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AN ANALYSIS OF MARINE CONTAINER TRANSPORTATION IN THE ASIAN REGION

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Abstract: This paper analyses the trends in international marine container transportation and the current conditions and issues of ports in the Asian region, and outlines the future demand for port facilities in the Asian region.

Key Words: Container movement, Population per 1 TEU, Shortage of handling capacity at container port

1. CHARACTERISTICS OF INTERNATIONAL CONTAINER MOVEMENTS

The container traffic moving in the world is estimated from the container traffic volume on main sea routes because it is difficult to figure it out from the volume of containers handled in ports. The estimated total container traffic (including empty) moving in the world has grown by an average of 8.8% annually from 36 million TEU in 1990 to 99 million TEU in 2002 (see Table 1).

Table 1. Change of Total Container Traffic Moving in The World (Unit: million TEU)

Year	1990	1995	1996	1997	1998	1999	2000	2001	2002
Traffic Volume	36	56	61	67	72	78	87	90	99
Growth Ratio	1.00	1.57	1.69	1.86	1.99	2.17	2.42	2.50	2.75
Annual Growth Rate		9.82%	7.62%	10.12%	7.25%	8.92%	11.32%	3.62%	9.82%

Source：Mitsui O. S. K. Lines Business Research Division using data of PIERS/JOC, Shipping Conferences, OCDI

The O/D data of container traffic are analyzed below with respect to loaded containers, empty containers and loaded plus empty container.

1.1 O/D Data of Loaded Container Traffic

Many maritime research institutes adopt eight standard regions for the purpose of the O/D Survey (see Table 2).

Table 2. Regions used for O/D Survey

Regions	Names of countries & regions
North America	USA, Canada
East Asia	Far East, South East Asia (Thailand, Malaysia, Singapore, East of Indonesia)
Europe	UK, northern Europe, Mediterranean, North Africa (between Morocco and Djibouti)
Central/S. America	All Latin American region south of Mexico, Caribbean Sea
Middle East	Arabian Peninsula, Iran
Indian sub-continent	Pakistan, India, Sri Lanka, Bangladesh, Myanmar
Africa	East Africa (South of Somalia), South Africa, West Africa (South of West Sahara)
Oceania	Australia, New Zealand, South Pacific Islands

Source：DREWRY、JAMRI (Japan Maritime Research Institute) Business Research Division – Mitsui O. S. K. Lines

Table 3 indicates the estimated O/D data of loaded container traffic moving among 8 eight regions.

Table 3. O/D Distribution of Loaded Containers in 2002 (Unit: 1,000TEU)

FROM/TO	N. Am.	E. Asia	Europe	C/S. Am.	Mid. East	Indo SC	Africa	Oceania	Total
N. America	1,678	3,964	1,959	1,030	226	178	134	193	9,362
East Asia	8,721	18,352	5,869	964	2,250	775	750	1,600	39,281
Europe	3,169	3,752	6,504	511	1,200	395	900	350	16,781
C/S. America	1,415	1,066	865	618	147	61	72	89	4,333
Middle East	129	400	325	43	250	40	28	35	1,250
Indo S. Cont	435	1,025	600	100	244	350	66	81	2,901
Africa	119	525	950	47	63	26	275	38	2,043
Oceania	172	925	225	44	59	25	29	375	1,855
Total	15,838	30,009	17,297	3,358	4,439	1,850	2,255	2,760	77,806

Source：Mitsui O. S. K. Lines Business Research Division using data of PIERS/JOC, Shipping Conferences, OCDI
Remarks: C/S America-Central & South America, Indo S. Cont- Indo Sub Continent

1.2 O/D Data of Empty Container Traffic

Since there is no appropriate data on the O/D of empty container traffic, these are estimated by using the Fratar Method under the following conditions; 1) The total volume of empty container traffic moving in the world is estimated at approximately 21 million TEU, 2) Most special containers such as a reefer container return to their origin as empty containers, 3) The total volume of origin containers (loaded plus empty) is equal to that of destination containers (loaded plus empty) in each region, 4) Even if the volume of origin loaded containers is more than that of destination loaded containers, it is assumed that the volume corresponding to 5 – 10% of origin loaded containers is that of empty containers in order to facilitate the traffic flow and because special containers such as a reefer container are moving among regions.

Table 4 indicates the estimated O/D data of empty container traffic moving among 8 eight regions.

