PORT CHOICE SELECTION BASED ON CARGO PHYSICAL DISTRIBUTION (CONTAINERIZATION) FOR EXPORT PROMOTION

Meor Aziz OSMAN
Graduate Student
Graduate School of Information Sciences
Tohoku University
Aoba, Aoba-ku, Sendai
980-77 Japan
Fax: +81-22- 217 7494
E-mail: kunta@plan.civil.tohoku.ac.jp

Hajime INAMURA
Professor
Graduate School of Information Sciences
Tohoku University
Aoba, Aoba-ku, Sendai
980-77 Japan
Fax: +81-22-217-7494
E-mail: inamura@plan.civil.tohoku.ac.jp

abstract: This paper analyzed the domestic port choice selection (case study of Japan) by determining the origin and destination of the export containerized cargo by volume, value, and commodity types involving two main stages; analyzing domestically the freight flow from the production area to domestic loading ports and secondly analyzing the international destination (trade partners) from the domestic ports. Several points were revealed; ports hinterland can demarcated, port by function of its trading partners (regional), and port by function of its freight commodities. Also, simple statistical analysis was done on selected infrastructure facilities variables (road and seaport) pertinent in the selection of seaports by shippers, consignor, or forwarding agent.

1. INTRODUCTION

Adequate and efficient transportation infrastructure networks consisting of inland road facility (most dominant of inland transportation) and seaport (the gateway to external trade) is one of the key prerequisite to industrial development and economic growth. As such its integration in the planning of transportation facilities network which should be in tandem with industrial growth is of paramount importance. A better plan transportation facilities in meeting the changing demands and competition due to industrial development will indeed promote further external trade transaction. Before such a comprehensive transportation development plan can be formulated, understanding the freight flow behavior and its relation to related infrastructure facilities is necessary.

In identifying the origin and destination (OD) of external trade freight flow which comprised of domestic OD (production center to loading port) and international OD (loading port to trading partners), the former has not been adequately investigated or omitted altogether due to data complexity. This missing link is an important element when analyzing the overall cargo flow which is extremely valuable to transportation planners for meaningful applications in the areas of cargo forecasting, economic analysis of trade patterns, intermodal competition, and market analyses[3]. With this background, the purpose of this paper is to examine the variations in the volume, value, and types of cargo (containerized) passing through a port with the economic conditions and the geographical area that constitutes its hinterland. The inland transportation mode and the international OD involving the trade partners need also to be scrutinized. Taking Japan as the country for this study, only export trade scenario was considered.

2. LITERATURE REVIEW

To identify and establish the water front of current research, literatures/book based on the following classifications were reviewed; port facilities[10]- determinants for efficiency and performance, modeling and travel choice[8]- mostly related to passenger demand analysis and minimal on commodity demand analysis, transportation and economic development[2,7], and interregional infrastructure planning framework.[9]

3. APPROACH

Fig. 1 shows the flow of the analysis adopted. Only export trade transaction is considered with the perception that domestic supply is the main function for infrastructure facility demand. To analyze the features of port choice selection, three components were identified; commodity production areas, the selection of domestic loading ports, and international destination of trade partners. By integrating the three components, intermodal transport used, and cargo volume, value and types, firstly, the domestic OD (production centers to loading ports), and secondly, the international OD (loading ports to international destinations) can be made known. By performing simple statistical analysis on variables related to port and road facility, coefficient of determination (R^2) and correlation coefficient can be determined. Thus, the variables having significant affect on the selection of ports can be highlighted.

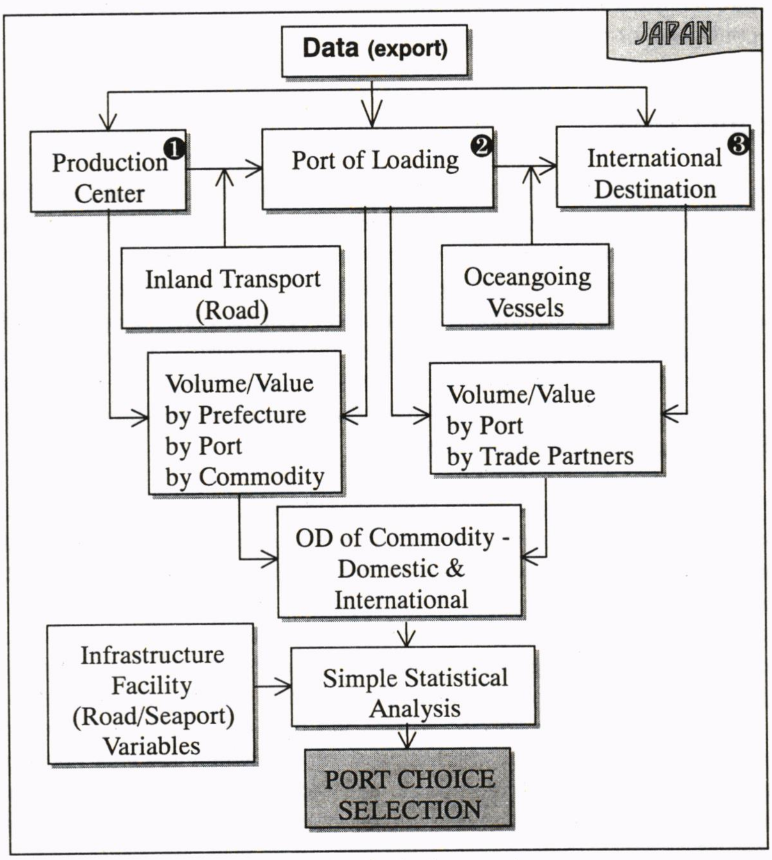


Fig.1: Analysis Approach

4. DATA CHARACTERISTICS

In the analyses, three main data/sources were used; Japan 1993 Container Export Freight Flow Survey, International Transportation Handbook 1993, and Japan Chartered Fare Table 1989. For container export freight flow survey, it has 23 types of entries with respective coding of which 7 types of data were selected to suit the analysis requirement. The related data are:

i. cargo value,
ii. freight tonnage,
iii. production area (by prefecture),
iv. port of loading,
v. commodity types (customs clearance statistical code),
vi. mode of transport (inland), and
vii. destination countries (trade partners).

4.1 Production Area

The whole 47 prefectures in Japan contributing to the container cargo has been included in this study and their location are as shown in **Fig. 2.**

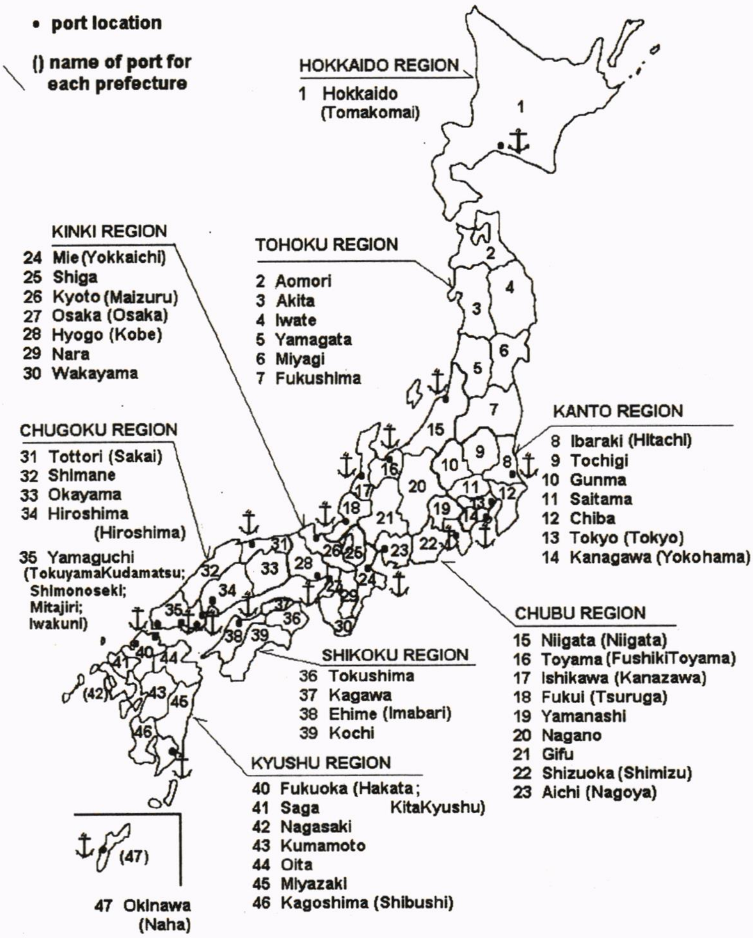


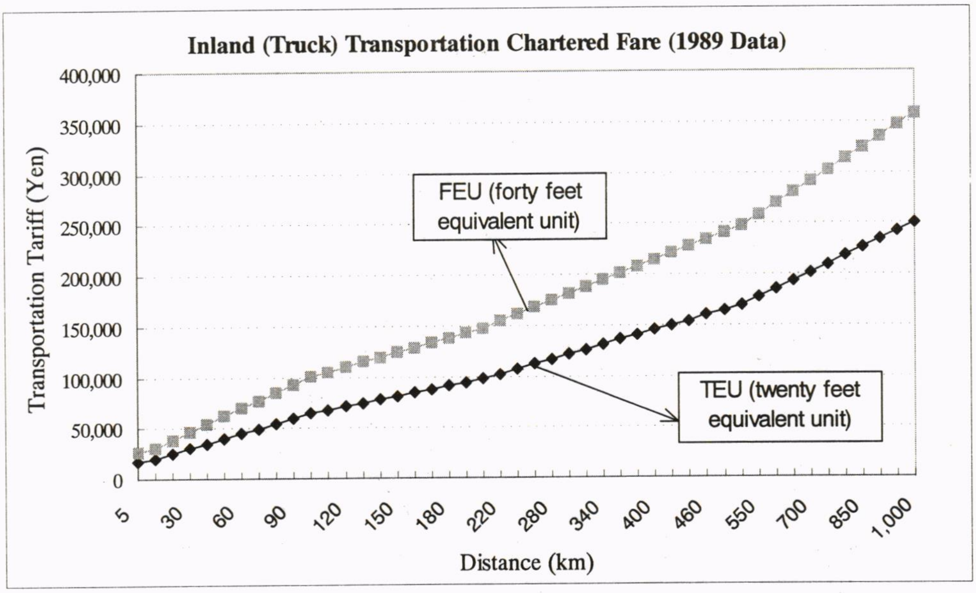
Fig. 2: Japan - Location of Prefectures and Selected Ports

4.2 Port of Loading

The total number of ports in Japan amount to 1099 (20 numbers as specially designated major ports, 113 as major ports, and 966 as local ports) as of July 1990[1]. It is observed that each individual prefecture has their own prefecture port serving as a discharge port but the commodity volume is very small and can be neglected. In order to reduce the data complexity, only 25 major ports have been selected which are distributed along the whole of Japan with the following regional distribution; Hokkaido: 1, Kanto: 3, Chubu: 5, Tohoku: 0, Kinki: 4, Chugoku: 5, Kyushu: 3, Shikoku: 1, and Okinawa: 1. The ports location are shown in Fig. 2.

