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AIR TRANSPORTATION IN SOUTHEAST ASIAN REGION: CURRENT SITUATION AND RESEARCH SCOPE

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This paper addresses the present condition of air transportation in the Southeast Asian region by analyzing the organization and operation of air transportation system, the level of facilities, the demand structure, and the network configuration. This was mainly done by comparing the mentioned factors of the four Southeast Asian countries of Indonesia, Malaysia, the Philippines, and Thailand. The trend to pluralization, privatization, and formation of regional blocks by Asian airlines, and the competition in providing gateway airports, were identified that are taking shape in the Asian air transportation market which could influence its future. A comprehensive review of air transportation research that has been done in the West in general and in Southeast Asia (SEA) in particular, are presented. A particular model that seeks a gateway airport (s) from among the airports in SEA, for accessibility within, and for accessibility of flight coming from the direction of Europe, the U.S., and Australia to enter SEA, is introduced. Other factors that could influence the air transport industry in SEA are also discussed.
Keywords *: Air transportation, Airflight network analysis, Research on Southeast Asian countries*

1. INTRODUCTION

For several years until now, there is an unprecedented economic growth in the Asia-Pacific Region where Southeast Asia (SEA) is a part. This economic growth has marked its impact on the air transportation industry of the region, partly, with the help of tourism industry. It cannot be denied that air transportation is the major mode of transport for both passenger and cargo, if the element of time, speed and efficiency are considered especially for archipelagos like the SEA countries. Seeing the great potential of the SEA region in air transport business, Western airlines have now joined the fray of enticing Asian passengers and freight. However, Asian airlines have braced themselves either individually or collectively against Western air carriers. These trends in the Asian air transportation market can be said to be taking shape to counter the entry of Western carriers in the Asian market. It is therefore important that proper research be done in air transportation of this region.

Firstly, this paper introduces the present condition of air transportation in the Southeast Asian region by analyzing the organization and operation of air transportation system, level of facilities, the demand structure and the network configuration. Secondly, the functions or factors which might be required for the research regarding air transportation in SEA region, that could help understand the circumstance of air transportation and instigate development of future strategy are addressed. Lastly, the result of analysis was presented in line with the second part, which seeks gateway airports within the SEA region.

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2. CURRENT SITUATION OF AIR TRANSPORTATION IN SEA REGION

There are four countries in Southeast Asia [SEA], namely, Indonesia, Malaysia, the Philippines and Thailand, in which the domestic air networks function independently. However, it cannot be denied that the resurgence of economic activity and flourishing tourist industry in these countries have strongly unified their domestic air networks.

On the other hand, several small countries or island colony within SEA, such as Singapore, Hongkong and even Taiwan, have no or few domestic air network to speak of. The airports of these countries serve as international airports and have already carved their own territories in the region.

(1) Domestic Air Transportation network Structure and Demand

Figure 1 shows the domestic air transportation networks of the major airlines in the four SEA countries. The major airlines are : the Garuda Indonesia of Indonesia, Malaysia Airlines of Malaysia, Philippine Airlines of the Philippines, and Thai Airways International of Thailand. The following could be observed from the domestic air networks :

1. The major hub airports of these domestic air networks are located in key cities : Jakarta for Indonesia, Kuala Lumpur for Malaysia, Manila for the Philippines, and Bangkok for Thailand .

2. In certain regional areas of the said countries, secondary hubs are established to serve the outlying feeder airports, such as Ujung-Pandang in Indonesia, Kota-Kinabalu in Malaysia, Cebu in the Philippines, and Chiang Mai in Thailand .

3. The Philippines and Indonesia, being archipelagos of great extent, have more extensive domestic air networks compared with the rest.

4. In Malaysia, most of domestic air travel occur between the two regions of Malaysia [main] and Sarawak-Sabah.

5. In the case of Thailand, being mostly a single piece of land , the road network plays the main role in both passenger and cargo transport. The air network is therefore not that extensive . For the same

reason, the air network has the same characteristics mentioned in the northern portion of the Philippines.

As shown in Figs. 2 and 3 respectively, there is an upward trend in the domestic passenger and cargo demand for the four SEA countries. Being the most populous, Indonesia has the highest passenger and cargo transported compared with the rest. Thailand's cargo demand is not that much because the bulk of these are carried by road transportation. Cargo demand in the Philippines is much higher than that in Malaysia for the reason that air cargoes for export from other part of the Philippines still have to be transported to Manila where the major international airport is located. Cebu international airport exports a small percentage. While in Malaysia, aside from that in Kuala Lumpur there are several international airports, such as in Kota Kinabalu and Penang. For this reason, not all exports need have to be conveyed to Kuala Lumpur.