Table 4. O/D Distribution of Empty Containers in 2002 (Unit: 1,000TEU)

FROM/TO	N. Am.	E. Asia	Europe	C/S. Am.	Mid. East	Indo SC	Africa	Oceania	Total
N. America	679	5,294	741	565	190	534	97	118	8,218
East Asia	357	2,784	390	297	100	281	51	62	4,321
Europe	200	1,558	218	166	56	157	28	35	2,419
C/S. America	39	307	43	33	11	31	6	7	477
Middle East	304	2,369	332	253	85	239	43	53	3,677
Indo S. Cont	26	206	29	22	7	21	4	5	319
Africa	38	297	42	32	11	30	5	7	460
Oceania	100	779	109	83	28	78	14	17	1,209
Total	1,742	13,593	1,903	1,452	488	1,370	248	304	21,099

Source：Mitsui O. S. K. Lines Business Research Division using data of PIERS/JOC, Shipping Conferences, OCDI

1.3 O/D Data of Total Container Traffic (Including Empty)

Table 5 indicates the estimated O/D data of whole container traffic (loaded plus empty) moving among 8 eight regions.

Table 5. O/D Distribution of Total Containers (Including Empty) in 2002 (Unit: 1,000TEU)

FROM/TO	N. Am.	E. Asia	Europe	C/S. Am.	Mid. East	Indo SC	Africa	Oceania	Total
N. America	2,357	9,258	2,700	1,595	416	712	231	311	17,580
East Asia	9,078	21,136	6,259	1,261	2,350	1,056	801	1,662	43,602
Europe	3,369	5,310	6,722	677	1,256	552	928	385	19,200
C/S. America	1,454	1,373	908	651	158	92	78	95	4,809
Middle East	433	2,769	657	296	335	279	72	88	4,927
Indo S. Cont	461	1,231	629	122	251	371	70	85	3,220
Africa	157	822	992	79	73	56	280	45	2,503
Oceania	272	1,704	334	128	87	103	44	392	3,064
Total	17,580	43,602	19,200	4,809	4,927	3,220	2,503	3,064	98,905

Source：Mitsui O. S. K. Lines Business Research Division using data of PIERS/JOC, Shipping Conferences, OCDI

In 2002, the total container traffic (including empty) moving between 8 regions in the world is estimated at about 98.9 million TEUs. In terms of O/D distribution, the greatest number of containers is originated in East Asia, followed by Europe and North America. In addition, the volume of containers within the Asian region and origin/destination containers of the Asian region is largest in the world. Therefore, the current flow of international container traffic centers on the Asian region.

1.4 Current Condition of Container Throughputs in the Asian Region

While world container throughput increased 3.1 times to 273 million TEU over 1990-2002, the throughput at East Asian and South Asian ports increased 4.1 times and 3.7 times respectively. Container throughput in the whole of Asia increased 4.1 times, exceeding the world's growth rate. Throughput at Chinese ports, in particular, miraculously increased 26 times to 31.8 million TEUs over 1990-2002, giving China the largest throughput in the world (see Table 6).

The transshipment rate of 10 ports (Hong Kong, Shenzhen, Busan, Singapore, Colombo, Kwangyang, Kaohsiung, Tanjung Pelepas, Klang) in the Asian region exceeds 30 percent and the transshipment volume at all Asian ports in 2002 is 38.5 million TEUs which corresponds to 52 percent of Asian container throughput (74.1 million TEUs). In addition, this transshipment volume (38.5 million TEU)

accounts for 51.4 percent of the world transshipment volume (74.9 million TEU). Therefore, Asian ports are handling more than one half of the world transshipment volume (see Table 7).

Table 6. Change of Container Throughput in Main Asian Countries (Unit: 1,000TEU)

Year	1990	1995	2000	2002	2002/1990
Japan	8,107	10,923	13,749	14,044	1.73
Far East Russia	1	74	73	134	133.80
South Korea	2,348	4,849	9,072	11,629	4.95
China	1,217	4,904	19,919	31,885	26.19
Hong Kong	5,101	12,550	18,100	19,140	3.75
Taiwan	5,451	7,849	10,511	11,605	2.13
Philippines	1,408	2,352	3,479	3,765	2.67
Malaysia	901	2,101	5,278	8,888	9.86
Brunei	1	71	26	70	70.00
Thailand	1,078	2,156	3,563	4,173	3.87
Singapore	5,224	11,846	17,096	16,986	3.25
Indonesia	924	2,786	5,070	5,747	6.22
Vietnam	39	893	1,834	2,281	58.48
East Asia Total	31,800	63,352	107,770	130,346	4.10
Myanmar	5	70	20	65	14.16
Bangladesh	107	245	475	573	5.34
India	746	1,451	2,515	3,339	4.48
Sri Lanka	584	1,029	1,733	1,765	3.02
Pakistan	390	551	775	943	2.42
South Asia Total	1,832	3,346	5,518	6,685	3.65
Asia Total	33,632	66,698	113,288	137,031	4.07
World Total	87,900	145,200	236,200	272,900	3.10

