Future Scenario of International Transport Based on Questionnaire Survey by the Delphi Method

Tsuneaki YOSHIDA
Professor, Dr. Eng.
Department of International Studies
Graduate School of Frontier Sciences
University of Tokyo
Room 774, Kashiwa-no-ha 5-1-5, Kashiwa, Chiba
277-8561 Japan
Fax: +81-4-7136-4874
E-mail: tyoshida@t.toshima.ne.jp

Ryuichi SHIBASAKI
Dr. Eng., Senior Researcher
Port and Harbor Department
National Institute for Land and Infrastructure Management, MLIT, Japan
3-1-1 Nagase, Yokosuka, Kanagawa
239-0826, Japan
Fax: +81-46-844-6029
E-mail: shibasaki-r92y2@ysk.nilim.go.jp

Toshinori NEMOTO
Professor, PhD.
Faculty of Commerce and Management
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo
186-8601 Japan
Fax: +81-42-580-8747
E-mail: cc00330@srv.cc.hit-u.ac.jp

Shinya HANAOKA
Associate Professor, Dr. Eng.
Department of International Development Engineering
Graduate School of Science and Engineering
Tokyo Institute of Technology
2-12-1-I4-12, O-okayama, Meguro-ku, Tokyo, 152-8550, JAPAN
Fax: +81-3-5734-3468
E-mail: hanaoka@ide.titech.ac.jp

Kenji ONO
Direcotr, Dr. Eng.
Coast Administration and Disaster Reduction Division
Ports and Harbours Bureau
Ministry of Land, Infrastructure, Transport and Tourism
2-1-3 Kasumigaseki, Chiyoda, Tokyo
100-8918 Japan
Fax: +81-3-5253-1654
E-mail: ono-k2ea@mlit.go.jp

Hitoshi ONODERA
M. Eng., Researcher,
Port and Harbor Department
Pacific Consultants Co., LTD.
Sekido 1-7-5, Tama City, Tokyo
206-8550 Japan
Fax: +81-42-372-6398
E-mail: Hitoshi.Onodera@ss.pacific.co.jp

Abstract: For a discussion on a future vision of international transport infrastructure and forecast on future trade and cargo demand, predicted figures for variables in socio-economics and infrastructure should be given as prerequisites. They will be simply estimated by extrapolation of past trends or based somewhat on econometric methodology. However, these figures may be very uncertain and difficult to estimate, especially in long-term forecasting with large changes over time. In this paper, following Yoshida et al. (2009a) discussing on future scenario of international economics, a questionnaire survey was conducted in the international transport field targeting many experts based on the Delphi method which seeks to consolidate expert opinions by repeating questions to the same respondents. The most probable future scenario for international transport in East Asia was summarized in order to contribute to the discussion on the direction they will take in the future and how they ought to be.

Key Words: *Future Scenario, Delphi Method, International Transport, East Asia*

1. INTRODUCTION

When discussing a future vision of international transport infrastructure and forecasting future situations of international trade and cargo demand, predicted figures for variables in socio-economic and infrastructural conditions (population, GDP, trade barriers such as tariffs, the progress of infrastructure development and increased size of transport equipment, the cost of fuel etc.) should be given as prerequisites. Extrapolation of past trends or econometric method are often applied as simple methods of forecasting; however, predicting future figures for these various variables will generally be attended by a great amount of uncertainty considering that numerous factors including economic policy will influence in a complex way. In particular, in making long-term forecasts, or under circumstances where major changes or gaps in trends of the times are anticipated to occur, future forecasting using the above methods will involve great difficulties.

This paper examines possible future scenarios for the international transport fields by conducting questionnaire surveys to Japanese experts in order to support forecasting of the international economy and transport, especially focusing on East Asia and discussing them as they ought to be, following Yoshida et al. (2009a) that summarize future scenarios for the international economy fields. This paper attempts to investigate future trends across the overall international transport fields by applying the Delphi method in which respondents answer the same questionnaire several times for a convergence of opinions, as in Yoshida et al. (2009a). After providing a short introduction of the questionnaire survey in chapter 2, the survey results and the most highly probable future scenarios will be described in chapter 3. Based on these results, the mutual consistency between the international economic and the international transport scenarios is investigated in chapter 4. Finally, chapter 5 will discuss future prospects and application methods.

