prominent being in the Former Soviet Union (FSU).

b. Along with the "Global environment issue", the "Industrial activities and structure" determines the "Energy consumption structure" in phases of the consumption volume and the quality of the energy. When the structure does not satisfy the "Global environment conservation standards", it functions to the "World economic growth" as a constraint.

The "Industrial activities and structure" requests increase of supply and improvement of quality of the energy. However, realization of the request, i.e. "Energy supply policies" depends largely on the "World economic growth because the policies need a huge amount of funds.

c. The "Global environment issue" can be clearly observed only when amount and quality of the exhaust emitted through the consumption of energy and the industrial activities exceeds the upper limit, which the global natural environment can absorb, and vice versa. This situation is common in cases of regional environment issues.

The issue is surely foreseen unless the "Industrial activities and structure" will be changed to an energy-efficient-use structure.
As the result, as expressed in the KYOTO (in Japan) Resolution, "Global environment conservation standard on some air pollution materials, e.g. carbon dioxide, have been globally set.

d. In the latter half of 1970s, the sudden use of the crude oil price brought about the worldwide economic recession for a middle-long period.

The recession was not caused by quantity control of the crude oil in the production countries. Lack of fund for purchasing the high priced crude oil in the world economy induced the recession. On the contrary, in 2000, the quantity control compared with the world demand on the crude oil generated its sudden rise of the crude oil price.

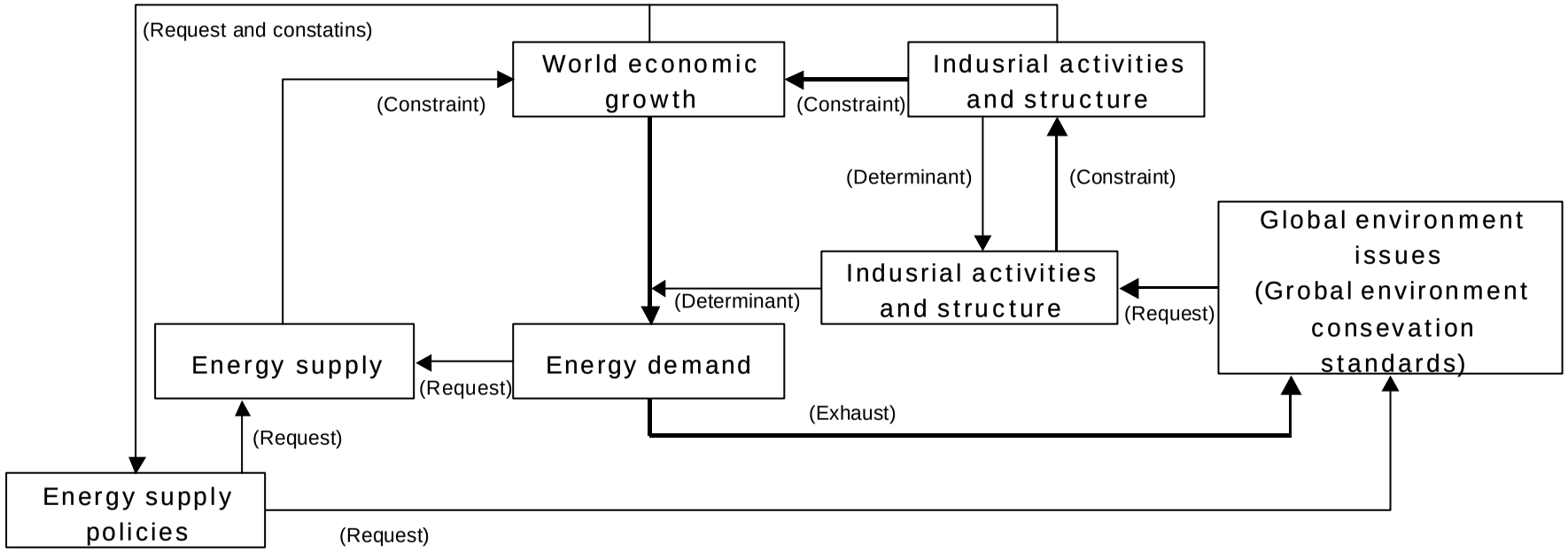


Figure B.1.2 Relationships between World Economic Growth and Global Environment, and Demand and Supply of Energy

B.1.2 Perspectives

B.1.2.1 Effect from the energy supply on the economic growth

If the energy supply made effects on the economic growth, it would be the energy to be imported, not the one to be produced in the regions concerned.

The energy to be imported can be characterized as, so to speak, "Demand market commodity", i.e. it can be supplied as much as the market demands. The huge reserves of crude oil and natural gas in the world and the diversification of their production spots over the world underpin the above recognition.

The recognition implies that there does and will not exist controls on the supply volumes of them for a long period in future, except the case observed in 2000. Consequently, as long as the supply volumes concerned, it will not affect the supposed economic growth. Of course, in case that their prices rise beyond the level that the markets expect and continue to be at the relatively high level for a middle and long period, they will become a constraint on the economic growth through the prices but not through the volumes. It is because that it takes a relatively long time for industrial structure concerned to cope with the new situation. At present, the OECD and World do not foresee such an unfavorable situation.

B.1.2.2 Effect from total volume of the exhaust on the economic growth

In the coming decade and more, the global environment conservation standards will be stipulated more clearly and the levels of the standards will be set higher than the present level.

At present, the items to be controlled globally are selected just on worldwide recognition that the items will surely make worse effect on the global environment, and it is not clear that even the volumes of the exhaust under the standards will surely contribute to the global environment conservation.

It may take at least another ten years before a worldwide consensus can be formed on the severe regulation on exhaust limits, and to set the individual conservation standards on all kinds of the exhaust, mainly because that the most of countries in the world, especially developing countries, have more concerned with economic development than environmental conservation.

In determining whether or not the amount of the exhaust will affect the future economic growth, a key factor is whether the energy consumption structure can cope with the conservation standards that will be set in future.
The present consumption and supply structures do not satisfy surely the global environment conservation standards.

Table B.1.1 Energy Consumption Structure and Economic Growth

Energy consumption structures	Effect of the amount of the exhaust on the economic growth
* Able to cope with future conservation standards	* The present supply structure of the energy (mainly primary energy) will not affect the economic growth
* Unable to cope with future conservation standards	* The present supply structure will surely affect the economic growth. As a result, the future economic growth will be forced to slow down.

The case of "Able to cope with future conservation standards" is likely to occur in future. The recent movements of the development of the energy consumption saving technology have led the industrial structures to use the energy more efficiently, and change in the energy consumption structures to use the clean energy supports the above perspective.