Table 1 compares the main fleet and airport facilities with other pertinent statistics of the four countries. PAL has aircraft in every range of seat size. Compared with other national countries, it has more in its fleet less-than-60-seater aircraft. This is because the regional areas in the Philippines are rather small. Most airports are feeder airports catering to small towns and cities. Garuda Indonesia Airline also has aircraft in every range of seater size except less-than-60-seater in capacity. This is due to the bigger regional areas in Indonesia and also, GIA shares the domestic market with local carriers such as Merpati Nusantara Airlines, whose fleet are mostly small aircraft. In Malaysia, air routes need middle size fleet, 100 to 200 seater, because as previously mentioned, the domestic air travel occur mostly between the two main regions of Malaysia (main) and Sarawak-Sabah. The distance between these two regions seem to be long for small aircraft. In the case of Thailand, most of its fleet are in the 200-and-over capacity range due mainly to the existence of road network and also the local air carrier, Bangkok Airways, provide support with smaller aircraft.

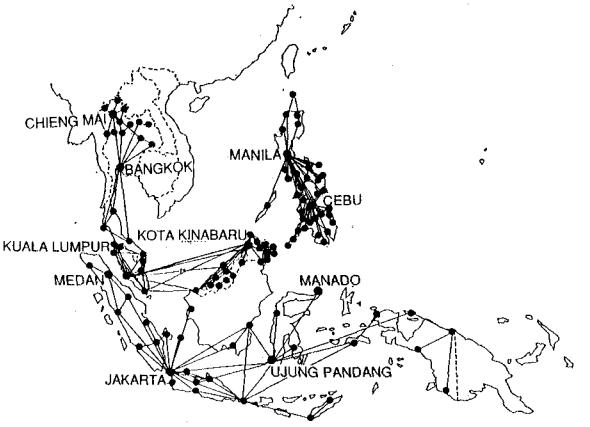

Fig.1 Domestic Air Transportation Network in SEA Countries

Table 1 Fleet of Main Carriers, Airport and Other Pertinent Statistics

			Philippines	Indonesia	Malaysia	Thailand
Area of Land (Km2)			300,000	1,904,569	329,749	513,115
Population (000)			61,480	179,300	17,861	57,196
Population Density			205	94	54	111
GDP (in million US$)			44,280	102,514	40,542	79,347
Number of Airport	Total		87	53	36	40
	for passenger		42	31	16	22
Area / No. of Airport			4,054	38,091	9,160	16,552
Number of Fleet	Total		64	107	69	62
	Dist.of Fleet by Size (%)	200 < seat	31.2	37.4	29.0	72.6
		100 < 200 seat	26.6	25.2	47.8	4.8
		60 < 100 seat	15.6	31.8	0.0	8.1
		< 60 seat	26.6	5.6	23.2	14.5
Passenger (000)			3,939	7,223	4,861	2,636
Passenger / No. of Airport			94	233	304	120