2. SHORT SUMMARY OF THE QUESTIONNAIRE SURVEY

The questionnaire survey for future scenario of international transport was conducted at the same time of the survey for international economy as described in Yoshida et al. (2009a), based on the Delphi method. For detail of the questionnaire survey, please refer to Yoshida et al. (2009a). The authors prepared a number of questions (103 in total) across the various topics of the international transport. The main topic and sub-topic of questions in the international transport field is shown in Table 1.

Table 1 Question topics in the questionnaire survey relating to international transport

B-1 Shippers
- Upgrading of SCM and DCM, trends in site locations of industrial bases, other trends in logistics, etc.
B-2 Ports and maritime transport
- Trends in maritime transport demand focusing on East Asia
- Strategies of shipping companies
- Development of international RORO ships and international ferry transport
- Building and operating of Mega-Container Ships
- New construction and expansion of container terminals and mega-operator trends
- Passenger demand
- Safety and security
- Ports and maritime transport policies in Japan and Asia
B-3 Airports and air transport
- Air transport market trends in the East Asian

- Air transport policies in East Asia
- Air transport security
- Airport and air transport trends in Japan

B-4 Inland transport and intermodal transport
- Development of cross-border transport
- Investment into the inland transport infrastructure

B-5 Others
- Potential for collaboration in common transport policies in East Asia

3. QUESTIIONAIRE SURVEY RESULTS AND FUTURE SCENARIO OF INTERNATIONAL TRANSPORT

The final results for all questions in the questionnaire survey conducted are shown in Figure 1 at the end of this paper. For almost all questions, a large disparity was not observed between the results of the first and second surveys. As well, referring to the graphs in Figure 1, there were few answers for which peaks split into two or were spread out among respondents.

Based on these results and through discussions among authors, the most highly probable future scenario for the international transport overall has been established, as shown below.

3.1 Shippers

The restructuring of manufacturing and logistics bases in Asia is proceeding, bolstered by progress through FTA/ETA's. Various factors are comprehensively drawn from to determine the location of such bases, such as market attractiveness, tariff rates, labor costs, the quality of labor, in addition to various conditions of infrastructural development, the accessibility of logistics services, and political stability, among others.

Since China's entry in the WTO at the end of 2001, investment in China is increasing, and this trend is expected to continue over the short-term (until 2010). In recent years, ASEAN (especially Thailand, Malaysia, and Vietnam) is being reevaluated as an investment destination. As well, India is attracting attention as a market, and over the mid- and long-terms (until 2020), investment into ASEAN and India is expected to relatively increase.

While these countries have introduced special zones which give tax incentives—particularly special logistics-related zones such as export processing zones—as a means to attract investment, it is expected that these zones will continue to increase for the time being. In the long-term, regional enterprises will become stronger, and the necessity to give preferential treatment to foreign capital will wane. Over the very-long-term, it is anticipated that the role played by special zones will become smaller due to the harmonization of industrial competition policies within the region.

Multinational corporations which are deployed in Asia obtain raw materials and industrial parts not only from local enterprises in the countries where they are located, but from companies in neighboring countries, and are shipping products within these countries and regions. Companies need to optimize their management of the entire supply chain within the region in accordance with final consumption demand. For example, in obtaining parts from abroad, the automobile industry is required to conduct "milk run" collections of parts required for production, consolidate them into containers, and to swiftly transport them to

assembly plants. While sophisticated logistics services which respond to the needs of shippers have been provided by Western and Japanese logistics companies, logistics companies established with local capital in China and ASEAN as 3PL have also begun attempts in providing the same kind of services. The quality of services provided by these logistics companies established with local capital is expected to increase over the mid- and long-terms.

3.2 Ports and Maritime Transport

3.2.1 Trends in maritime cargo and passenger transport demand with a focus on East Asia
International maritime container cargo demand in the world is expected to continue growing at least at its current pace into the future (at an annual rate of approx. 10%). It is possible that the pace of growth will further become robust temporarily over the short- and mid-terms. Even international maritime containers to/from the East Asian region and to/from other regions of the world including Western countries, which account for about 2/3 of the world's flow, are expected to follow a similar tendency. On the other hand, as for international maritime containers within the East Asian region, there is a high possibility that the current pace of increase will continue even over the short- and long-terms. While containerization is expected to proceed in the future with a focus on perishable food, scraps, wooden products, and grains etc., it is also possible that a slight swing-back may occur over the very-long-term.