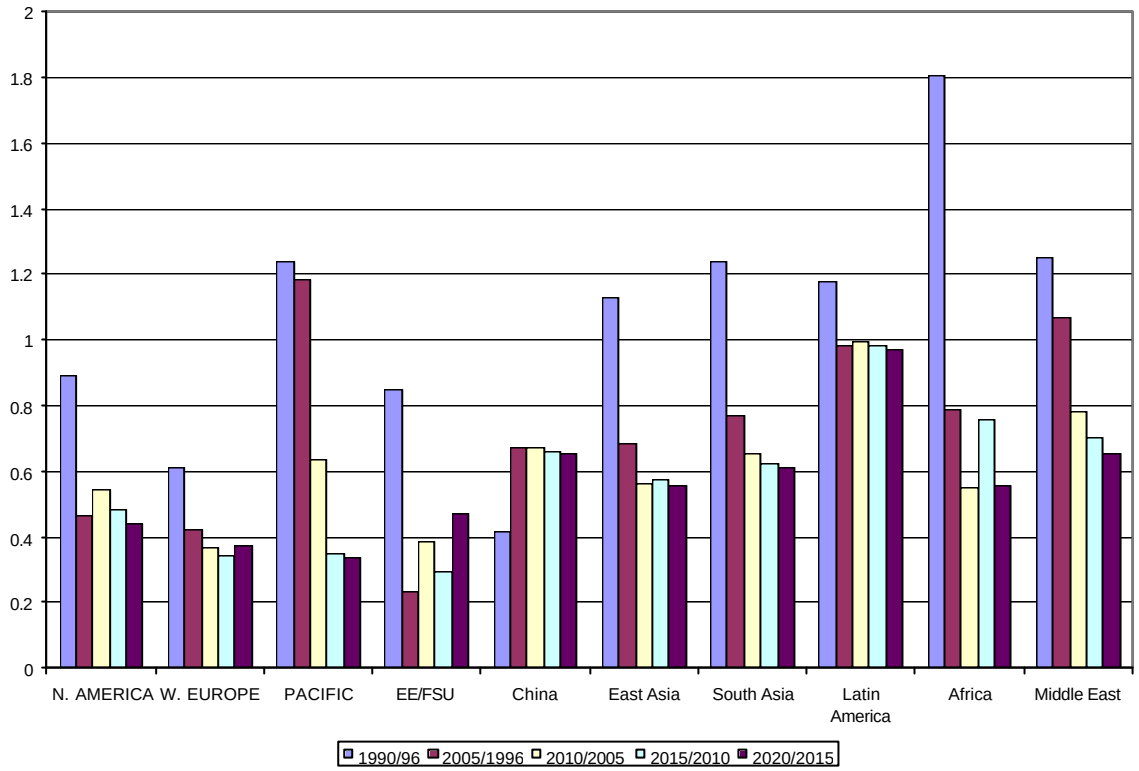
B.2 Scenarios on energy consumption volumes by cases of the economic growth until the year 2020

B.2.1 Background

The normal drivers for energy consumption are economic growth (or income) and prices. Labor and capital are substitutes for energy to a degree, but are usually not factored into forecasts, as they do not typically vary as much as other variables and/or are not controlled by policy. Technology is also important, inasmuch as it determines the rate of efficiency, and is partly amenable to policy decisions.

As the International Energy Agency noted, "In aggregate, the region had an energy intensity in 1993 of about 2.4 tons of oil equivalent per $1000. If purchasing power parity exchange rates were used, however, energy intensity could be on the order of 0.8 ton per $1000.

Also, a major factor in the apparently high level of growth in energy use has come from the conversion from non-commercial to commercial energy. Actual energy use has not increased as much as perceived, rather measured energy is being substituted for energy that is not measured (fuel wood, dung, etc.) As nations develop, this effect tends to decline and the energy/GDP ratio drops. This is shown in the figure below, where the US Department of Energy forecasts falling Energy/GDP ratios in the developing nations.



Source) US Department of Energy

Figure B.2.1 Energy/GDP Ratio, US Dept. of Energy Forecast by Region

(1) Factors driving energy demand and energy/GDP ratio:

A variety of variables that are largely independent of GDP growth can drive the energy/GDP ratio and modify it significantly. These include:

- Energy prices;
- Regulations on energy efficiency;
- Fuel mix, which can affect thermal efficiency;
- Technological advance;
- Sector shifts in the economy, which affect the amount and type of energy used; and
- Global climate change, which can alter heating and cooling patterns.

(2) Trends

There is some disagreement amongst the major forecasting agencies about the energy/GDP ratio over the next twenty years, with US Department of Energy (DOE) and the International Energy Agency (IEA) differing by about 10% at the global level, and much more for some regions, as Table B.2.1 shows.

Table B.2.1 Energy to GDP Ratio Forecasts

	IEA 1998 for 1995-2020	DOE 2000 for 1996-2020
N. America	0.38	0.48
Europe	0.55	0.39
Pacific	0.67	0.59
Transition Economies	0.45	0.35
China	0.65	0.67
East Asia	0.91	0.60
South Asia	1.02	0.69
Latin America	0.97	0.98
Africa	1.04	0.67
Middle East	0.96	0.82
WORLD	**0.65**	**0.72**

Sources) International Energy Agency (IEA) and US Department of Energy (DOE)

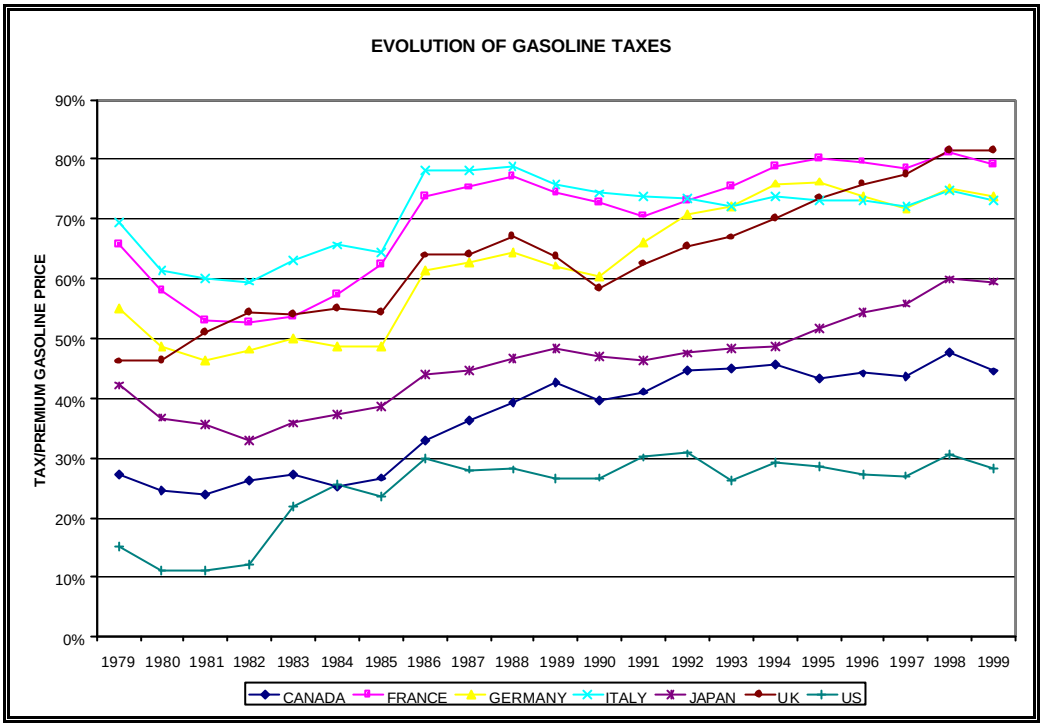
The IEA only projects the ratio for the entire period, which is unfortunate, because the path of energy intensity will not be smooth over time. Since it will be slightly different in different regions, and their relative share will change over time, the ratio will also tend to grow. Economic growth rates and energy consumption growth are both higher in the developing countries, and energy intensity tends to be higher as well, so that overall energy efficiency should be shifting over time.