4.3 Inland Transportation (Road Mode)

In the case of Japan, above 90% of inland commodity transportation mode are transported by truck, appropriately it is the only mode considered here. To calculate the cost/TEU (TEU-twenty equivalent unit is selected) and the time taken for each OD (production center to port of choice), container tariff (transportation fare) and distance need to be known. These were made available using Japan Chartered Fare Table 1989 and represented in graphical form by **Fig. 3** while distance was computed manually.



Source: Japan Chartered Fare Table:1989

Fig. 3: Japan Inland (Truck) Transportation Fare

4.4 Freight Commodity

Commodity classification follows that recorded by Japan customs clearance statistical code (JCSC). A total of 74 commodity items were listed and for simplicity 13 main sectors were selected as given by **Table 1**.

4.5 International OD (Trade Partners)

From the data, a total of 46 trade partners were recorded, however, in this analysis instead of dealing with each individual trade countries, they were considered under six regions comprising of Asia, Europe, North America, South America, Africa, and Oceania.

Table 1: Customs Clearance Statistical Code-13 Main Sectors

Code	Commodity	Code	Commodity
1	Food	8	Metal products
2	Textiles	9	General machinery
3	Pulp and Paper	10	Electrical appliances
4	Chemicals	11	Transport vehicles
5	Petroleum products/coal products	12	Precision equipment
6	Ceramics	13	Other manufacturing industry
7	Primary metal		

4.6 Selection of Variables

The related variables for port and road transportation facilities deemed to have impact of varying degrees to the selection of ports can be categorized into 5 main groups with their breakdown as given in **Fig. 4**. There are 15 variables identified and the shaded boxes indicate the variables with available data. These variables are by no means final, and the list can be added further depending on the variable significance and data availability.

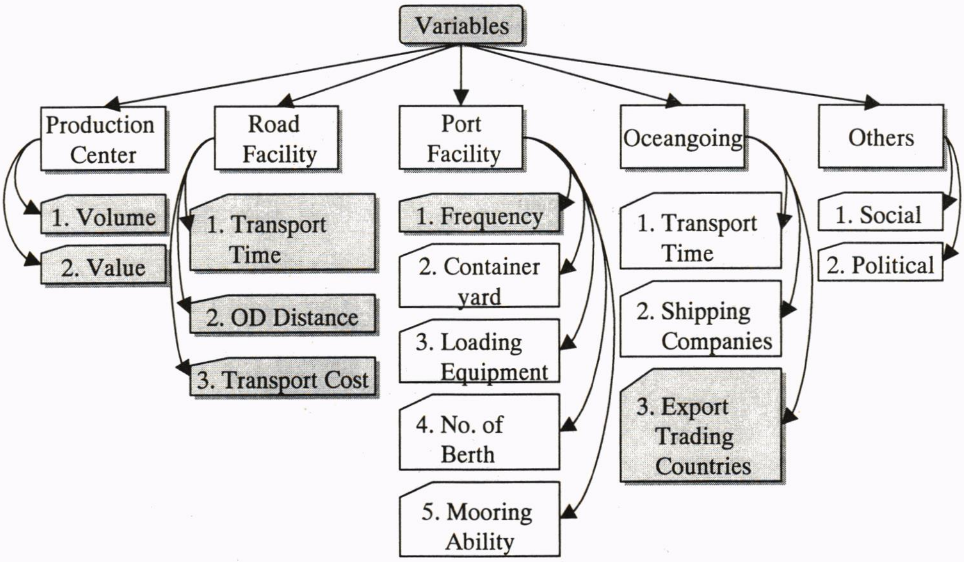


Fig. 4: Variables Related to Port and Road Facilities

5. RESULTS OF ANALYSES

5.1 Production Center

Table 2 (page 12) shows the export volume and value by region and prefecture. The main concentration of industrial centers lie in the middle belt of Japan comprising of Kanto, Chubu, and Kinki region having a total share of 79.49% (volume) and 83.32% (value) compared to the overall export volume and value respectively. Not surprisingly, these industrial centers are located nearer to the main ports of Japan. **Fig. 5** illustrates this point.

5.2 Domestic OD (Production Center to Loading Ports)

The OD between the production areas (prefectures) and the port of choice can be represented by matrix form as given in **Table 3** (page 13). The main ports; Osaka, Kobe, Yokohama, Kobe and Tokyo can be singled out by examining the superior ranking in volume and the number of production areas the ports cater. For example, even though Shimonoseki port (code 9) did cater for almost the prefectures but in terms of volume handled and port selection ranking by respective prefectures, the indicator is low.

Considering only the main ports, the table suggests the following observation. By virtue of its volume and value, two port pairs exists; Yokohama(3) and Tokyo(1), and Kobe(8) and Osaka(7). For each pair, one port portrays a dominant role (Yokohama and Kobe) by handling a bigger volume while the other act as a complementary. Nagoya port established herself as an intermediate port (in distance and location) and handles less volume than the two pairs of ports and acts as an alternative. These main ports handled cargo from almost all the prefectures.