Following 20ft, 40ft, and 40ft high-cube containers, while 45ft containers which received ISO standardization in 2005 only account for about 2% of overall container sizes, it is assumed that they will steadily increase in the future owing to ISO standardization. In Japan, on the other hand, while passage of semi-trailers with 45ft containers on general roads may become possible to some extent in the future, making their passage possible comprehensively will be difficult due to various restrictions.

As well, passenger ship cruise demand is expected to show an increasing trend in the East Asian region for the foreseeable future.

3.2.2 Shipping company strategies, commissioning of ultra-large size ships, and security problems
In recent years, shipping companies are operated under two main styles: major international container shipping companies forming alliances with one another in pursuit of advantage of scale; and the formation of a single giant shipping company through mergers and acquisitions etc. In the past years, although the forming of giant shipping companies has gained momentum (such as Maersk, MSC, and CMA-CGM), recently this trend has been receding. This can be seen for example in how Maersk suffered losses because it was unable to take advantage of the merits of the P&O-Nedlloyd merger. Under these circumstances, while there is a high possibility that the alliance style will become mainstream for the time being (for about 10 years), it is difficult to foresee which style will become predominant over the long-term. On the other hand, major companies have made advances into local shipping routes within East Asia in recent years, and the grouping of regional shipping companies into alliances is expected to continue.

Reduction of transport costs despite rising pressures due to the rise in fuel costs etc., and improving competitiveness to deal with fierce competition among shipping companies due to enlargement of scale and discounts, have become main future themes for shipping companies. Although there is a growing movement in the EU to reexamine competition law exemption regulations for international shipping businesses, the role of agreements between shipping

companies will increase in the future. With respect to empty containers which are becoming a big issue in recent years, in addition to immediate countermeasures to ensure back-haul by offering discounts etc., more essential measures are needed such as accommodation between shipping companies and provision of inland depots and empty container depots and promoting their effective use.

The increasing trend in container ship size is still continuing today, and the building of the first ship to exceed 10,000 TEU was completed in September 2006. In October 2007, major South Korean shipbuilder Samsung Heavy Industries announced that is developed the world's largest container ship with a container loading capacity of 16,000 TEU. Thus, the number of large-size container ships exceeding 10,000 TEU going into service is expected to increase in the future. On the other hand, in the long- and very-long-terms, India and Brazil will become the production centers for the next age, and due in part to the reduction in transport distance to North America and Europe etc., it is also possible that the number of larger ships entering into service will slightly decrease.

In the future, a maximum container ship carrying capacity of 16,000 TEU is expected over the short-term, approx. 18,000–20,000 TEU in about 5 years, and is expected to peak thereafter. While 30,000 TEU ships may emerge in the very-long-term, as diseconomies of scale may occur in the loading and unloading of cargo at ports if ships are too large, the majority of forecasts in this survey were skeptical. Due to the expansion of the Panama Canal scheduled to be completed by 2014, as passage of mega-ships will also become possible, shares of East Asian and North American East Coast routes (relative to North American West Coast routes) are anticipated to expand to some degree around 2020, and is also expected to greatly influence shipping route plans made by international container shipping companies. As a result, mega-ships are anticipated to start servicing not only Asia–European routes, but Asia–North American routes to a similar degree. The number of port calls made in the East Asian region is 3–5 ports for every 1 loop, and may decrease slightly in the future. Shanghai, Singapore, and Hong Kong are expected to be dominant calling ports, followed by Busan and Shenzhen.

From the perspective of maritime transport security, main topics of concern are countermeasures against pirate attacks and against terrorist attacks. Incidents of pirate attacks in the East Asian region are expected to continue occurring in the future with a focus on the Straits of Malacca and in Philippine waters, etc. While costs for security measures are expected to continue occupying a share of logistics costs, the frequency of pirate attacks is not expected to change greatly into the future. On the other hand, owing to strengthening of U.S. container security measures (obligatory inspection of all imported cargo etc.), lead time at ports is anticipated to increase by about 2–3 days over the short-term. Over the long-term, it is expected to be reduced due to technological advances etc. and is ultimately expected to return to or be slightly more than current levels.