Source: Containerization International Year Book 1991 - 2003

Table 7. Transshipment Containers Handled in Main Asian Ports (2002) (Unit: TEU)

Name of Port	Container Throughput (TEU)	Transshipment Container (TEU)	Transshipment Rate
Hong Kong	19,150,000	6,990,000	36.5%
Shenzhen	10,000,000	3,000,000	30.0%
Busan	9,450,000	3,900,000	41.3%
Singapore	16,800,000	13,600,000	81.0%
Colombo	1,900,000	1,290,000	67.9%
Kwangyang	1,080,000	320,000	29.6%
Kaohsiung	8,500,000	5,000,000	58.8%
Tanjung Pelepas	2,660,000	2,600,000	97.7%
Klang	4,530,000	1,810,000	40.0%
(a) Total	74,070,000	38,510,000	52.0%
(a)/(b)	27.14%	51.42%	
(b) World Total	272,900,000	74,900,000	27.4%

Source: OCDI

2. CURRENT CONDITIONS AND ISSUES OF PORTS IN ASIA

2.1 Development of Container Terminals

The average growth rate of container handling volume throughput in Asian Ports is much higher than the world average in the last 10 years. Total container handling volume throughput in Asia in 2000 reached 100 million TEU, an increase of three times over 1990. This huge growth in container handling volume throughput is due to large quantities of competitive Chinese export products and import materials. Ports surrounding main production areas are aiming to handle or to transship these products. Container handling volume throughput and handling volume per berth in main Asian ports in 2002 is shown in Table 8. Since berth dimensions, handling equipment, working condition, work efficiency etc. differ, it is not easy to simply compare the container handling volume per berth. However, annual productivity at Chinese ports and international hub ports ranges widely between 300,000 TEU and 500,000TEU per berth.

Table 8. Container Volume Throughput in Main Asian Ports（Year 2002）

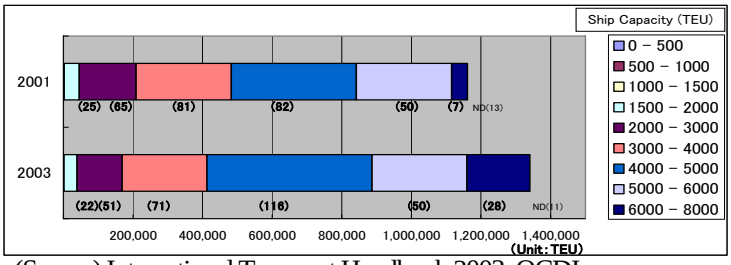
Country	Port	Berth Number	Throughput（million TEU）	Throughput/Berth (10 thousand TEU)	Remarks
Korea	Busan	20	9.44	47.20	
	Kwangyang	12	1.08	9.00	
	Inchon	6	0.76	12.67	
China	Dalian	8	1.35	16.88	
	Qingdao	6	3.41	56.83	
	Tianjin	9	2.41	26.78	
	Shanghai	22	8.61	39.14	
	Ningbo	6	1.86	31.00	
	Shenzhen	13	7.61	58.54	
	Guangzhou	6	2.18	36.33	
Hong Kong	Hong Kong	22	19.14	87.00	
Taiwan	Kaohsiung	27	8.49	31.44	
	Keelun	14	1.91	13.64	
	Taichung	5	1.19	23.80	
Singapore	Singapore	36	16.80	46.67	
Malaysia	Tanjung Pelepas	9	2.66	29.56	
	Port Klang	15	4.53	30.20	
Indonesia	Tanjung Priok	10	2.68	26.80	
	Tanjung Perak	7	1.42	20.29	
Philippines	Manila	15	2.46	16.40	
	Cebu	3	0.40	13.33	（2001）
Thailand	Bangkok	17	1.05	6.18	
	Laem Chabang	8	2.66	33.25	
Vietnam	Haiphong	3	0.29	9.67	（2001）
	Ho Chi Minh	12	1.05	8.75	
India	Mumbai	6	0.21	3.50	
	Chennai	3	0.42	14.00	
	Jawaharlal Nehru	5	1.97	39.40	
Sri Lanka	Colombo	10	1.76	17.60	
Japan	Tokyo	14	2.71	19.36	
	Yokohama	20	2.36	11.80	