B.2.2 Future Scenarios

B.2.2.1 Scenario 1: High growth, strong constraint to energy consumption

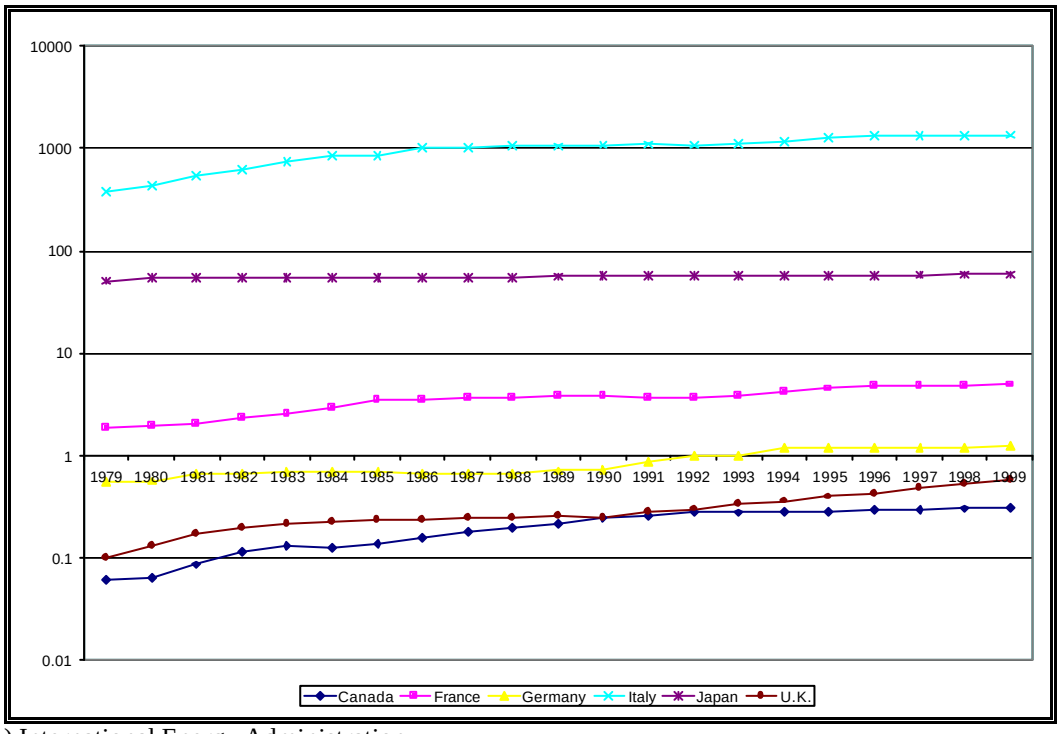
In this case, economic growth would be high but energy consumption would not. There are three potential drivers for this scenario: higher energy prices (including taxes), better energy technology, whether mandated or market driven, greater activity in the "new economy" and a shift to more direct energy use (i.e., lower conversion losses). The first is quite possible, the second could conceivably be done, and the third might be a factor under unusual circumstances.

Higher energy prices are often assumed unlikely because they have tended to be flat or lower over the long term (25-100 years), but that is primarily because of the focus on the raw material prices. Actual delivered prices also tend to decline, as processing and distribution costs have a tendency to drop over time, but taxes are another matter. As Figure B.2.2 shows, the proportion of end-use prices made up of taxes has tended to rise for gasoline in European countries, as they continually raise nominal taxes (Figure B.2.3) to keep up with (or surpass) inflation. This could become more broadly true in the future, as other countries become more aggressive about petroleum product taxation. Future taxes aimed at reducing carbon and other greenhouse gas emissions would have a similar affect.



Source) International Energy Administration

Figure B.2.2 Developed Country Gasoline Taxes in Local currencies (Percent)



Source) International Energy Administration

Figure B.2.3 Developed Country Gasoline Taxes in Local currencies (Log Scale, Nominal)

Better energy technologies such as hybrid vehicles, fuel cells and gas turbines have the potential to reduce the ratio substantially. A certain amount of improvement is assumed as

part of the historical trend, but the rate of improvement could increase.

B.2.2.2 Scenario 2: High growth, weak constraint to energy consumption

In this scenario, the energy-to-GDP ratio would be elevated and economic growth would be high, a combination that would mean very high-energy consumption. The primary factors that could cause this are weak energy prices, which could be due to rapid expansion of production capacity in OPEC, construction of LNG plants and gas pipelines, and so forth, that keep markets well supplied and prices down. Alternatively, recent protests against petroleum product taxes could lead to their being reduced, although this seems unlikely.

Still, a more complacent view of energy supply and environmental issues could occur in coming years, and cause governments to be much less inclined to mandate new, more efficient technologies or raise energy taxes. This would allow energy growth to rise relative to economic growth, and the energy/GDP ratio to be higher.

B.2.2.3 Scenario 3: Low Economic Growth, strong constraint to energy consumption

A number of developments could lead to this scenario, including those discussed in Scenario 1, with the exception of a shift to a "new economy". If the "new economy" is growing rapidly, then the necessary investment levels should imply high economic growth (unless the shift represented more the decline in the old economy than the growth in the new). Higher energy taxes and strong technological improvements could occur in this scenario to reduce demand, even if economic growth is weak.

And there could be an element of causality as well. Higher energy prices lower both energy consumption and economic growth. Also, severe environmental policies could be enacted that would impair economic growth, partly by restricting energy consumption below the optimal level for economic output.

B.2.2.4 Scenario 4: Low growth, weak constraint to energy consumption

This scenario can also have a number of independent or correlated factors that drive the combination of low economic growth and a weak constraint to energy consumption, although it is unlikely that high-energy prices would be causing low economic growth, since it would also tend to reduce energy consumption. However, weak investment levels would mean less replacement of inefficient equipment and thus raise energy consumption compared to the base trend. Also, lower economic growth could discourage governments from imposing new energy efficiency requirements or mandating investment in new technologies.

B.2.2.5 Quantitative Forecast

Using the various estimates of energy and economic growth rates, the following energy/GDP ratios are estimated for the baseline and the four different scenarios:

Table B.2.2 Energy/GDP Ratio

ENERGY/GDP RATIOS					
	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2000	0.685	0.685	0.685	0.685	0.685
2005	0.708	0.688	0.720	0.683	0.720
2010	0.723	0.683	0.775	0.673	0.747
2015	0.735	0.675	0.813	0.660	0.771
2020	0.744	0.664	0.848	0.644	0.792
2025	0.752	0.652	0.882	0.627	0.812

Appendix C Panama Canal and US Land-bridge

The role in international trade and the affect on the Suez Canal of the Panama Canal and the US land bridge route for sea-borne trade is presented in this appendix. Because there is a portion of the potential cargo handled by the Suez Canal that can also be routed across the American continent, either via the Panama Canal or across the land bridge, the future development of this route is important to analyze. These routes can be considered either direct or indirect competitors to the Suez Canal, depending on whether exporters are making a route choice or importers are shifting supply countries due to lower delivered transportation prices or higher quality transportation services.

C.1 Evaluation of the Panama Canal

C.1.1 Introduction

The Panama Canal serves primarily east-west sea-trade routes with the largest Panama Canal trade volume being agricultural exports from United States to Asia. There is also some north-south trade activity between North and South America that uses the Canal, but it is less of a potential for affecting the Suez Canal. The most significant characteristic of the Panama Canal is the restriction on ship size due to the dimensions of the Panama Canal locks. There are studies underway by the Panamanians that are considering the construction of new locks that could potentially alter the affect of the traditional dimension restriction on Panama Canal shipping.