3.2.3 The development of international RORO ships and ferry transport

Even in the vicinity of Japan, logistics utilizing international RORO ships and international ferries to supplement container transport and air transport is recently attracting attention. Examples of this are the Shanghai Super Express connecting between Hakata and Shanghai, and the establishment of new international ferry routes crossing the Japan Sea. In the future, international RORO ship and ferry routes in the East Asian region are expected to steadily increase into the future with a focus on electrical and mechanical goods, perishable goods, general merchandise etc.. In particular, shipping routes are expected to be opened and

expanded between Kyushu–South Korea and China, as well as between Hokuriku–Siberia. Among them, short-distance routes such as Kyushu–South Korea and South Korea–China possess the merits of not requiring handling at the port; mid-distance routes such as Kyushu–China and Kyushu–Taiwan possess the complementary element of being positioned between container transport and air transport in terms of cost and transport time; and the Siberia-Hokuriku route possesses the merits attending the expansion of Hot Delivery Service and advances by Japanese companies. Measures which are considered important to enhance use include chassis mutual entry between countries, obtaining major shippers etc. to ensure more stable cargo demand, and easing of regulations for various procedures relating to the establishment of international shipping routes.

3.2.4 Provisioning and expansion of container terminals, mega-operator trends, and port and maritime transport policies in Japan and East Asian countries

Large-scale port development is being planned in various countries, encouraged by the conspicuous growth in container flow and handling volume in the East Asian region in recent years. Among them, it is anticipated that development will proceed at a higher pace than initially planned at various Chinese ports which are recently experiencing the greatest growth (particularly the ports of Shanghai and Shenzhen). The advance of mega-operators and the handling of transshipped cargo are expected to increase with a focus on the above ports and the ports along the coast of Bohai Bay etc. On the other hand, the future for major existing ports and hub ports (or ports aiming to become hubs) in and around China is generally difficult. On this note, the situation of South Korea's Busan (New) Port and Gwangyang Port, Taiwan's Kaohsiung Port, and port of Hong Kong is more critical compared to Japanese ports which still have a larger domestic demand. However, steady growth is expected to continue for the Port of Singapore in the future, partly because it is geographically located far from China. Moreover, ports which have a strong growth potential over the long-term, although presently still inconspicuous, are Vietnamese ports such as Hai Phong and Ho Chi Minh, and ports in India. The advance of (mega-)terminal operators into these ports and in Far East Russia is expected to proceed in the future.

Starting from a few years ago, aiming to strengthen the international competitiveness of its ports, Japan has introduced super hub port policies in the context of "selective and focused" policies. The aim of these policies is to reduce port costs by 30% and to reduce customs clearance time to about 1 day, equivalent to the level of the Port of Singapore, until around 2010. While both objectives are expected to be achieved by around 2015–2020, their achievement by 2010 is expected to be difficult. As future policies which are considered necessary to sustain and strengthen the international competitiveness of Japan's ports, the easing of port transport regulations is expected to be important, in addition to making further efforts to pursue current agendas raised by the super hub port policies such as keeping the gates open for 24 hours, cooperative strengthening of ports and hinterland transport facilities, promotion of cooperation between ports, and the provisioning of large-scale terminals etc. In addition, it is possible there will be gradual progress made toward the easing of cabotage regulations in the East Asian region over the long- and very-long-terms.

3.3 Airports and Air Transport

3.3.1 The air transport market in East Asia

Air transport liberalizations are making headway in various regions around the world, especially in North America and Europe. In the East Asian region, regulations for aviation

services between capital cities within the ASEAN region will be abolished by 2008, and full liberalization within the region and elimination of foreign capital regulations are scheduled by 2015. This movement has fallen into step with the goal of realizing the ASEAN Economic Community by the same year. On the other hand, in North East Asia, liberalization is not expected to make sufficient progress over the short-term. However, gradual liberalization in the form of easing capacity regulations9 is expected to proceed over the mid- and long-terms in this region.

Under these conditions, international passenger demand in the East Asian region is expected to continue increasing gradually over the short-, mid-, and long-terms, international cargo demand will increase significantly over the short-term, and is thereafter expected to maintain a high rate of growth with a focus on telecommunication devices. International services by low-cost carriers (LCCs) and regional carriers will increase over the short- and long-terms, and together with this trend, the use of mid-sized aircraft (B737, A320 class) with a seating capacity of 100–200 seats will be increased. The use of small aircraft (CRJ, Embraer class) which seat less than 100 passengers are expected to continue increasing. While the use of large-size aircraft is anticipated to increase gradually over the long-term, due to the emergence of ultra-large size A380 capable of seating passengers on two floors, the trend toward making larger aircraft will gradually decline over the very-long-term. Airlines entering into air transport alliances are expected to increase over the long-term, and mergers and acquisitions between alliances are expected to proceed over the mid- and long-terms as well.