Source：OCDI

2.2 Coping with Larger Container Ships

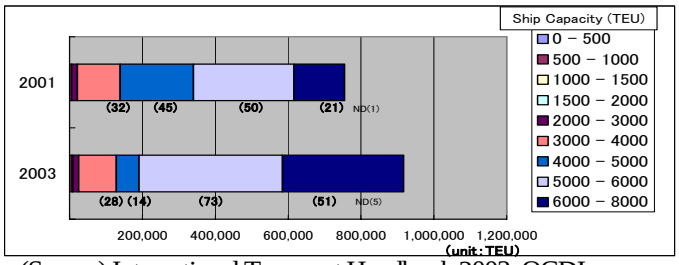
(1) Change of Ship Size in Trunk Routes

Figure 1 and 2 show the ship size distribution in Asian/North American shipping route and Asian/European shipping route in 2001 and 2003, respectively. The horizontal axis in each figure indicates total ship capacity ((TEU/ship number)*ship number) where number of ships is shown in parentheses. Number of ships on the North American route (West Coast) increased from 326 to 351. Number of ships ranging from 6,000 TEUs - 8,000 TEUs and 4,000 TEUs - 5,000 TEUs increased significantly whereas ships smaller than 4,000 TEUs decreased. On the other hand, number of ships on the European route increased from 162 to 187. Number of ships ranging from 5,000 TEUs - 6,000 TEUs and 6,000 TEUs - 8,000 TEUs increased, whereas ships ranging from 4,000 TEUs - 5,000 TEUs decreased on the route.



(Source) International Transport Handbook 2003, OCDI

Figure 1. Characteristics of Container Ship Size on Asian/North American Routes

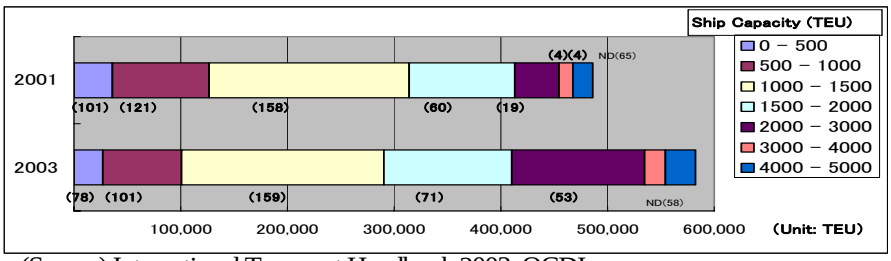


(Source) International Transport Handbook 2003, OCDI

Figure 2. Characteristics of Container Ship Size on Asian/European Routes

(2) Change of Ship Size in Inter-Asian Routes

Figure 3 shows the change of container ship size in inter-Asian routes in 2001 and 2003. While the number of ships remained the same, total ship capacity increased from 486,000 TEUs to 582,000 TEUs. In particular, number of 2,000-3,000 TEU type ships increased remarkably. It should be noted that statistics of Middle East/South Asian routes are included in Figure 3, and all ships of 3,000 TEUs and over are used on these routes. This means that the size of container ships employed in South East Asia is smaller than 3,000 TEUs.

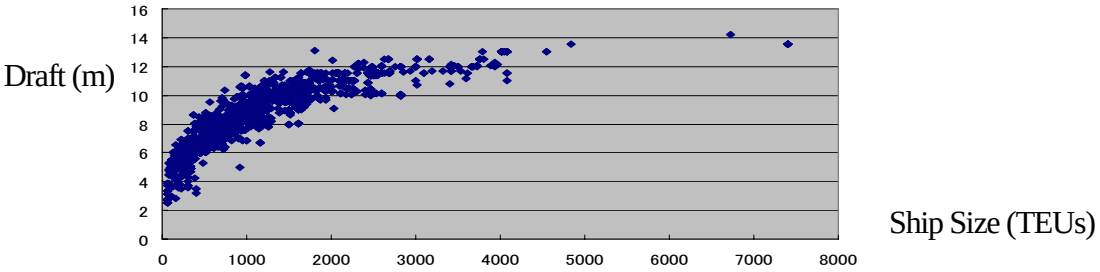


(Source) International Transport Handbook 2003, OCDI

Figure 3. Characteristics of Container Ship Size in Inter-Asian Routes

(3) Relation between Ship Type and Draft

Figure 4 shows the relation between ship type and draft. On the North America and Europe routes, the predominant container ship size is 6,000 TEUs and above while ship draft ranges from –14.0m ～ –14.5m. Accordingly, a container berth must have a depth –15m ～–16m to accommodate such vessels. As mentioned above, container ships in the 4,000 – 5,000 TEU range, ship draft of which is –14m ～ –15m have decreased. On the other hand, while dominant container ship size on inter-Asian routes is 500 TEUs – 1,500 TEUs, and thus ship draft is less than –12m, container ships of 2,000 TEUs and above are on the increase.