One reason for the consideration of new lock construction in Panama is that the Panama Canal has been operating at historically high rates of utilization in terms of total canal transits for the last several years. The high level of transits in 1999 resulted in a 2.3% increase in Panama Canal/Universal Measurement System (PC/UMS) net tons to 227.9 million with 13,003 commercial ocean-going transits. This was a slight increase over 1998 but down compared with earlier years, reflecting a continuing growth in the average vessel sizes transiting the Panama Canal.

The ocean-going commercial cargo tonnage through the Panama Canal increased in Fiscal Year 1999 by two percent to 195.9 million long tons. The key commodities such as corn, petro-chemicals, bananas and containerized cargoes increased, while crude oil, phosphates (from Florida in the USA), and manufactures of iron and steel showed declines. The Panama Canal toll revenues in Fiscal Year 1999 rose to $US 566 million, with total transit revenue, which includes pilotage and other services, up to $US 706 million.

The current capacity of the Panama Canal is approximately 15,000 transits, including those made by non-commercial ocean-going vessels. This equates to approximately 42-45 maximum sustainable canal transits per day. The quality of service provided by the Panama Canal is directly related to the capacity for meeting transit demand. As such, the ideal number of transits at the moment is closer to 38-39 transits per day. As the number goes above this level, operational problems begin to surface, including an

increase in Canal Waters Time (CWT) which is measured as the period a ship is at the waterway and ready for transit until the transit is complete. The Panama Canal Authority has stated that they have an operating policy objective to have maximum CWT of 24 hours, yet in 1999 the average CWT rose to over 32 hours per transit.

The Panama Canal Authority has approved measures to increase and accelerate the program to provide increased transit capacity. This includes acceleration of the widening of their Gaillard Cut, augmentation of the tugboat fleet, design and procurement of additional locomotives for the locks, modernization of the vessel traffic management system, hydraulic conversion of miter gates and rising stem valves moving machinery and automation of locks machinery controls. This program will cost approximately $US 1 billion to execute. They intend to complete all of these steps by the end of 2002. The result of this major capital program will be an increase in the throughput capacity of the Panama Canal to a maximum sustainable level of about 48-50 transits per day. In order to have an average CWT of about 24 hours, the operating capacity will be approximately 43-44 transits per day, which translates to an annual level of about 17,000 Canal transits.

Additional capacity increases for the Panama Canal beyond this level would require the large capital expenditures associated with the construction of new locks. This would be an enormous step for the Panama Canal, especially as it is now owned and operated solely by the Panamanian government. There are both considerable financial and environmental obstacles to the construction of new Panama Canal locks, which calls into question the real potential for further capacity increases.

C.1.2 Commodities and Trade Routes

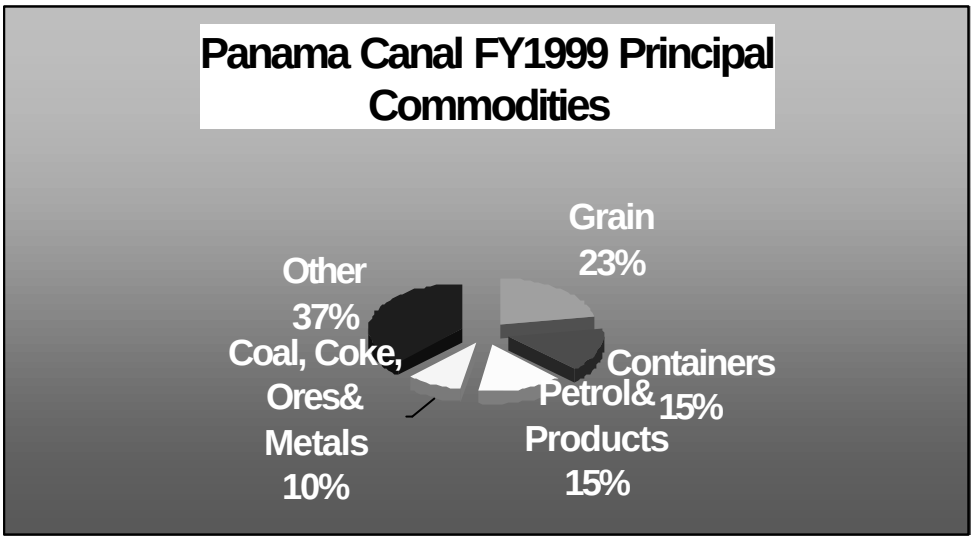
During Fiscal Year 1999, the primary growth in cargo tonnage through the Panama Canal was recorded in shipments of grain and containerized traffic predominantly on Asian routes. Cargo originating in Asia went up by 16.2% to 66.8 million tons, although cargo to Asia declined slightly by 2.5% to 27.4 million tons.

The largest single commodity through the Panama Canal for the past thirteen years has been grain, which reached an all time high of 44.2 million tons during Fiscal Year 1999, up by over 23% on the previous year. Within this category, the main commodity is corn, which moves primarily from the U.S. Gulf coast to Japan (12.9 million long tons). US soybean shipments also increased significantly with exports increasing to Japan, Taiwan, Philippines and Thailand.

Panama Canal containerized cargo increased by 3.6% to an all-time high of 29.5 million long tons, with the main route being the Asia to U.S. East Coast (up 3.9% to 11.8 million tons). Volumes of crude oil continued to decline, with a 24% drop, mainly from Ecuador. The drop in phosphate shipments from the U.S. to Asia was 28.1% to 5.4 million tons.

Significant growth was registered in the shipment of automobiles through the Panama

Canal on their important Asia to US East Coast trade route. Reflecting the high value per ton of automobiles, this commodity category represents some 6.8% of Panama Canal revenue despite the small share of Panama Canal tonnage.



Source) Panama Canal Authority

Figure C.1.1 Panama Canal Principal Commodity Volume Share, FY1999

C.1.3 Panama Canal Ship Size

In order to provide a better understanding of the composition of Panama Canal transits the changing ship size and growth in ship utilization of the larger ships has been analyzed. The table below confirms this adjustment historically, with the change varying by route and by ship size. Of course shifts from smaller vessels to larger vessels occur and smaller ships may be eliminated in the competitive environment over time.

The trend of increasing vessel sizes is likely to continue over time at a relatively slower pace, as evidenced by the historical trend and the estimate for the year 2000. Obviously the worldwide trend in vessel size ultimately works against the Panama Canal with the dimensional limits on the existing locks. Over time, a smaller and smaller percentage of the world vessel fleet capacity is able to transit the Panama Canal which works to the advantage of the Suez Canal for competitive route traffic during the next twenty years.

Table C.1.1 Average Panama Canal Vessel DWT by Ship Type (1000 Tons)

	1980	1990	2000	%80-90	%90-00
Bulk	33.7	37.9	44.6	12.2%	17.8%
Container	22.0	32.8	36.6	49.2%	11.4%
General Cargo	10.6	12.4	13.3	16.6%	7.5%
Tanker	36.6	31.4	37.4	-14.4%	19.4%
RoRo	14.1	16.4	20.9	16.0%	27.8%
Reefer	6.4	7.7	8.7	18.7%	14.0%
Vehicle	14.5	14.3	15.2	-1.4%	6.5%

Source) WEFA, Inc. analysis of Panama Canal Authority Statistics; 2000 estimated.