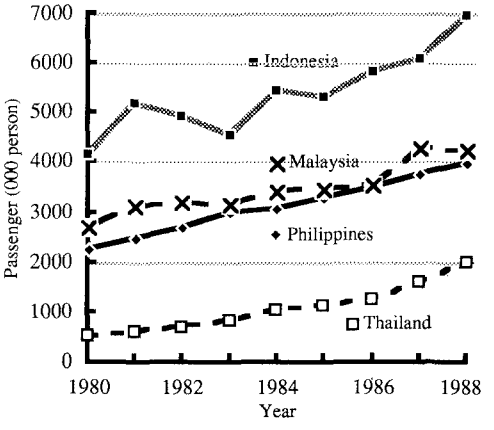

Fig.2 Trend of Passenger in Domestic

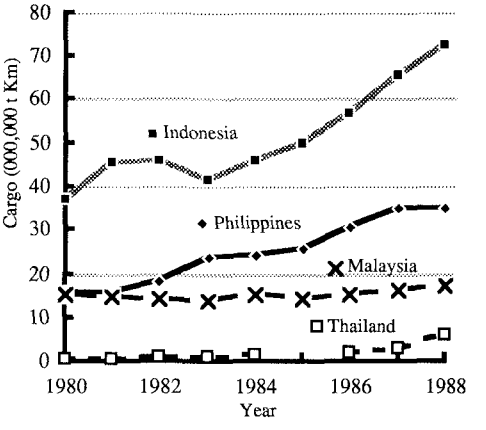

Fig.3 Trend of Cargo in Domestic

(2) International Air Transportation

Fig. 4 shows the international air transportation network in Southeast Asia. Table 2, Fig. 5, and Fig. 6 show some statistics on international air transportation in Southeast Asia. Fig. 6 shows that the international passenger trend is upward for all countries. International airports in Singapore, Hongkong and Thailand are respectively the highest in passenger and cargo demands because they serve as international hubs for flights coming from Europe and other continents. Most of these passengers could be tourist and a big percentage could be transfer passengers. The Kuala Lumpur airport in Malaysia is a good transit point for tourists travelling along the Singapore-Bangkok line, which is why the passenger demand in this airport is not far behind.

(3) Trend in Air Transportation Market in SEA region

SEA countries as well as foreign airlines anticipate the expansion of air transportation market in this region. They seem inclined to adapt deregulation, to bring about competition, on both airline and airport management in order to make the industry stronger. Currently, four trends could be identified that are taking shape in the Asian air Transportation market. These are:

1) the trend towards pluralization of air carriers,

2) the trend towards privatization of air carriers,

3) the trend towards formation of regional blocks to counter the entry and expansion of western air carriers in the Asian market, and

4) the trend towards competition as a gateway airport to achieve hegemony of local market.

Several reasons could be attributed to the four trends just mentioned, such as:

1) American carriers, who have strong constitution and who have obtained full victories in their market, are now seeking new markets and therefore come to the Asian region. Also, European carriers try to expand to this region in order to fortify and supplement their air flight market. To resist the threat posed by Western airlines, the air carriers of the Asian countries have to make the constitution of their air carriers more stronger through privatization and expansion of market share by acquisition of new air route (pluralize). Also, they ask the government to develop and/or expand international airports.

2) With many air carriers involved to lure the Asian passenger, there are also trends of establishing market blocks in the region. Much attention