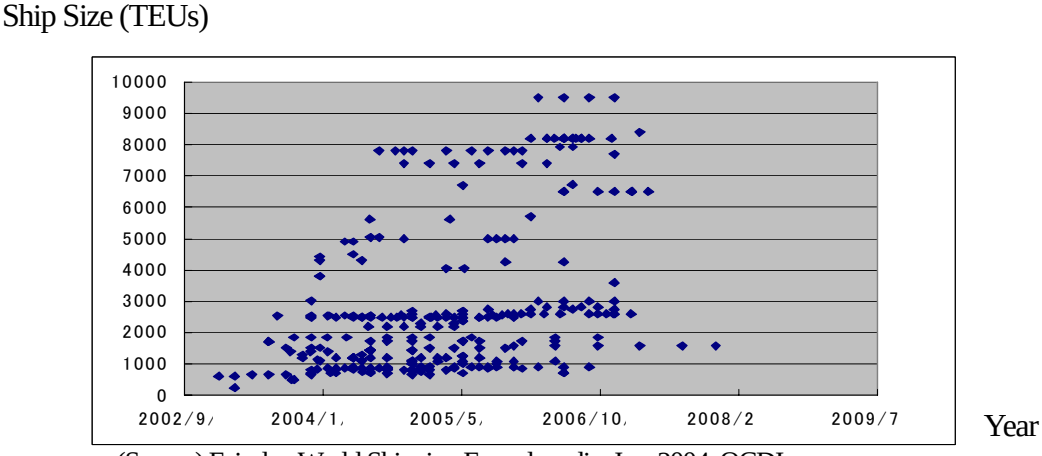


(Source) Fairplay World Shipping Encyclopedia, Jan. 2004, OCDI

Figure 4. Relation between Container Ship Size and its Draft

(4) Cascade Effect of Container Ships in Asia

According to Fairplay World Shipping Encyclopedia, Jan. 2004, one hundred and forty container ships of 6,000 TEUs and above are scheduled to be built and employed on trunk routes by the end of 2007 (see Figure 5). Given the importance of these large ships to the overall strategy of each shipping company, it is easy to understand why no information on delivery plans is currently available. However it is self-evident that due to the introduction of large size container ships, middle-size ships in trunk routes will have to be transferred to regional shipping routes as part of the "cascade effect". This "cascade effect" can be accompanied by several problems such as insufficient berth depth. The possible impact on inter-Asia container shipping routes is examined below.



(Source) Fairplay World Shipping Encyclopedia, Jan. 2004, OCDI

Figure 5. Size and Handover Schedule of Newly Built World Container Ships

The increase in ships ranging from 2,000 TEUs – 3,000 TEUs from 2001 to 2003 (see Figure 4) on inter-Asian routes could be attributed to the "cascade effect". Judging from the existing ship size distribution in Asia, it is reasonable to assume that ships in the 2,000 – 3,000 TEU range could become the dominant ship type, and this would necessitate increasing the alongside depth of berths to –12m ～

–13m.

In this event, Cebu Port, Hai Phong Port, Ho Chi Minh Port, Sihanoukville Port, Yangon Port and others would have to increase berth depth in order to accommodate this ship type. Among these ports, Cebu Port and Sihanoukville Port are sea ports and thus face no physical constraints in increasing depth. The size of ships calling Yangon Port will remain small due to the limited amount of international trade and thus no impact is expected by the "cascade effect". Vietnam, however, may suffer from the constraints of berth depth which is controlled by shallow river depth. It is urgent for the country to develop deeper container terminals in order to accommodate larger vessels. While the Vietnamese Government has newly developed Cai Lan Port to the east of Hai Phong and is proceeding with deep sea port development in the Southern region, Hai Phon Port and Ho Chi Minh Port will remain as the main urban ports in future due to their strategic locations. Accordingly, some practical measures need to be introduced to allow these two main ports to cope with the "cascade effect".

On the other hand, the following main ports in Asia have been preparing deeper container terminals to accommodate the largest container ships: Port of Singapore (-16m), Port of Kaohsiung (-16m ～ -17m), Port of Laem Chabang (-16m), Port of Tanjung Pelepas (-17m), and the Port of Shenzhen (-16m ～-17m).

As discussed above, there are two types of impacts generated by the delivery of new large container ships. First, to accommodate these "mega" ships, the world's deepest container berths must be constructed. Second, the introduction of these new large ships results in the "cascade effect". In this connection, it is observed that there seem to be no serious problems in Asian ports regarding the first impact whereas several ports need urgent measures to cope with "cascade effects".