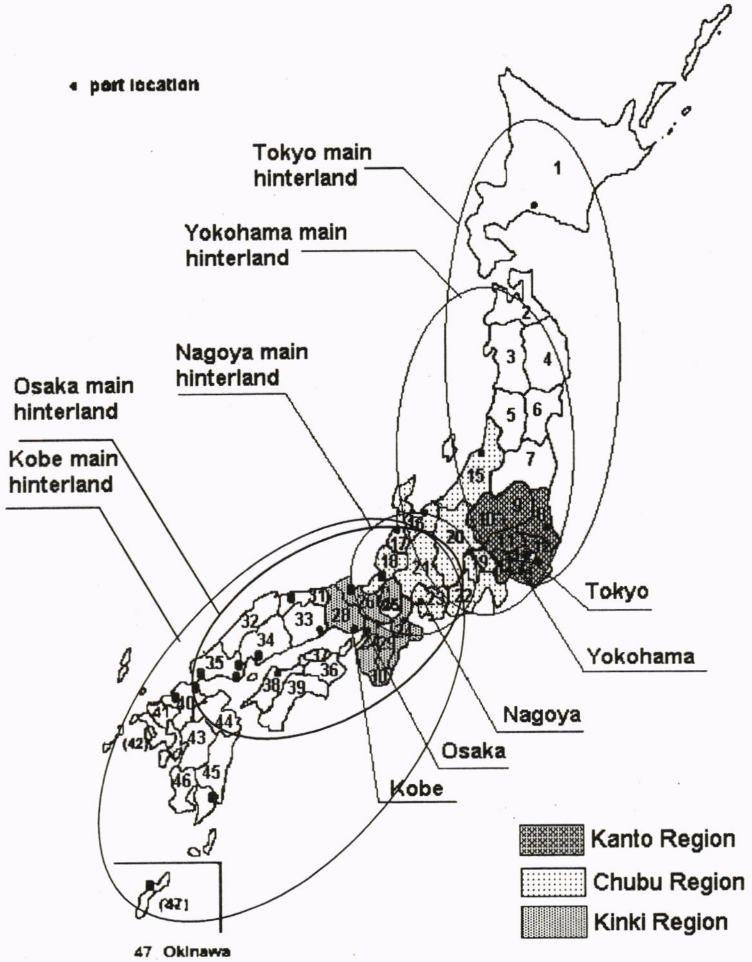


Fig 5: Main Ports Hinterland Boundary

5.3 Port Hinterland

By numbering the prefectures in sequence, north to south of Japan, hinterland boundary for the main ports can be demarcated (oval shape). Overlapping do exist due to inclusive and exclusive of hinterland, but this can be reduced significantly by only considering the major production areas (volume). In this case, taking ranking 1 and 2 of loading port with respect to volume, their positions are close to each other forming two extreme limits as compare to others (refer to table 3). Tokyo has the limit between prefecture 1 and 19, Yokohama between prefecture 1 and 22, Nagoya between prefecture 16 and 25, Osaka between prefecture 17 and 39, and Kobe between 16 and 47. Fig. 5 illustrates this point.

Another point to note regarding the hinterland boundaries, each port pairs handle a different set of hinterland but between the hub port and its complementary port, the hinterland is in the same direction with the hub port serving more prefectures. Yokohama and Tokyo hinterlands are seen to start at their respective port location and moved towards the northern belt. Likewise to Kobe and Osaka but towards the southern belt.

5.4 Port Transaction and Commodity Types

Table 4 shows the results of analyzing commodity types and the volume handled for each loading ports. The purpose of this analysis is to see whether port function by specific commodity type.

Table 4: Volume Handled and Commodity Types by Ports

Ports	Volume (ton)	Commodity types(top four)
1. Tokyo*	596,232	(9)-8.01%;(10)-6.36%;(12)-2.87%; (11)-2.02%
2. Niigata	6,519	(4)-0.08%;(9)-0.02%;(12)-0.02%;(1)-0.01%
3. Yokohama*	1,101,743	(9)-9.0%;8(11)-7.50%;(10)-6.85%;(4)-3.47%
4. Shimizu*	205,889	(9)-2.04%;(10)-0.83%;(13)-0.45%;(1)-0.03%
5. Nagoya*	941,589	(11)-14.80;(9)-14.60%;(10)-6.44%;(4)-2.0%
6. Yokkaichi	10,638	(4)-0.11%;(13)-0.03%;(9)-0.02%;(11)-0.01%
7. Osaka*	344,359	(9)-3.41%;(10)-3.12%;(12)-1.21%; (4)-1.12%
8. Kobe*	1,189,080	(9)-7.86%;(11)-5.79%;(10)-5.47%; (4)-3.59
9. Shimonoseki	12,947	(10)-0.15%;(4)-0.12%;(9)-0.03%;(1)-0.03%
10. KitaKyushu	136,862	(11)-1.27%;(4)-1.24%;(9)-0.36%;(13)-0.24%
11. Hakata	65,927	(9)-0.57%;(10)-0.19%;(11)-0.19%;(4)-0.15%
12. Tomakomai	5,697	)
13. Hitachi	6,679	)
14. FushikiToyama	4,992	)
15. Kanazawa	1,475	)small volume
16. Tsuruga	3,447	)
17. Maizuru	2,893	)
18. Sakai	1,788	)
19. Hiroshima	31,234	(11)-0.19%;(9)-0.12%;(4)-0.07%;(13)-007%
20. TokuyamaKudatmatsu	11,549	(4)-0.16%;(13)-0.06%;(5)-0.01%
21. Iwakuni	7,763	)
22. Mitajiri	5,195	)
23. Imabari	2,787	) small volume
24. Shibushi	1,474	)
25. Naha	1,640	)
26. Others	161	)
Total	4,700,559	