3.3.2 Airports in East Asia

The development of Shanghai's Pudong International Airport and Seoul's Incheon International Airport into hub airports will proceed over the short- and mid-terms, in terms of both passenger and cargo, in the background of increased direct flights to North America owing to improvements in the performance of aircraft, expansion of airport capacity, and strategic cooperation between airlines and airports. It is also possible that Hong Kong International Airport, Beijing Capital International Airport, and Guangzhou Baiyun International Airport will grow as hub airports for the same reasons. Okinawa's Naha Airport is expected to become a hub airport for cargo transport in the region. In terms of airport development, new runways and terminals will probably be constructed at Pudong Airport and Incheon Airport, as well as at Beijing Airport and Bangkok's Suvarnabhumi Airport which are continuing to expect increased demand in recent years. The construction of new airports is also expected to continue in mainland China and India which are expanding rapidly in terms of air transport demand in the last decade.

Since the 9/11 terrorist attacks in the U.S. in 2001, security measures in the air transport sector are being strengthened annually. Due to these security measures, more time is being required to conduct various procedures at airport terminals, which makes increased congestion a possibility. In the long-term, the costs for these security measures may be shifted onto air fares.

3.3.3 Air transport and airports in Japan

As Japan's population has begun to decrease, domestic air transport demand and international outbound flight demand is expected to gradually increase until around 2015, and demand is expected to stagnate or decline thereafter. Due to the declining birthrate and a growing proportion of elderly people, passenger demand among the young adult segment is expected to decrease over the short- and mid-terms and demand among the elderly will increase. International inbound flight demand is expected to increase gradually due to the approval of

travel without a visa and policies to attract tourists. In particular, demand from neighboring Asian countries such as China and South Korea will increase, and LCC and regional carriers will enter the market.

To respond to increased air transport demand in the Tokyo metropolitan area, airport capacity will be increased by improving air traffic control. Over the very-long-term, the construction of a third airport in the Tokyo metropolitan area may be discussed. After the completion of a 4th runway at Haneda Airport, scheduled international flights with the world's major cities especially with neighboring countries will most likely become operational. For Japan as a whole, reforms to the special account for airport development, and incorporation and privatization of public airports are expected to proceed. Over the long-term, a restructuring of the airport management system may occur.

3.4 Inland Transport and Intermodal Transport

3.4.1 Development of cross-border transport

Among regions in Asia, cross-border land transport is developing the most in the South East Asian region (ASEAN plus China's Yunnan Province and Guangxi Province) and continued development is anticipated into the future. In addition, cross-border barriers between North East Asia and Central Asia are expected to decrease over the long-term, and to continue in South Asia.

Important measures which will contribute to decreasing cross-border barriers, in order of descending priority, include the simplification of cross-border procedures, provisioning and upgrading of transport infrastructure and immigration management facilities, the improvement of cargo transshipment facilities and promotion of the mutual entry system, simplification of customs clearance procedures and worker training, demand stimulation and the introduction of intermodal promotion policies.

As for the acceleration of economic growth in Asian countries, the function that ports will play in effectively connecting their comparative advantage in manufacturing and other fields to the world's economy should be particularly noted. Ports not only serve as logistics bases, but have formed giant centers of production and consumption. Main Asian countries have shared an open market development strategy since the 1980's, and major cities and industrial centers formed in their environs have gradually transcended borders and established effective connections through economic corridors. In particular, ASEAN countries have made it their common objective to increase their international competitiveness through strengthening regional cooperation relative to the world market. In order for this region to achieve its common purpose, a reduction in cross-border barriers is indispensable. As well, reduction in cross-border barriers is also desirable from the viewpoint of correcting regional income disparities between coastal regions and inland regions.

3.4.2 Transcontinental infrastructure development

Routes on the Trans-Eurasian Railway forecast to have the largest demand are the Siberia Land Bridge, followed by the China Land Bridge, and the Mongol Tianjin route; there is a small demand in other routes. As well, individual routes such as the Trans-Korea Railway between South Korea and North Korea, and railways between Singapore and Kunming are not expected to enter service over the short- or mid-terms, although there are prospects over the very-long-term.