C.1.4 Panama Canal Tariff Structure

In the past eight decades of the Panama Canal's history, Panama Canal tolls rates have increased seven times, with increasing frequency since 1974. During the 1980's Panama Canal traffic and toll revenues fluctuated. Earlier downward trending periods were based on the following:

- The 1982 opening of the Trans-Panama oil pipeline, significantly affecting previous Alaska North Slope oil shipments through the Panama Canal
- The world-wide economic recession of 1982-1983.
- The period from 1985 to 1988 when traffic and revenues improved due to increasing trade in the automobile and container markets transiting the Panama Canal.

Tolls were raised again in 1989 and in 1992, and the planned introduction of the Panama Canal Universal Measurement System (PC/UMS) in 1994, was preceded by an increase of 9.9 percent in tolls. Two further toll increases took effect in 1997 and 1998. The history of the toll increases is summarised below.

Table C.1.2 History of Panama Canal Toll Increases

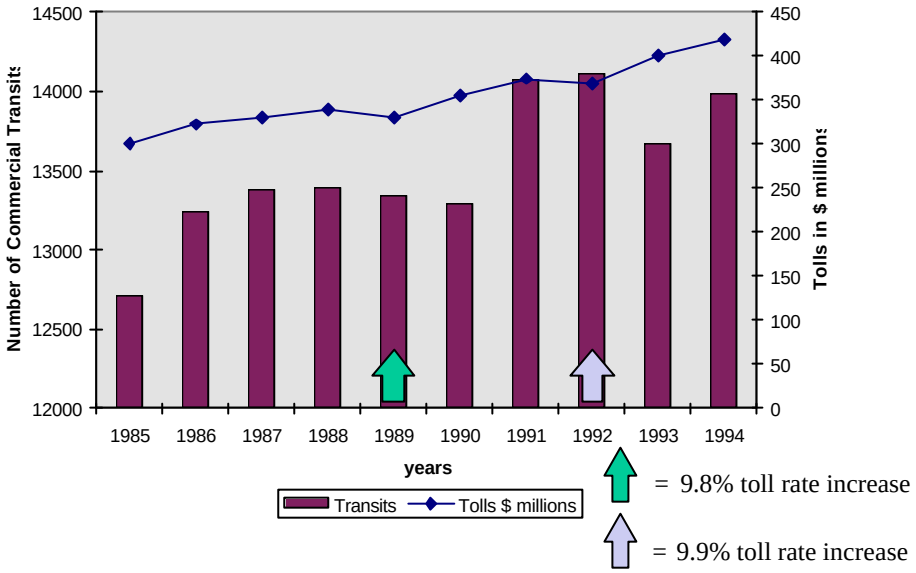
Year	***Toll for Laden Voyage***	***Percent Increase***
1974	$1.08	19.7
1976	$1.29	19.5
1979	$1.67	29.3
1983	$1.83	9.8
1989	$2.01	9.8
1992	$2.21	9.9
1997	$2.39	8.2
1998	$2.57	7.5

Source) Panama Canal Authority

Over the 18-year time period (1974-1992), the average annual toll increase was 4.4%, but the most recent annual increase was nearer 8%.

When annual Panama Canal transits and their corresponding toll revenues are compared with each toll increase, a direct relationship may be derived. The chart below shows the number of commercial vessel transits and toll revenues from 1985 to 1994. The arrows in 1989 and 1992 denote those toll increases. Toll receipts are seen to increase after the 1989 change. After the 1992 toll change, tolls fell but quickly rebounded in the following years.

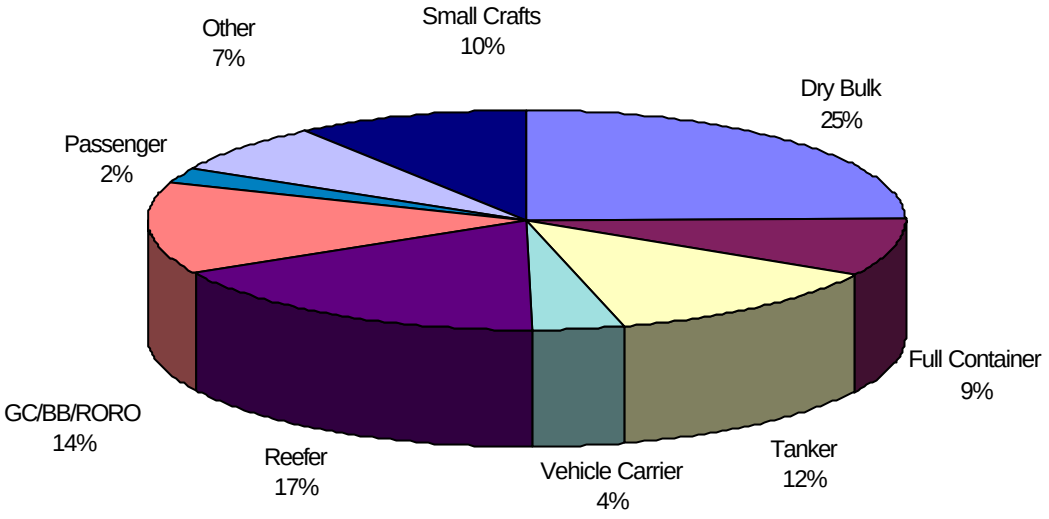
C.1.5 Panama Canal Toll Revenue and Commercial Vessel Transits



Source) Panama Canal Authority

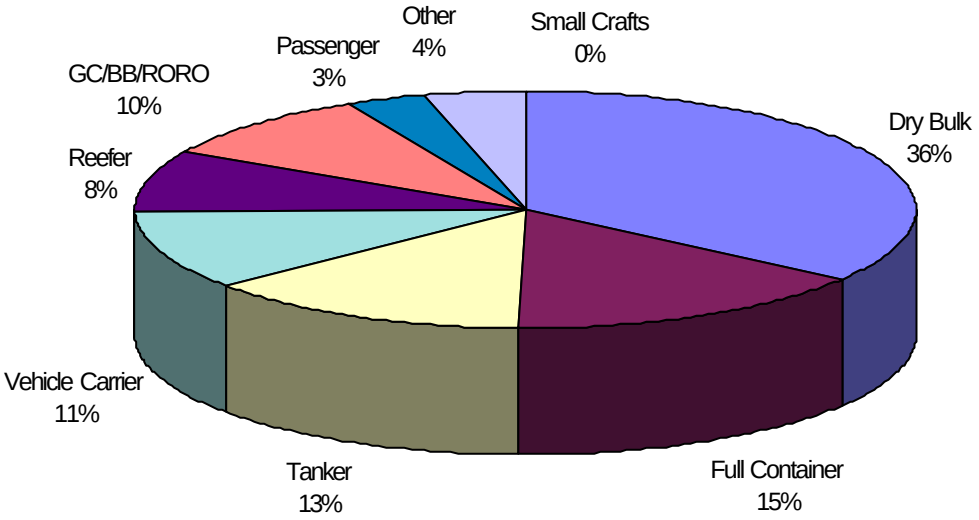
Figure C.1.2 Comparison of number of Commercial Transits and Tolls Collected per year (1985-1994)

The two charts below summarize the distribution of traffic across the most important Panama Canal market segments, in terms of both number of canal transits and toll revenue. The largest market segment is dry bulk, accounting for 25% of transits and 35% of toll revenue. Other important segments are full container ships and tankers, especially when considered in terms of toll revenue. It is interesting to note that the combination of dry bulk, containerships, tankers and vehicle carriers account for 75% of tolls revenues versus only 50% of Panama Canal transits. This reflects the larger carrying capacity of these vessel types. Reefers, general cargo vessels, break bulk and other smaller cargo vessels represent 33% of transits and just 22% of revenues.