Note: 1. The figures in parenthesis indicate the commodity type (related to table 1).
2...%: The percentage between commodity volume compared to the total volume
3. *: main ports

Only the top four commodity types were selected and ports having a small handling volume have been omitted. Results from the table shows that for the main ports, they cater for the same commodity types with machinery as the main commodity (9), follows by the interchangeable of position between electrical appliances (10), transport vehicles (11) and chemicals (4). Other smaller ports also portrays a similar pattern but to a lesser extent, with two or three constant commodity with the addition of an intermittent commodity. Thus, ports cannot be categorized as a function of specific commodity type since the ports handled nearly the same commodity types reflecting high correlation with the industrial structure and location throughout the country.

5.5 International OD (Trade Partners by Region)

Having known the OD from the production center to the respective ports and to a certain extent the commodity types, OD from the domestic ports to the trade partners concludes the linkages required in this study. Results of the analysis can be represented by **Fig. 6**. It shows the ranking of each destination by region for each respective ports. The figure in percentage is the ratio between the volume of cargo handled for each region compared to the total cargo handled for each respective ports. From the figure, the following points can be noted.

i. For the smaller ports with low handling volume, most of them cater for Asian destinations (noticeably a shorter distance than the other regions).
ii. For the major ports (Tokyo, Nagoya, Yokohama, Osaka, and Kobe), different characteristics are observed. They cater for a specific region since the difference between the top and second rank shows a significant difference implying that the regions can be divided into primary and secondary regions. The only exceptions are Kobe and Yokohama ports where destination to all the regions are about balance in their trade volume. With this phenomena this two ports can be labeled as the main hub ports having a distance of 574 km apart between them. Both cater for different sets of hinterland. Yokohama main hinterlands are the Kanto and Chubu regions while for Kobe, the Kinki and Chugoku regions. By identifying ports by regional function, Tokyo caters for Europe region, Nagoya for North America region, Osaka for Oceania region, Yokohama and Kobe for the all regions with both having South America as their leading destination.
iii. Another set of ports are the medium ports comprising of Hakata, KitaKyushu, and Shimizu which are having a similar characteristic as Kobe and Yokohama but handled a smaller volume. They are quite a distance apart to be influenced by the same hinterland except for Hakata and KitaKyushu which are in the same prefecture. They can be said to cater cargo which basically overflows from Yokohama and Kobe -as supporting ports.

5.6 Statistical Analysis on Variables

Multiple regression analysis was performed on the variables with available data as indicated in Fig. 3. Transportation cost and time between prefectures and respective loading ports were calculated based on the information from Fig.2 (transport tariff), Table 3 (distance matrix), and taking the average truck speed as 70km/hr. Frequency for vessels calling at a port is counted from International Transportation Handbook 1993. **Table 5** shows the results measuring the degree of association between the variables – dependent and independent variables. Low and high coefficient of correlation are recorded. **Table 6** shows the results obtained for coefficient of determination (R^2) in which to find the percent variation in the dependent variable explained by the independent variables. By selecting only two data sets (dependent and an independent variable), R2 is low but reasonably high value when regress with the total (5) independent variables. For dependent (Y) variable, volume (share) is selected instead of volume (ton), value (share) or value (Yen) since it gives a better correlation results. Additional variables can be incorporated as and when data is available.