Among the many inland transit corridors of the Greater Mekong Sub-region (GMS), the most economically effective corridor is the North-South corridor, followed by the East-West corridor, and the Southern corridor in order of descending priority. Over the very-long-term, Myanmar and Thailand are expected to play greater roles as inland corridor hubs connecting the economic zones of China and India.

As for the development of Asia's highways and railway networks, while both show a tendency for increased development, there is a higher priority for the development of highways compared to railways and their pace of development is also fast. In the regions of China, ASEAN, and India, while shares of railway and domestic water transport are not expected to increase over the short-term, they are expected to increase over the long-term. This is because in addition to positive expectations of higher demand for long distance transport crossing borders, they are comparatively superior to roads in responding to increasing energy costs and environmental problems.

3.4.3 Development of inland centers

Although the development of inland centers which will be indispensable for the development of cross-border and transcontinental transport will not proceed immediately, much progress can be anticipated in the future due to the introduction of various policies in the mid- and long-terms (provisioning of depot facilities, development of intermodal hubs, reduction in lead time due to the procedures for consolidation and customs clearance through agency, and cost reductions due to accommodation for empty container transport).

An increase in door-to-door intermodal transport demand straddling various transport modes (road, railway, water, and air), with a focus on economic corridors which cross borders and connect mega-cities in the East Asian region can be expected over the short- and long-terms.

3.5 Common Transport Policies

Although about half of the plans under the TEN-T project (which is being promoted under Europe's Common Transport Policy) are expected to be realized by around 2015, the realization of most projects is forecast for after 2020.

On the other hand, there are several issues which are impeding the realization of a seamless transport environment in Asia ("Seamless Asia"). Other than the delay in hard infrastructure development such as roads, railways, river routes, ports, and airports etc. which make up the Asian transport network, there are differences in structural, safety, and environmental standards for automobiles, trains, ships, and aircraft etc. which are important software (soft infrastructure) required for the smooth operation of the transport infrastructure. As well, administrative procedures in border-crossing such as customs, immigration control, and quarantine procedures etc., as well as various cross-border transport obstacles (cross-border barriers) originating from bilateral differences in soft infrastructure such as insurance systems etc. can be raised.

In overcoming these issues, following after the example of European Common Transport Policy, efforts to formulate cooperative transport policies and joint policies in the East Asian region are expected to become increasingly necessary in the future. These include dealing with standardization of data specifications and development and publication of joint database relating to domestic and international transport flow in the East Asian region and infrastructure stock etc.. This also includes promoting research exchange, strengthening and

developing cooperation among East Asia's universities, research institutes, and working groups, as well as establishing socioeconomic scenarios and a framework which should be shared in East Asia.

3.6 Consistency and Risks of Each Topic in the International Transport Scenario

As with Yoshida et al. (2009a) on the international economy, the scenario described in this paper which was created from the numerous opinions obtained from the questionnaire results for the international transport section was generally found to be consistent overall. There were no major discrepancies in the tendencies of each sector such as shippers, maritime transport and ports, air transport and airports, inland transport and intermodal transport, among others. However, differences in opinion were discovered for some questions with a focus on very-long-term trends, such as that containerization will slightly decline in the very-long-term, special logistics zones will continue to exist even over the long-term, and the number of large-size ships will decrease over the very-long-term etc.

With respect to the "timing" which needs to be decided in advance when making specific forecasts using a model etc., there may also be cases which will diverge from the basic scenario that we have seen thus far. For example, perhaps no one who could have anticipated before 9/11 that terrorist attacks involving airplanes would occur causing air transport demand to drop significantly, requiring a certain amount of time for recovery. Or, how in the case of the Asian currency crisis in 1997, Asian trade was thrown into confusion if only temporarily. The occurrence of such unanticipated situations will have a major effect on the growth process of international transport. Using an analogy from more recent circumstances, it can be said that we are now at a crossroads in judging how the sharp rise in the resource price such as crude oil and worldwide financial crisis instigated in the U.S, are expected to influence international transport flow (whether it will influence short-term or long-term trends).