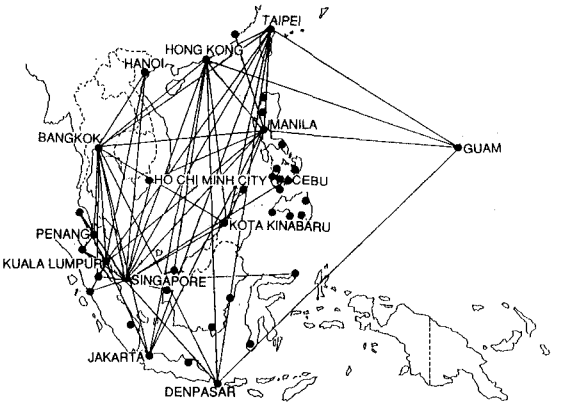

Fig.4 International Air Transportation Network in SEA Countries

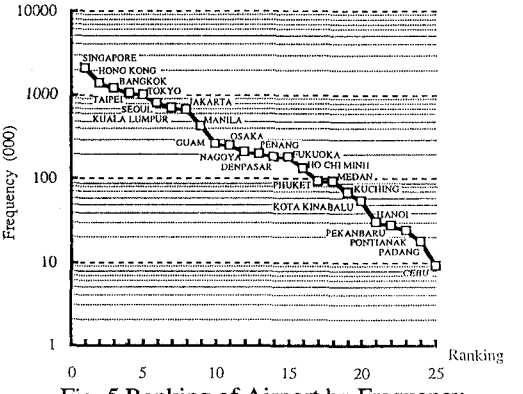

Fig. 5 Ranking of Airport by Frequency

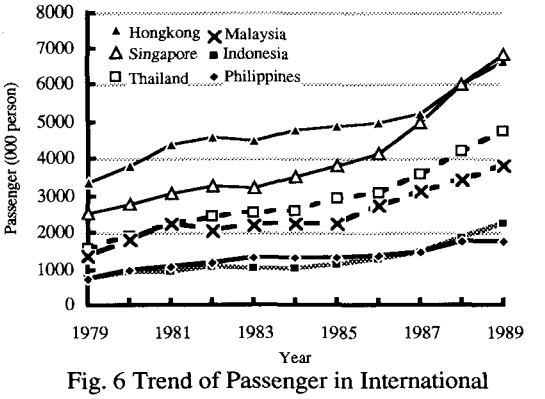

Fig. 6 Trend of Passenger in International

Table 2 Comparison of Main Airports in SEA Region

		Philippines	Indonesia	Malaysia	Thailand	Singapore	Hongkong
Frequency	Total	NA	89.4	58.0	78.5	79.0	87.4
	International	22.3	16.9	25.9	62.6	79.0	87.0
Passenger (000)	Total	NA	7,172	NA	10,555	11,381	15,277
	International	3,953	2,337	NA	8,456	11,381	15,277
Cargo (000t)	Total	NA	114.0	NA	297.5	511.5	694.1
	International	176.8	61.8	NA	291.5	511.5	694.1

should be given to several recent airline agreements, such as, the unification of air market by the conclusion of air flight cooperation agreement of ASEAN countries (July/1992) and creation of centers of excellence by air carriers, establishment of the Association of South Asia Airlines (ASAA) by nine air carriers (Nov/1992) and the establishment of the Asia Frequent Flier Program Co. by Singapore Airlines, Cathay Pacific Air, Malaysia Airline System (July/1993), among others.

3. RESEARCH SCOPE

(1) Previous Researches

General circumstance of Air transportation in the Asian Region as one of transportation modes can be refered through the country report or the airline reports. Also, a lot of study reports for the appraisal of a project by foreign organization and private firms are available, but most of them concentrated in an airport project.

On the other hand, a few number of researches have been conducted on the problem concerning domestic air transportation networks, e.g. in Thailand (Inamura,1988), Indonesia (Todoroki, Hanzawa and Fukuda, 1992), Philippines (Alex and Fukuda,1990,1993) and comparison within SEA Region (Todoroki and Hanzawa 1991, Alex and Fukuda, 1993).

(2) Scope of Research

Generally, we could identify four main issues in the field of air transportation analysis, namely, behavior and strategy of airline operators, strategy of airport authorities, institution for air flight, and demand analysis depending on preference and behavior of users. However, the scope of researches only mentioned here concerned only with SEA area.

Preceding any future researches, the following general research investigating both study area and data must be done;

(1) Airports located in Southeast Asia countries might be studied together with airports in East Asia such as Hongkong, Taipei, Tokyo, etc. in terms of connectivity on air network route or economical relation, while on the researches regarding the air flight in Pacific area, they used to be discussed excluding airport in SEA area, or it can be said that the SEA area is equivalent with the US as shown in Fig.7 so that they might be studied together. Thus, it is important to the confirm study area as the framework of researches.

(2) Net flow data are required for future researches as well as in other areas, but it is not available now in SEA area because there are a lot of flights connecting SEA with both US and European territories so that data on net flow within SEA can not be identified under existing condition. Thus, the study to estimate net flow from available data is needed as well as data collection.

After this, following specific researches may be effective so as to understand circumstance and develop policies;

i) Analyze the impact of unification of domestic and international air network over the countries.

ii) Analyze its institutional problem such as the cooperation between countries and air carriers. Also, analyse the impavt on the market after institutional improvement like as introducing of deregulation.

iii) Find out gateway in this area and analyze the competition between gateways, and

iv) Investigate relationship between tourist industry and air flight demand.