2.3 Maintenance of Port Facilities

Due to insufficient budget, most developing countries are unable to properly maintain existing facilities for daily port operations. A considerable portion of port facilities in each Asian country requires rehabilitation to be safely and efficiently used in operations. For the development of new facilities, financial cooperation systems of international donors are available, but there is no rehabilitation loan system presently. Under such circumstances, port rehabilitation is a heavy burden on developing countries and countermeasures on this matter are urgently needed. In particular, river ports in Asia have been commonly troubled with shallow depth due to soil sedimentation at the mouth of rivers. If effective measures for maintaining the depth of river mouth could be found, larger ships could economically call these ports which would be of great benefit for all parties.

In Indonesia, major commercial ports have been developed and managed by Public Corporations and small ports have been handled by DGSC. But this port system has been changed recently as a result of new regulations. To promote decentralization, Presidential Decrees in 2000 and 2001 stipulated that the management of small ports is to be transferred to local government. However, the new system has not been working well so far because the central government still controls the port revenue system of small ports and does not provide local government with enough incentives to efficiently manage small ports.

A similar situation is seen in the Philippines. Major commercial ports are managed by PPA and small ports are maintained by DOTC. While the role of small ports is vital to the daily life of citizens, insufficient revenues make port management difficult. Main reason for this is that the domestic tariff is kept unnaturally low out of political considerations.

2.4 Response to Private Sector Involvement in Port Projects

For these ten years, steady economic growth in Asia has required continuous expansion of port capacities to accommodate explosive container throughput. However, most ports in Asia have been suffering from budget constraints. In this regard, private sector participation has been playing an essential role for the continuous development of major ports and for the economic growth of each nation.

At the same time, negative aspects of port privatization have been observed in several projects. These negative aspects include the generation of monopolistic conditions, inefficient port operations due to labor problems and contractual disputes.

Accordingly, to effectively introduce privatization in future, the following issues need to be adequately addressed.

a) For the future port projects, roles of both public and private sectors need to be clarified. Budget constraints should not be the sole reason for privatization.

b) Many troubles are caused by a lack of understanding of contracts. It is necessary to review various constraints and ascertain the actual situation in world ports. The desirable privatization scheme usually varies by each port. The most desirable contracts for ports should be sought keeping in mind that contracts are effective for twenty/thirty years.

3. DEMAND FORECAST OF MARITIME CONTAINERS

In order to estimate the shortage of container handling capacity in the Asian region, demand forecast of maritime container is conducted using a simple forecasting model.

3.1 Relation between Container Throughput and Population/Economic Indicators in 7 Main Developed Countries (G7)

The value of "Population per 1 TEU" in 6 main developed countries (excluding France) is 7 - 9.5 in 2002 (see Table 9).

Table 9. Relation between Container Throughput and Population/Economic Indicators in G7 Countries

Country	Population (million)	Throughput (million TEU)	GDP per capita	Population per TEU (2002)	Main Transshipment Ports
Japan	127.15	14.04	31,407	9.05	
USA	288.37	30.81	36,006	9.36	
Canada	31.36	3.30	22,777	9.50	
UK	59.23	7.58	26,445	7.81	
Germany	82.50	9.48	24,051	8.71	
France	59.49	3.28	24,061	18.14	
Italy	57.69	7.95	20,528	7.26	Gioia Tauro
(a) G7 Total	705.78	76.44	30,118	9.23	
(a)/(b)	11.37%	28.01%			
(b) World Total	6,204.79	272.90	5,202	22.74	

Source: OCDI

3.2 Change of the Value of "Population per 1 TEU" in G7

The value of "Population per 1 TEU" in 7 main developed countries converges from 50 - 444 in 1970 to 7 - 9.5 in 2002. It can be seen that this value tends to decrease as containerization and container volumes increase due to economic growth (see Figure 6).