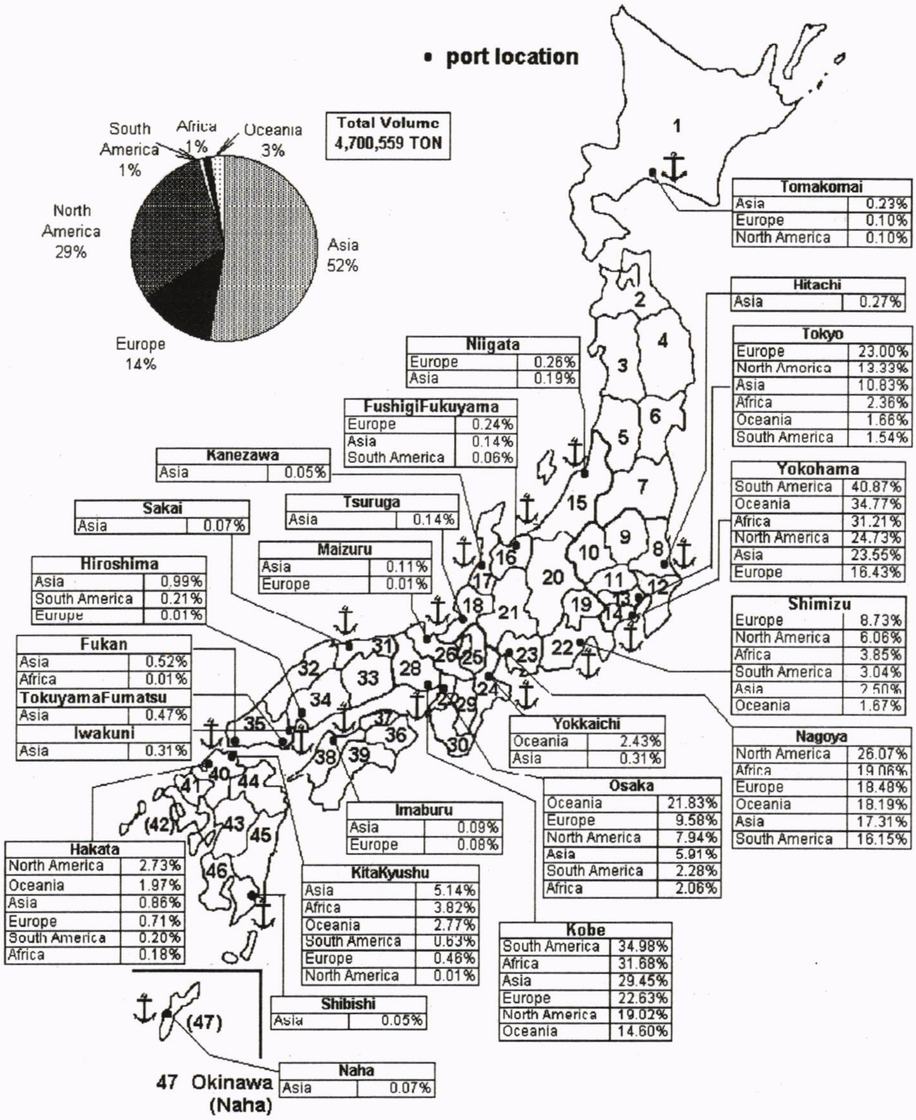


Fig. 6: International OD and Volume Handled (%) for Ports

Table 5: Correlation Coefficient of Port Selection Variables

	Vol (Share)	Distance(km)	Time(hr)	Cost	Freq.	Trading Country
Volume (share)	1					
Distance	-0.36044	1				
Time(hr)	-0.36031	0.99998	1			
Cost	-0.39578	0.98087	0.98087	1		
Frequency	0.38902	0.03128	0.03143	0.05765	1	
Trading Country	0.33415	0.05448	0.05444	0.08301	0.77077	1

Table 6: Coefficient of Determination (R^2)

Dependent Variable (Y)	Independent Variables (X)					
Volume (share)	Transport Cost	Transport Time	OD Distance	Frequency	Trade Partners	R2
●	●					0.4001
●		●				0.3642
●			●			0.3641
●				●		0.3922
●					●	0.3327
●	●	●	●	●	●	0.6173

6. CONCLUSION

By performing the analysis of container freight flow for external trade (export) and from the statistical data evaluated, the following conclusions can be inferred.

1. As in the case of Japan, the main producing areas and their locations with respect to ports location has been highlighted. It includes the linkages between the domestic and international OD in freight flow transaction taking into account the commodity types and the pattern of port selection choice.
2. Smaller ports (prefecture ports) play the role as a discharge point for cargo from close vicinity production areas with shorter international destinations . Volume handled are also small.
3. Ports function by commodity types is not clearly defined since most of the ports support a uniform industrial structure throughout the country.
4. For larger volume of cargo involving main export commodity, the cargo are transported to bigger ports known as hub-ports and several major ports depending on the logistics. Ports' hinterland can be demarcated by neglecting prefectures contributing small volume of cargo. Basically, a port caters for a known area of hinterland and located closer to main producing areas. It is also observed that high volume handled by ports relates to wider hinterland and vice versa.
5. Another feature of the hub-ports (main selection by production centers), cargo is generated from production area as far as about 900km. For the case of Yokohama and Kobe, this covers both ends of Japan. This suggests that inland transportation cost is not the only criteria considered when selecting ports. Perhaps, by introducing other hub-ports to reduce the radius of hinterland serviced, the logistic cost benefit can be attained.
6. For the major ports, for international OD, the ports can generally be categorized by the regional destination function.
7. Regression analysis (coefficient of determination) on port selection variables implies that no independent variables are dominant in selecting a port. In other words, consignor, shippers or forwarding agent, has several preferences with similar weightage when making port selection as suggested by a higher R^2 value for overall variables.

From the above statements, by understanding the dynamics of physical cargo distribution for external trade, it provides a useful input for port development plan. For this study to be more beneficial, modeling into a port choice model needs to be done and whether transferability of the model to other countries having similar features is possible. This would be dealt with at a later stage.