Source) Panama Canal Authority

Figure C.1.3 Distribution of Vessel Transits by Vessel Type



Source) Panama Canal Authority

Figure C.1.4 Distribution of Panama Toll Revenues by Vessel Type

A strong pattern can be observed with respect to the distribution of Panama Canal traffic by trade route. Five major trade routes, or origin-destination pairs, account for 76% of cargo tonnage, with just one, between East Coast North America and Asia, making up 44% of Panama Canal cargo tonnage. The other major routes link the East Coast of North America with other Pacific locations and Europe with the West Coast of the Americas. The Panama Canal is particularly important to trade in the Western hemisphere. About 64% of Panama Canal business originates or is bound for the US

and about 14% of total US trade makes use of the Panama Canal. The Panama Canal is the major trade route also for some countries in Latin America.

C.2 U.S. Landbridge

C.2.1 Introduction

The Unites States railroad and truck transportation industries have become interlinked over the years in an effort to provide point-to-point shipping across these modes, once containers arrive at U.S. ports. While the so-called U.S. landbridge is not truly a full landbridge between oceans, the main function of the landbridge is to carry containers from US West Coast ports eastward to other distributions points within the US such as the Chicago, Denver, Kansas City, and Atlanta metropolitan areas. From there, the containers move by truck to their ultimate destinations. While the original focus of this intermodal flow was eastbound, over the years, westbound intermodal growth has been captured for both in-country and export markets.

C.2.2 Growth of the U.S. Landbridge Intermodal Network

Switching between transportation modes is not necessarily a desirable method for shippers to get their products to market. The increased handling of containers always increases the cost of transport. However, over the period since the late 1950s, when international intermodal container transport started, the inter-line (between railroads) and intermodal connections have become more and more seamless, secure, safe, and efficient.

The U.S. landbridge developed as a successful competitor to the Panama Canal for a series of reasons that are somewhat unique to the United States. Also, once the cost efficiencies of the intermodal landbridge system were realized, the necessary infrastructure to handle intermodal cargoes developed quickly. The key factors in the successful development of the U.S. landbridge network are summarized below:

The U.S. is large enough so that the efficiencies of railroads can be realized for domestic long-haul freight movements as well as for imported containers. This is an extremely important point since most of the other potential trans-continent landbridge routes are considerably shorter, usually about 200 miles in length, and are, therefore, not long enough to generate the low operating cost per ton-mile that is now the norm in the U.S. railroad industry.

While many of the alternative rail landbridges proposed for crossing the Americas in other countries depend on operations with full containers both directions, most of these proposals have not gone forward due to problems with financial viability. In the U.S., there has been a very successful improvement in the backhaul of containers, although, in the westbound direction some of the containers may carry cargo of lesser value, and at lower rates, than that in the eastbound direction.

Over the years, an entire industry has developed that is focused on the transport of less-than-truckload (LTL) cargoes. These are typically shipments of smaller volume and lower weights than traditional full-container load cargo. The specialized firms serve as an intermediary between the LTL trucking industry and the long-haul railroads that provide the greatest cost efficiency for shipments more than 1,000 miles. Such companies combine and consolidate shipments across several shippers in order to reach the higher volumes per shipment that are required to be competitive for railroad carriage. This interchange ability is essential in order to maximize the utilization of cargo capacity on both the truck and the railroad portions of a typical shipment.

On long hauls in the U.S., double stack rail shipments can often be priced as much as 30 percent below comparable truckload shipments; for example, shipments between Chicago and Los Angeles cost between 30 and 35 percent less by rail than by truck. While rail is the preferred choice over the long haul, trucks are employed locally at the destination for final delivery to the customer.

When the cost advantages of intermodal were realized for long-haul segments, many railroads forged alliances with trucking firms and with ocean carriers in order to provide a seamless transport option that is more cost effective than truckload carriage alone.

C.3 Possibility as an alternative route

It is important to note that manufacturing and assembly operations in Far East Asia have, over the last 20 years, shifted toward Southeast Asia, representing a move from Japan, Hong Kong and South Korea to the West and South, including Southern China. From these locations, some containers shipped to the U.S. East Coast are now moving via the Suez Canal, thereby bypassing both the Panama Canal and the U.S. landbridge. This is another factor that has contributed to the modest slowing of intermodal traffic growth in the U.S. in recent years. The table below shows the routes from Singapore to three U.S. East Coast ports and the comparative times through each of the two Canal options. Clearly, the time savings are significant, and, as a result, there is not much Southeast Asia cargo exports appearing in the Panama Canal transit data.

Table C.3.1 Approximate Time Savings in Days: Suez Canal versus Panama Canal

Singapore to:	Via Panama Canal	Via Suez Canal	Time Savings
New York	36	22	14
Charleston	32	24	8
Norfolk	34	26	8

Source) WEFA, Inc. analysis of published container vessel service schedules

The long-term potential for the US landbridge is for further increases in capacity for handling international container trade. The US West Coast ports are making significant capital investments to expand container trade handling capacity intended for inland carriage via the rail landbridge. Despite some service quality problems in recent years,

the US railroads are making investments to increase reliability of delivery time for international trade containers. This will make the landbridge a continued competitor to the all-water Suez Canal route for this portion of North American container trade in the future. No matter what landbridge capacity is added however, the higher costs associated with the landbridge means that some of this Asia-US container traffic will continue to move on the all-water routes (especially for lower value containerized goods).

Appendix D SUMED Pipeline and Gas Pipelines

D.1 SUMED Pipeline

D.1.1 Outline of SUMED

SUMED is another name of the Arab Petroleum Pipelines Co., and passes from the Suez Gulf to the Mediterranean. It was in 1974 that SUMED was established as a private sector under Egyptian law. The purpose of the company is to supply an alternative route of crude oil transport along with the Suez Canal. By the time SUMED opened, the Suez Canal was the major route of crude oil transport from the Red Sea to the Mediterranean. When the Canal was closed due to the war, the world economy was seriously damaged. The main reason of the establishment of SUMED was to give the reliability to the route from the Red Sea to the Mediterranean.

The capital of SUMED is 400 mil dollars and stockholders are governmental petroleum companies of Egypt, Saudi Arabia, Kuwait, UAE, and Qatar. The shares of stocks are 50%, 15%, 15%, 15%, 5%, respectively.

According to the interview at SUMED, Egyptian mostly manages the company. Saudi Arabia has a seat of a vice president, but he is not stationed and only comes to SUMED every 3 months to check the finance. SUMED people say that the policy of SUMED is to earn maximum benefit for the Egyptian economy.

The business of SUMED is limited to the transmission of crude oil. It operates pipelines and terminal facilities including ports at Sidi Kerir and Ain Sukhna. It was in December of 1976 that the first tanker arrived at Ain Sukhna Terminal from the Red Sea. In January of 1977 the first tanker loaded crude oil at Sidi Kerir Terminal.