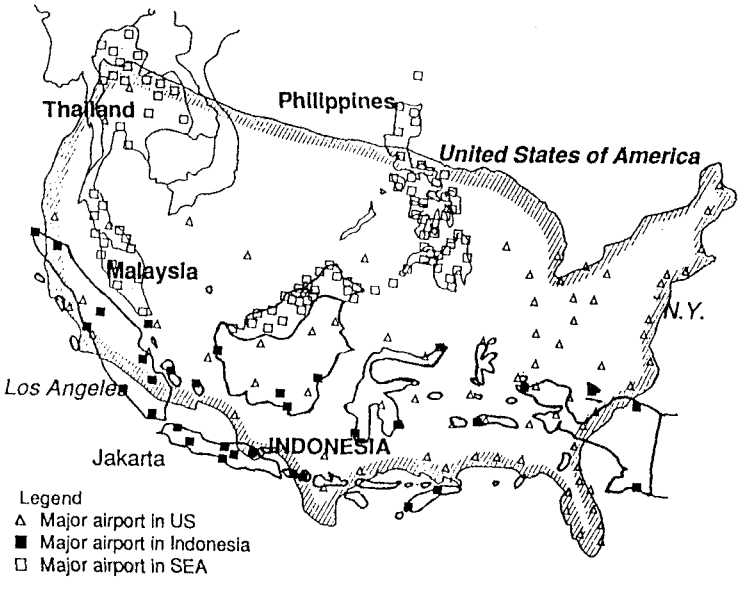

Fig.7 Comparison of Geographical area of the US and SEA[1)]

4. ANALYSIS OF INTERNATIONAL AIR NETWORK IN SEA REGION

With SEA airlines in the process of expansion by acquiring new aircraft and with the ongoing alliance between them, they are now ready to operate in the whole of the SEA region. It is then necessary to consider a broader air network over the SEA countries to operate while at the same time improve the efficiency of the domestic air networks in the region. The following reasons support these concept:

1. Interdependence among countries, due to economics, has become stronger. So that, even though an optimal air network could be obtained within a country, it would not be suitable for the actual demand.
2. Geographical relationship between countries seems to be an intricate puzzle, thus minimizing of trips on domestic air flight for some area would make international trip maximum in other regions.
3. A hub airport's location even if servicing mainly for domestic air flights, must be obtained not only for domestic convenience but must also satisfy the requirements for international flights.

(1) Procedure of Analysis

So far, the application of an interaction matrix in network analysis uses the characteristics of the network in terms of connectivity or accessibility with regards to the significance of links and/or nodes. However the existing international air network in this region (See Fig. 4) has few routes connecting domestic airports over the countries so that the analysis of existing network is not so effective. In this research, the significance of airports as nodes on air networks were estimated by ranking them depending on their accessibility to one another. This criteria is actually not for a network. The significance of airports is calculated as follows:

1. Prepare the connectivity matrix (1-0 matrix), with regards to the connection between airports by using flight books or other information which were issued by airline companies to ICAO,
2. Calculate the flight distance between airports using latitude and departure of both, if flight exists.
3. Search the shortest route from one airport to other airports using dijkstra method, and
4. Sum up all of this shortest route by each origin airport and order airports by these numbers.

The calculation was adopted for the network conditions which covers Southeast and East Asian countries including Tokyo, Nagoya, Osaka, Fukuoka, Seoul and Taipei using two sets of data. The first data uses the existing air network with scheduled flights. The second data uses an assumed air network in which middle-sized airports in Indonesia and the Philippines are included due to data availability, and also because domestic flights exist among these airports. An airport is considered middle-size if it has a runway length of more than 1,600 m long and 30 m wide and also with an apron area of over 1,000 m2, so that medium-sized aircraft used for international flights, could land and takeoff. This network was tested in order to evaluate the condition when the domestic and international air networks are coordinated. Since it is considered that the accessibility of airports must be different with respect to direction because most of the main airports are located in the area's extremities, the accessibility was calculated with respect to three directions. These three directions are to/from the continents of Europe, the U.S., and Australia.

(2) Results and Analysis

In the case of using the existing air network with scheduled flights, Fig. 8 shows the ranking of airports on accessibility. Singapore, Kuala Lumpur, Pekanbaru, Ho Chi Minh and Hongkong are airports located in the Rank 1 category. Singapore, Kuala Lumpur, and Hongkong are such, because a lot of air routes are attracted to them and also they are geographically located in the center of this area. Ho Chi Minh and Pekanbaru could serve as potential hubs for this area as well. Tokyo, Seoul and Taipei also attracted a lot of air routes, but their ranks are not high mainly because their locations may be too far as hub airports within this area.