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Table 2: Export Volume and Value By Prefecture and Region

Region	Prefecture	Volume			Value		
		Ton	Share %	Ranking	Yen	Share %	Ranking
Hokkaido	1. Hokkaido	15,970	0.34	36	10,004,197	0.61	32
	Sub-total	*15,970*	*0.34*	*8*	*10,004,197*	*0.61*	*8*
Tohoku	2. Aomori	6,806	0.14	43	2,473,397	0.15	41
	3. Iwate	9,469	0.20	41	5,145,882	0.32	35
	4. Miyagi	41,024	0.87	25	23,108,709	1.42	21
	5. Akita	7,724	0.16	42	4,408,136	0.27	38
	6. Yamagata	18,039	0.38	34	10,888,989	0.67	30
	7. Fukushima	59,846	1.27	22	24,533,295	1.51	19
	Sub-total	*142,908*	*3.04*	*6*	*70,558,408*	*4.34*	*5*
Kanto	8. Ibaraki	179,671	3.82	8	87979294	5.41	6
	9. Tochigi	107,325	2.28	17	42,596,268	2.62	12
	10. Gunma	113,347	2.41	16	42,079,191	2.59	13
	11. Saitama	189,693	4.03	6	80,856,730	4.97	7
	12. Chiba	181,693	3.86	7	46710389	2.87	10
	13. Tokyo	178,610	3.79	9	92,135,491	5.67	5
	14. Kanagawa	374,970	7.97	2	156,814,222	9.65	2
	Sub-total	*1,325,557*	*28.19*	*2*	*549,171,585*	*33.79*	*1*
Chubu	15. Niigata	44,211	0.94	23	15,112,128	0.93	27
	16. Toyama	30,552	0.65	29	11,771,330	0.72	29
	17. Ishikawa	29,946	0.63	30	15,268,186	0.94	25
	18. Fukui	32,024	0.68	28	16,519,256	0.10	46
	19. Yamanashi	20,928	0.44	31	16,069,124	0.99	24
	20. Nagano	74,922	1.59	19	50,392,250	3.10	9
	21. Gifu	63,839	1.35	21	21,561,496	1.32	22
	22. Shizuoka	341,185	7.25	3	118,470,494	7.29	4
	23. Aichi	700,451	14.90	1	191,823,365	11.8	1
	Sub-total	*1,338,058*	*28.46*	*1*	*456,987,629*	*28.09*	*2*
Kinki	24. Mie	173,004	3.68	10	37,460,004	2.30	16
	25. Shiga	146,499	3.11	13	41,318,145	2.54	4
	26. Kyoto	92,546	1.96	18	46,106,555	2.83	11
	27. Osaka	325,279	6.92	4	126,256,628	7.77	3
	28. Hyogo	274,740	5.84	5	72,793,842	4.48	8
	29. Nara	42,368	0.90	24	17,192,847	1.05	23
	30. Wakayama	19,013	0.40	33	7,340,752	0.45	33
	Sub-total	*1,073,449*	*22.84*	*3*	*348,468,773*	*21.44*	*3*
Chugoku	31. Tottori	11,656	0.24	39	3,296,437	0.20	40
	32. Shimane	6,445	0.14	44	2,137,468	0.13	43
	33. Okayama	120,941	2.57	15	28,173,750	1.73	7
	34. Hiroshima	138,964	2.96	14	39,064,526	2.40	15
	35. Yamaguchi	155,246	3.30	11	23,808,060	1.46	21
	Sub-total	*433,252*	*9.21*	*4*	*96,480,241*	*5.86*	*4*
Shikoku	36. Tokushima	16,317	0.35	35	5,068,916	0.31	37
	37. Kagawa	10,268	0.21	40	2,140,840	0.13	42
	38. Ehime	64,037	1.36	20	14,942,951	0.92	28
	39. Kochi	5,383	0.11	46	1,892,649	0.11	45
	Sub-total	*96,005*	*2.04*	*7*	*22,152,707*	*1.48*	*7*
Kyushu	40. Fukuoka	147,674	3.14	12	26,326,477	1.62	18
	41. Saga	19,920	0.42	32	6,108,947	0.38	34
	42. Nagasaki	13,532	0.29	38	10,773,141	0.66	31
	43. Kumamoto	38,753	0.82	26	15,246,775	0.94	26
	44. Oita	15,082	0.32	37	3,673,708	0.22	39
	45. Miyazaki	33,513	0.71	27	5,081,128	0.31	36
	46. Kagoshima	6,275	0.13	45	2,168,406	0.13	44
	47. Okinawa	611	0.01	47	59,952	0	47
	Sub-total	*274,749*	*5.84*	*5*	*69,438,534*	*4.27*	*6*
	Total	**4,700,559**			**1,625,154,723**		