SUMED has already invested as much as 900 mil dollars for facilities.

SUMED is not only a supplement of the Suez Canal, but became one of the main route of crude oil transportation. The facility can handle fully loaded vessels up to 517,000 DWT.

The roles of SUMED are considered as follows.
1) Saving in distance and time of transport
2) Flexible distribution to refineries
3) Supplement to the Suez Canal

D.1.2 Crude oil movement

The most of crude oil that is transmitted through SUMED comes from Arabian Gulf to Europe. They have little interest in the crude oil from Persian Gulf to America. Crude oil to America is very competitive with the Cape route. SUMED route can save only 5 days of transport if VLCC carries crude oil. This small difference between SUMED and the Cape gives SUMED small profits. To win the competition with the Cape, SUMED has to lay small

due which is equal to only operation cost of transmission. In contrast to the movement to America, SUMED can save about 15days of transport to Europe. This is the reason that SUMED can get profits and the volume of the oil to Europe is large. SUMED says that 92 to 93% of the demand is the oil to Europe.

SUMED transmits the domestic crude oil, too. It is produced in oil fields around Red Sea of Egypt, and is by pipeline of other entity to Ain Sukhna, where it is transferred to SUMED pipeline. The final destination of it is refineries near Alexandria, and the products of this oil are mostly consumed in Egypt.

D.1.3 Facilities of SUMED

At port of Ain Sukhna crude oil is unloaded from vessels to storage tanks. The port has 4 moorings. One can be moored with a fully loaded 500,000 DWT vessel and others are two 320,000 DWTs and one 150,000 DWT. Crude oil can be unloaded from 4 tankers simultaneously with complete segregation at a rate of 14,000 cubic meters per hour.

15 storage tanks of each 100,000 cubic meters stand at the shore.

It takes about 10 to 30 hours to unload oil depending on the volume of oil. Usually 150,000 to 450,000 DWT vessels arrived at Ain Sukhna.

Table D.1.1 Ability of Ain Sukhna port.

Moorings	max. vessel size (000DWT)	max. draft (feet)
1	500	Unlimited
2	320	75
3	320	75
4	150	55

The crude oil is transmitted through pipelines to Sidi Kerir where is 27km west of Alexandria. The pipelines have two parallel lines, each of which is 42 inches diameter 320km long.

The system capacity was 80 mil tons per year (1.6 mil barrels per day) at the first stage and was increased to 117 mil tons per year (2.4 mil barrels per day) after a second pumping station was installed. It will take about 28 hours for fully loaded VLCC.

At the port of Sidi Kerir, 6 moorings are equipped for vessels of 350,000 DWT, 2 x 285,000 DWT, and 3 x 150,000 DWT. 15 same storage tanks as are in Ain Sukhna stand at the shore of Sidi Kerir. Crude oil can be loaded there to tankers at a rate of 12,000 tons per hour.

Table D.1.2 Ability of Sidi Kerir port

Moorings	max. vessel size (000DWT)	max. draft (feet)
1	350	75
2	285	75
3	285	75
4	150	75/55
5	150	75/55
6	150	75/55

D.1.4 Operation of SUMED

Relationship between transportation methods of crude oil
The Suez Canal has now physical restriction on the loaded VLCC's and ULCC's traffic through the Canal; the Suez Max

In case of VLCC and ULCC'S the tanker can select one of the following transportation methods:

Method 1 : Unload of the whole volume of crude oil at Ain Sukhna , transport of it to Sidi Kerir through the SUMED pipeline and non-passage of the through the Canal .

Method 2 : Utilization of the lightening System at Ain Sukhna, passage of the tanker through the canal, and re-load of the crude oil which is transported through the pipeline at Sidi Kerir.

The following facilities of the SUMED and transportation system from Sidi Kerir to the final destination ports of the crude oil make the Method 1 possible:

- The SUMED can manage up to a full loaded 500.000 DWT tanker at Ain Sukhna
- It has a sufficient storage facilities of crude oil at Ain Sukhna and Sidi Kerir, and
- Less than ULCC (under 300,000 DWT) or ULCC (200,000-300,000 DWT) takes the crude oil transported through the pipeline at Sidi Kerir and transports it to the final destination parts.

The lightening System is like this: the tanker unloads a part of loaded crude oil at Ain Sukhna so as to decrease the total weight of the crude oil loaded in the tanker under permissible draft, the tanker passes through the Canal and it re-loads the same crude oil transported through the pipeline at Sidi Kerir.

Actually, not only the VLCC and ULCC (over 300.000 DWT) but also the less than VLCC adopt the above mentioned Method 1. However, when the VLCC and ULCC want to pass the Canal, they have to adopt the lightening System, i.e. the Method 2.

D.1.5 Future plan of SUMED

SUMED doesn't fully use their facilities. The capacity is enough large compared to the

demand. SUMED is worried that the demand may decrease. According to their comments, there are 3 reasons.

1st reason is an environmental problem. If Europe countries shift the crude oil to lighter one, the demand of Arabian oil will decrease. Most of Arabian oil is dirty and it costs much to refine.

2nd reason is the peace in the Middle East. If pipelines from the Persian Gulf to the Mediterranean re-open, the demand through the SUMED will decrease.

3rd reason is the Canal. SCA has a plan to enlarge the Canal to the draft of 72 ft. If a VLCC becomes able to pass through the Canal with full load, no more VLCC will use SUMED.

By these reasons, SUMED has no plan to enlarge the capacity. Moreover, the throughput capacity of the pipelines is stipulated by special low for installation of the facility. Their investment is limited for better quality of operation.

D.1.6 Competition and Complement to the Canal

(1) Factors that bring about the competition and complement to the Canal.

The following functions of the SUMED bring about the competition against the Canal and complement to the canal:
Function 1 : Transportation of crude oil from Ain Sukhna to Sidi Kerir,
Function 2 : Crude oil trading market at Sidi Kerir.

The sufficient storage facilities by kinds of crude oil at Ain Sukhna and Sidi Kerir make the Fundation 2 workable.

Customers of crude oil, e.g. Arabian light, can purchase and carry out their crude oil at Sidi Karir without considering the time for the transportation from the Gulf countries to Sidi Karir. For example transportation of all volume of crude oil carried by an ULCC takes about five (5) days through the pipeline. The customers do not need to consider the time for the transportation. This point is an unparalleled advantage of the SUMED, compared with the function of the Canal.

The Function 1 “Transportation of crude oil” generates the competition situation or complement situation, depending on the cases of the transportation. In case of adoption of the lightening System, the SUMED pipeline works as complementing function to the Canal. Because the ULCC and VLCC can not pass the canal without assistance from the lightening System. On the contrary, in case of the non-adoption, the SUMED is in the competitive situation with the canal.

The function 2 “Crude oil trading market” always generates the competitive situation against the Canal.

(2) Time for the transportation of crude oil from Ain Sukhna to Sidi Kerir by the transportation methods

- By the pipeline (adoption case of the lightening System)

For unloading at Ain Sukhna	:	12 hours
Transportation through the pipeline	:	10 hours
For re-loading at Sidi Kerir	:	12 hours
Total	:	34 hours

- Through the Canal.