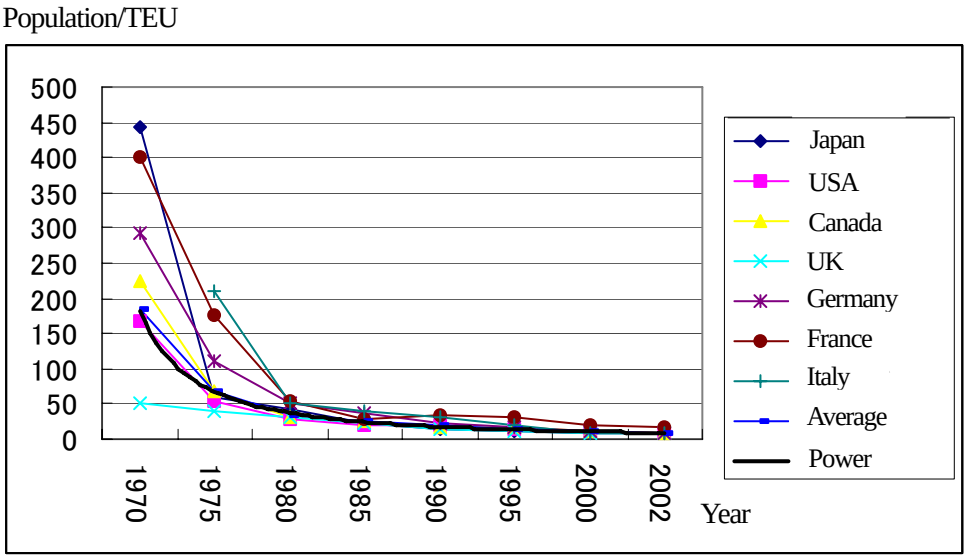


Figure 6. Change of the Value of "Population per 1 TEU" in G7 Countries

3.3 Current Situation of Container Throughput and Population/Economics in Main Countries of the World

Table 10 indicates population, container throughput and the value of "Population per 1 TEU" of 20 main countries of which transshipment volume is not relatively bigger. In this table, these countries are ranked from smaller GDP per capita.

3.4 Correlation between GDP per Capita and the Value of "Population per 1 TEU"

The correlation between "GDP per capita" and the value of "Population per 1 TEU" regarding 20 countries in Table 7 is shown in Figure 7.

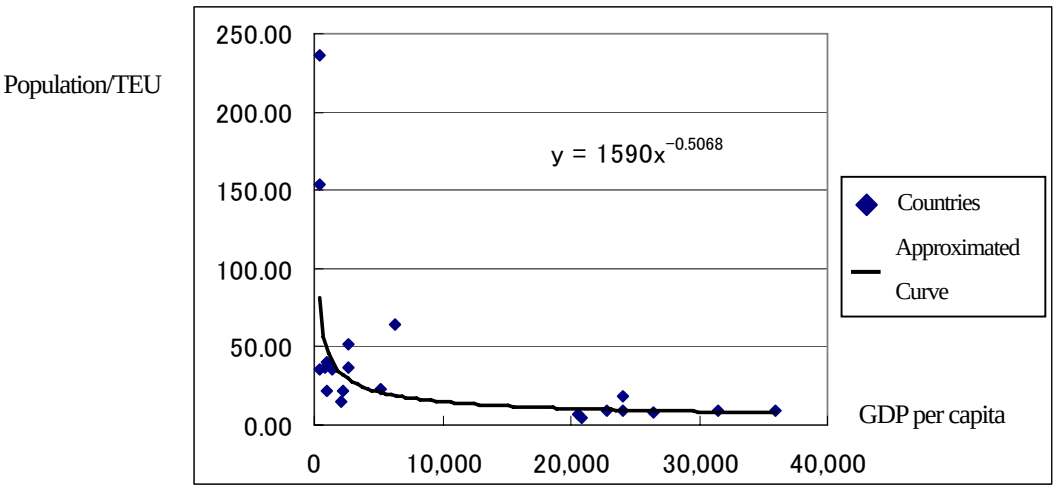


Figure 7. Correlation between GDP per Capita and the Value of "Population per 1 TEU" of 20 Countries

Table 10. Relation between Container Throughput and Population/Economic Indicators in 20 Main Countries

Country	Population (million)	Throughput (million TEU)	GDP per capita (US$)	Population/TEU (2002)
Bangladesh	135.68	0.573	351	236.62
Pakistan	144.90	0.943	408	153.68
Vietnam	80.42	2.281	436	35.26
Indonesia	211.72	5.747	817	36.84
Philippines	79.94	3.765	975	21.23
China	1,280.40	31.885	989	40.16
Egypt	66.37	1.862	1,354	35.65
Thailand	61.61	4.173	2,060	14.76
South Africa	45.35	2.076	2,299	21.84
Brazil	174.49	3.408	2,593	51.20
Turkey	69.63	1.877	2,638	37.09
Mexico	100.82	1.562	6,320	64.55
Italy	57.69	7.948	20,528	7.26
Australia	19.66	3.851	20,822	5.11
Canada	31.36	3.300	22,777	9.50
Germany	82.50	9.477	24,051	8.71
France	59.49	3.279	24,061	18.14
UK	59.23	7.585	26,445	7.81
Japan	127.15	14.044	31,407	9.05
USA	288.37	30.806	36,006	9.36
(a) Total	3,176.77	140.44	7,844	22.62
(a)/(b)	51.20%	51.46%		
(b) World Total	6,204.79	272.900	5,202	22.74
World Total excluding Transshipments	6,204.79	197.800	5,202	31.36

Source: OCDI

Since it would generally appear that the container throughput correlates with GDP or population, the following approximate expression is derived from the relation between GDP per capita and "Population per 1 TEU" of 20 main countries in consideration of the above tendency.

$$Y = 1{,}590 X^{(-0.5068)} \qquad Y: \text{Population per 1 TEU} \quad X: \text{GDP per Capita} \qquad (1)$$

3.5 Procedure of Forecasting International Marine Container Throughput

According to the procedure shown in Figure 8, the container throughputs of main countries in future can be forecasted using the above expression, future population and GDP per capita forecasts.