Table 4: Distance Matrix Between Prefectures and Port of Loading

	Tokyo		Yokohama		Nagoya		Osaka	Kobe																		
PRODUCTION AREAS (PREFECTURES) / PORT OF LOADING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25**	26
1**	d(1)		d(3)		d(8)		d(5)	d(4)	d(7)	d(6)		66(2)														
2	643(1)		681(2)	794(7)			1182(6)	1212(3)	1552(8)	1579(5)		d(4)														
3	485(2)		507(1)	636(3)	821(8)		1015(7)	1045(5)	1484(9)			d(6)	386(4)													
4	326(1)		352(2)		659(6)		803(5)	831(3)					228(4)													
5	958(1)	242(5)	1002(2)		1326(6)		1462(8)	1500(4)	1947(3)				440(7)													
6	372(2)	136(5)	398(1)		713(6)		849(4)	992(3)	857(9)	872(8)			274(7)													
7	265(2)	182(5)	287(1)		606(3)		742(5)	887(4)	1227(9)	1242(11)	130(8)		156(6)	364(10)												
8*	106(2)	288(8)	129(1)		447(7)		583(5)	780(4)	1106(6)	1121(6)			30(3)				606(10)		806(11)							
9	106(2)		129(1)	258(7)	447(6)		583(5)	621(3)	1106(9)		1180(4)	d(11)	76(10)	326(8)												
10	108(1)		131(2)	242(9)	449(6)		585(4)	623(3)	1108(5)	1123(7)	1182(8)															
11*	30(2)	280(7)	53(1)	164(3)	371(6)		457(5)	545(4)	942(8)	957(10)	1016(11)			348(9)												
12*	46(2)	332(5)	69(1)	180(10)	387(6)		473(7)	561(3)	958(4)	973(11)	1032(9)		137(8)													
13*	3(2)	300(11)	23(1)	134(8)	341(5)		427(4)	515(3)	912(6)	927(10)	986(7)						508(10)								d(9)	d(13)
14*	23(2)	330(10)	4(1)	104(6)	311(4)		397(5)	485(3)	970(7)	985(9)	1044(11)								758(12)						d(8)	
15	300(2)	2(3)	230(1)	434(8)	641(4)		727(6)	815(5)	1212(9)					235(7)												
16	302(6)	235(9)	303(4)		242(2)		387(5)	419(1)	872(7)	887(8)				15(3)	76(10)											
17	370(4)		364(6)		212(3)		280(2)	313(1)	765(10)	780(8)				76(7)	3(5)		197(9)									
18	453(7)		443(4)	319(9)	185(2)		712(8)	228(1)	697(8)	712(11)				288(10)	76(6)	46(5)										
19	114(2)		114(1)	82(4)	288(3)		454(6)	484(5)	942(7)																	
20	212(8)	170(8)	262(1)	226(4)	243(3)		384(6)	416(5)	869(7)																	
21	362(5)		336(1)	214(1)	72(8)	61(7)	154(3)	179(2)	639(6)	654(9)																
22*	167(3)		137(2)	16(1)	166(4)		319(6)	347(5)	804(7)	819(8)	878(9)															
23*	341(6)	641(11)	311(4)	167(5)	14(1)	40(7)	150(3)	167(2)	635(10)	650(9)					212(13)		159(14)								d(8)	
24*	409(6)		386(5)	228(7)	69(1)	28(4)	106(3)	138(2)	591(8)	606(9)																
25	461(6)	473(11)	438(5)	285(12)	109(2)	90(9)	53(3)	85(1)	538(7)	553(10)				281(8)		91(4)										
26	443(8)		419(5)		135(8)	90(7)	46(2)	78(1)	531(9)	546(10)				270(6)			85(4)									
27*	427(5)	727(9)	397(3)	314(13)	150(4)		3(2)	32(1)	485(6)	500(8)	559(10)						119(13)		312(12)						d(7)	d(11)
28*	515(6)	815(9)	485(3)	341(10)	167(5)		32(2)	2(1)	453(4)	468(7)	527(8)															
29	463(5)		440(4)		121(3)		35(2)	67(1)	520(6)	535(2)																
30	582(6)		559(3)	394(7)	228(4)		64(2)	96(1)	549(8)	564(9)													373(5)			
31	658(6)		635(7)		317(5)		170(3)	152(1)	394(4)	409(8)								94(2)								
32	769(7)		746(4)		428(8)		282(2)	256(1)	276(6)	291(5)	350(3)															
33	582(3)	710(10)	559(4)		306(6)		152(2)	120(1)	315(7)	330(8)	390(9)								170(5)							
34	790(8)		758(4)	629(11)	462(6)		312(3)	280(1)	170(5)	185(7)	244(10)								31(2)	99(9)					d(12)	
35	909(12)		886(10)		581(11)		431(3)	399(1)	61(8)	76(2)	135(5)						458(14)		121(9)	38(4)	90(6)	6(7)				d(13)
36	771(6)		748(3)		423(7)		288(2)	256(1)	423(5)	438(4)				590(8)												
37	697(6)		674(3)		349(5)		214(2)	182(1)	334(7)	349(8)													122(4)			
38	808(7)		785(6)		460(5)		325(2)	293(1)	453(10)	468(4)	527(9)												32(3)		d(8)	
39	788(7)		765(4)		440(6)		305(2)	273(1)	422(5)														167(3)			
40	987(8)		964(6)		710(9)		560(4)	528(2)	75(5)	55(1)	2(3)														d(7)	
41	1030(8)		1007(6)	917(5)	753(7)		603(4)	571(2)	118(9)	103(3)	44(1)															
42	1114(7)		1091(5)		837(6)		687(3)	655(2)		202(4)	128(1)															
43	1079(7)		1056(6)	969(8)	802(9)		652(4)	620(2)	167(5)	152(1)	103(3)														d(10)	
44	1032(7)		1009(5)		755(8)		605(4)	573(2)	120(6)	118(1)	125(3)															
45	1217(10)		1194(7)	1104(6)	940(8)		790(3)	758(1)	305(9)	303(2)	310(4)													69(5)		
46	1249(6)		1226(8)		972(3)		822(9)	790(4)	337(7)	275(1)	322(2)														d(5)	
47**			d(2)				d(4)	d(1)																	d(1)	
Total+	46	16	47	24	45	5	47	47	44	38	22	4	8	10	4	2	7	1	6	2	1	1	4	1	10	3
Rank#	4	15	2	6	3	12	5	1	10	7	8	16	14	18	24	19	20	22	9	11	13	17	21	25	23	26

* top 10 production areas(volume)

** transportation mode by ferry/ship

+ number of prod. areas cater

overall ranking w.r.t total volume

(shaded) not a loading port

(circled) above the top three ports

(n) ranking of loading port with respect to volume