Voyage from Ain Sukhna to Port Said	:	14 hours
Voyage from Port Said to Sidi Kerir	:	6 hours
Total	:	20 hours

The Canal has a comparative advantage of shorter time almost by one day against the case of the pipeline transportation.

(3) Domain where the Suez Canal Dues effects on the selection of the transportation methods between Ain Sukhna and Sidi Kerir

When consigners and/or consignees of the crude oil want to utilize the Function 2 “Crude oil trade market at Sidi Kerir”, the Suez Canal cannot induce any size of tankers to the Canal however Canal dues the Suez Canal offer to them.

The adoption of the Function 2 by the consigners and/or consignees has nothing to do with the transportation cost between the two locations.

What the Suez Canal will do by means of the Canal dues?

- For the ULCC and VLCC, to support for adoption of the lightening System,
- For Suez Max VLCC, to make them recognize the relative disadvantage in adoption of the lightening System.

Accordingly, the following Suez Canal dues may be recommended;

- For the ULCC and VLCC, as lower dues as possible but above the low limit which can be estimated based on the Canal operation cost,
- For Suez Max VLCC, as higher dues as possible, but they must give the tanker sufficient incentives for passing the Canal compared with the lightening System, which can be estimated based on the difference in the time for the transportation of crude oil described above, the pipeline dues and waiting time and handling time for crude oil to be burdened to the tankers.

D.1.7 SUMED Dues.

The SUMED dues at present are tabulated in Table D.1.3.

Table D.1.3 SUMED dues

(as of October, 2000)

Volume categories [*1] In cargo ton base	US$ / Ton	Other charges [*2]	Total charges
Less than 120.000	2.40	0.36	2.76
120.000-160.000	2.25	0.36	2.61
More than 160.000	1.50[*3]	0.36	1.86

Note *1: The volume categories is applied at Sidi Kerir, i.e. loading basis of the crude oil

Note *2: Actually, the other charges are decided, depending on the crude oil prices.

Note *3: It is depend on the world scale rates at that time. The US$/ton 1.50 corresponds to the case of the world scale rates of 57% (the ceiling case, the rate is unchanged for the higher rate than 57%).

The total changes by the volume categories are set to decrease as the volume to be leaded increases.

D.2 Gas Pipeline.

D.2.1 Forms of natural and petroleum gases

There are two forms for the transportation; gaseous and liquid. The gas pipeline can transport gas in gaseous form but not one in liquid form. On the other hand, the gas that goes through the Suez Canal is the one in liquid form.

The two forms of the gas have the following merit and demerit when they are transported:

Factors	Gaseous gas	Liquefied gas
Amount of energy contained in an unit volume		<merit> About 1.470 times the gaseous gas.
Transportation to foreign markets.	<merit> When a gas pipeline connects the gas fields and the markets, the transportation is easier than the liquefied gas	

In conclusion, in case of the connection, the gaseous gas has a comparative advantage in its transportation than the liquefied gas, while in case of the disconnection, gas can be transported only in the liquid form.

In the present situation of the gas pipelines installed between the countries, it can be said that the gaseous and liquefied gases are in a supplementary relationship. However, the gas pipeline will almost surely expanded in future, and the two forms of the gases will enter into a competitive relationship in the future situation.

Factors that will decide competitive powers between them are the C.I.F prices per the amount of energy contained in the two forms of the gas per the unit volume, and specialty in usage of the gas concerned.

D.2.2 Present and future situation of gas pipeline grids by countries

Countries enumerated hereinafter are selected from viewpoint of relationship between the transportation volume of the gases and the Suez Canal transit volume of the LNG/LPG and crude oil. The present situation of the gas pipeline grids is cited from the "Arab Oil and Gas Directory 2000" Arab Petroleum Research Center.

(1) Algeria.

1) Export volumes of the natural gas in 1999.

Volume (billion cu m)	
Liquefied gas	: 25.76
Gaseous gas (by the pipeline)	: 33.88

Total : 59.64*

Note *: After conversion to LNP tonnage, it amounts to 51.1 million tons. The consultant calculation, applying one ton of oil is equal to approximately 1.167 cu m of the natural gas.

Shares of the sales by foreign markets

Southern Europe	: 72%
Northern Europe including France	: 25%
USA	: 3%
Total	:100%

Algeria has the biggest gas field in the world

2) Gas pipelines connecting the gas fields and the foreign markets

Along with her gas domestic pipeline grids for domestic consumption and the liquidization, Algeria has installed two pipelines that connect directly the foreign markets. Sonatrach operates those pipelines.

a. Transmit gas pipeline.

Route : Algeria (Hessi R'Mel)? Tunisia? Italy, about 1500 Km long.
Capacity : At present : 24 billion cu m/year
: Future : 30 billion cu m/year
Volume Transported in 1998 : 22 billion cu m/year

b. Maghreb-Europe gas pipeline.

Inauguration : 1996
Route : Algeria ? Morocco ? Spain.
Capacity : in 2000 : 10 billion cu m/year

In future, the pipelines will be extended to connect directly the gas pipeline grids within the Western Europe (France, Germany, Switzerland, Belgium).

c. Gas liquidization plants.

Capacity : At present : 30.5 billion cu m/year.

(2) Iraq

Along with her domestic gas pipeline grids, Iraq has two pipelines connecting directly the foreign markets: the existing and planned ones.

a. Gas pipeline to Kuwait.

Inauguration : 1987
Capacity : 400 million cu ft/day
Operation : It has not been operated since 1990

b. Gas pipeline to Turkey.

Targeted market : World markets

Capacity : 10 billion cu m/year
Completion : The portion in Turkey has not been completed due to the UN embargo, though signed with Turkey in August 1996.

After partial or full removal of the UN embargo, the two pipeline will be completed and operated.

(3) Iran

Along with her gas domestic pipeline grids, Iran has one existing and two planned pipelines connecting directly the foreign markets.

a. Gas pipeline to Turkey.
Completion : The portion in Iran was completed in 1999, but the portion in Turkey has not been completed due to the political issue between the countries.

b. Gas pipeline to Azerbaijan, 1,100 Km long.
Operation : The pipeline had been operated until 1995, but stopped operating afterwards due to the social unrest in the region.

c. Gas pipeline to northwest India, 2,500 Km long.
Completion : Joint study on the pipeline composed by Iran, Pakistan and India will be started in 2000.

Iran has gas reserve of 25 trillion cu m (21.4 billion oil equivalent tons) and her main markets are Armenia, Azerbaijan, Dubai and Turkey.

(4) Saudi Arabia.

1)Gas pipelines.

At present, Saudi Arabia has no pipeline connecting foreign markets. However, gas pipeline for natural and petroleum gases runs along the TAP crude oil pipeline. It starts from the gas field in the eastern area in the country near the Persian Gulf to the process plants located near the Red Sea.

2)Exporting capacity and volume exported of LPG

Capacity : Total : 19.5 million tons/year
Composition : Propane : 9 million tons
Butane : 5.5 million tons]
Natural gasoline : 5 million tons
Volume exported in recent year : About 16 million tons.

(5) Qatar

1)Gas pipeline

At present, Qatar has no gas pipeline connecting the foreign markets. However, pipelines to India, United Arab Emirates and Oman are planned.

2)Exporting capacity of LNG.

Capacity : 15 million tons /year at end of 2000.
: 26 million tons /year in 2003.
The LNG is exported to mainly South Korea, Japan, India and EU countries.