In this procedure, the future population forecasted by the United Nations and the future GDP estimated by each country are adopted. If the future GDP is not estimated for a country, the future GDP per capita which is forecasted using economic growth rate assumed in Table 11 is adopted.

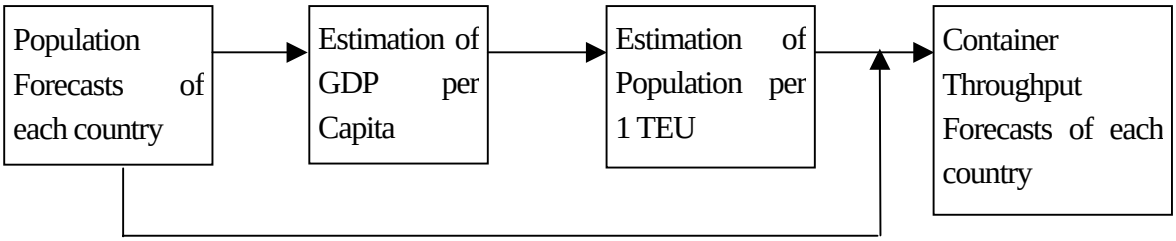


Figure 8. Procedure of Forecasting International Marine Container Throughput

Table 11. Assumed GDP Growth Rate per Capita

GDP per capita (US$)	Economic Growth Rate (%)
30,000 －	1.00%
20,000 － 30,000	1.50%
10,000 － 20,000	2.00%
5,000 － 10,000	2.50%
3,000 － 5,000	3.00%
1,000 － 3,000	4.00%
－ 1,000	5.00%

Source: OCDI

The container throughputs of Asian countries in 2010 and 2020 are forecasted based on the above procedure (see Table 12). According to the result of demand forecast, the growth rates of China and India are large.

Table 12. Demand Forecast of Container Throughput in Asian Countries (Unit: million TEU)

Country	2002	2010	2020
Japan	14.04	17.68	18.11
China	31.89	43.30	58.74
Philippines	3.77	5.20	7.17
Thailand	4.17	5.28	6.88
Indonesia	5.75	7.87	10.59
Vietnam	2.28	3.14	4.54
Bangladesh	0.57	2.27	3.26
India	3.34	20.32	28.73
Pakistan	0.94	3.22	5.04
World Total (excluding transshipment)	197.80	351.01	427.23
World Total (including transshipment)	272.90	491.41	598.12

Source: OCDI

4. FORECASTING SHORTAGE OF CONTAINER HANDLING CAPACITY OF ASIAN PORTS IN FUTURE

The shortage of container handling capacity in Asian ports in 2010 and 2020 is estimated from the difference between the above forecasted demand and existing handling capacity (port throughput in 2002) (see Table 13).

The shortage of container handling capacity is bigger in China and India during both 2002 – 2010 and 2010 – 2020.

Table 13. Shortage of Container Handling Capacity in Asian Countries (Unit: million TEU)

Country	2002	Shortage 2002 – 2010	Shortage 2010 - 2020
Japan	14.04	3.64	0.43
China	31.89	11.41	15.44
Philippines	3.77	1.43	1.97
Thailand	4.17	1.11	1.60
Indonesia	5.75	2.12	2.72
Vietnam	2.28	0.86	1.40
Bangladesh	0.57	1.70	0.99
India	3.34	16.98	8.41
Pakistan	0.94	2.28	1.82
World Total (excluding transshipment)	197.80	153.21	76.22
World Total (including transshipment)	272.90	218.51	106.71

Assuming that the container handling capacity per berth is approximately 30 thousand TEU, the required number of berths in Asian countries is estimated in Table 14.

Table 14. Required Number of Berths in Asian Countries

Country	Required No. of Berths 2002 – 2010	Required No. of Berths 2010 - 2020
Japan	13	2
China	38	52
Philippines	5	7
Thailand	4	6
Indonesia	8	10
Vietnam	3	5
Bangladesh	6	4
India	57	28
Pakistan	8	7
World Total (excluding transshipment)	511	255
World Total (including transshipment)	729	356

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