On the other hand, the ranking on the assumed air network by direction give different results. In the case of attractiveness for international flights coming from Europe, the airports at Bangkok, Penang, Kuala Lumpur, Ho Chi Minh and Phuket were selected as shown in Figure 9. This is true in the current situation because most airlines coming from Europe use Bangkok and Kuala Lumpur as hubs. Geographically, the mentioned airports will continue to be so because the continents of mainland of China and Russia are not accessible for flights coming from Europe. Likewise, Tokyo, Nagoya, Osaka, Fukuoka, and Seoul are the most attractive for flights coming from the U.S. For geographical reasons, the mentioned airports are the nearest access to the SEA region for flights coming from the U.S. Lastly, Ujung Pandang, Balikpapan, General Santos, Zamboanga, and Cotabato are high ranked for flights coming from Australia, because the airports are located in that part of Southeast Asia that is directly above the continent of Australia. If some of these airports are opened to international flights, it could greatly help in stirring up the economy as well as tourism in both countries. As mentioned before, most of major hub airports are located in the extremities of this area so that different airports were selected with respect to the different directions. The result shows that accessibility of airports depend not only on network configuration but also from outside influences of other regions. This means that there is a hierarchical structure on the network depending on the nearness to the gateway. Likewise, geography plays a very important role in the accessibility of airports in the region. The result also shows that the airports that could be chosen as hub, which could function in both domestic and international service, seems limited. Thus, to seek the hub airport is very important on the improvement of domestic air network.

5. CONCLUSION AND POSSIBLE RESEARCH TREND

A comprehensive view of the present domestic and international air transport within Southeast Asia has been presented. A healthy air transportation industry is directly related to the country's strong economy. While tourism related activities has greatly enhanced the airline business of most SEA countries, Indonesia and the Philippines could further develop their tourism industry by opening several international airports, specifically the obtained gateway airports. To open additional airports, hindrances such as security should be carefully weighed versus the growing demand in Asia which could result to airport congestion if not enough infrastructure is constructed.

With the global trend of regionalization, the attempt to combine the domestic and international air networks in SEA and its surrounding regions to locate the best rank airports as hubs for accessibility within and to other continents is one of the promising concepts in air network design. With deregulation imminent, alliances between SEA airlines or SEA airlines with foreign airlines entail the need to analyze a more comprehensive air network covering the area served by the alliance. SEA national carriers with hubs at home need to locate additional hubs for the international market depending on what direction of international demand and wider air network to operate. However, in SEA, it is still necessary to support the bigger aircraft with smaller ones for geographical reasons.

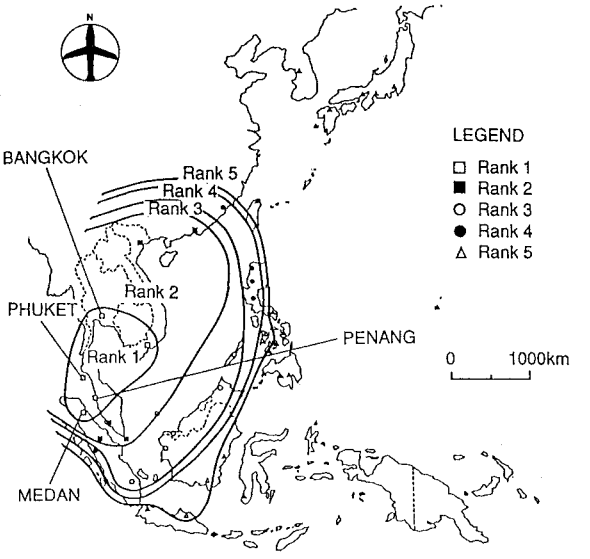

Fig.8 Ranking of Airport in terms of Accessibility within Region

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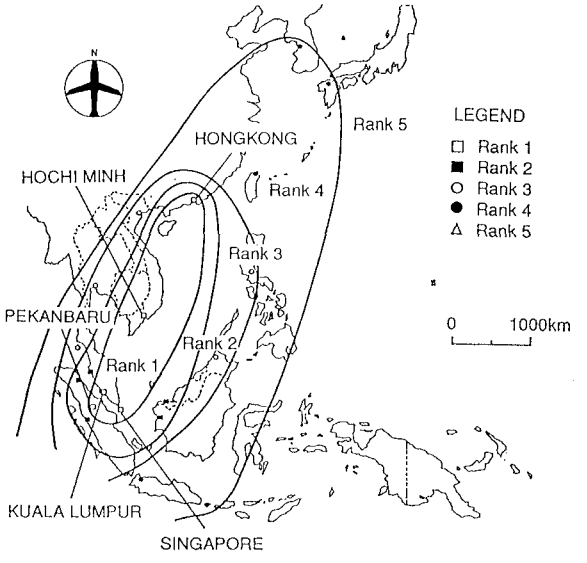

Fig.9 Ranking of Airport in terms of Accessibility from Europe