4. CONSISTENCY BETWEEN THE INTERNATIONAL ECONOMIC SCENARIO AND THE INTERNATIONAL TRANSPORT SCNENARIO

Examined comprehensively, large discrepancies between both scenarios were not observed and they were largely judged to be consistent. However, with respect to various types of transport infrastructure policies, in particular cross-border policies, we cannot expect the effect of the policies to be realized if the international politics of the regions in question do not stabilize. Again, cargo and passenger demand will of course be influenced by economic growth in each country, by international economic and trade policies such as FTA etc., or by regional development policies. In ascertaining these causal relationships and forecasting periods and sequences of realization, it is necessary to carefully investigate the circumstances using various models etc.

The escalation of environmental and resource issues as well as risk scenarios will affect both the international economy and international transport. For example, the major natural disasters mentioned in (1) as risks for international economics, will have a large impact on international transport flow, while the terrorist attacks mentioned in (2) as risks for international transport will of course have a large impact on international economics. With respect to climatic changes, while there will be an increased frequency of disasters and the increased risk of flooding of coastal regions etc., it is also possible that a significant reduction

in transport costs may be realized from an increased supply of energy and utilization of Arctic routes through development of the Arctic area.

In developing models based on this scenario and considering derivative scenarios, they should be discussed keeping in mind the repercussions from all topics mentioned in this scenario, rather than focusing only on the individual results of responses.

5. CONCLUSION

In investigating possible scenarios which may arise in the future of the international transport fields, the authors conducted a questionnaire survey toward experts based on the Delphi method and established the most probable scenarios based on aggregate results. We also investigated the mutual consistency between the survey topic results and the consistency between the international economic and the international transport scenarios. The results showed that despite the large number of respondents, there were many questions which showed relatively small variance. From a comprehensive viewpoint, the scenarios derived, as well as the aggregate results were within reason.

In addition to widely releasing the results of this study to the public both in Japan and internationally, and in applying the results to future forecast models which is one of the objectives for implementing this survey, it will be necessary to construct a quantitative future scenario based on the results of this survey. We hope to be able to use it for various applications such as for model input values, for validating output results, and as basic reference data to be shared among model constructors when setting policies and directions for model building.

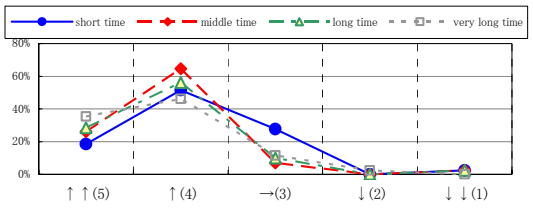
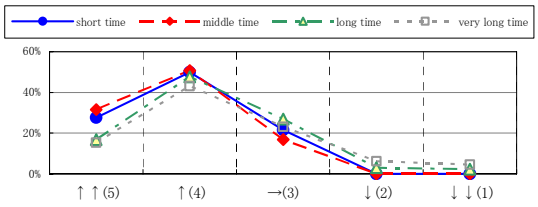
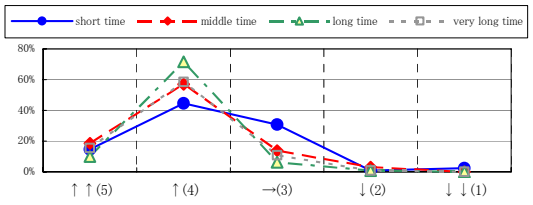
ACKNOWLEDGEMENTS

We would like to express our gratitude to all those who cooperated in responding to this questionnaire survey, despite its length. We would also like to thank chairman Kuroda and the members of the Japan Society of Civil Engineers, International Transport Network Strategy Research Committee. This research was also partly supported by Grant-in-Aid for Scientific Research (B) No. 20310084.

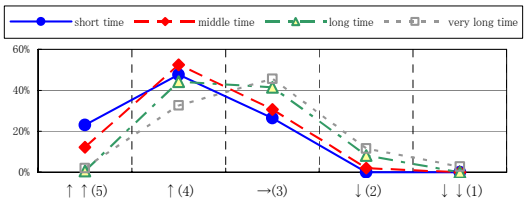
REFERENCES

Yoshida, T., Shibasaki, R., Abe, K. and Onodera, H. (2009a) Future scenario of international economics based on questionnaire survey by the Delphi method, Proceedings of the Eastern Asia Society for Transportation Studies, Vol.6 (under reviewing)

B-1. Shippers

Upgrading SCM and DCM, trends in site location of industrial bases and other trends in logistics		Number of respondents	81 people
Upgrading SCM and DCM			
B1	Do you anticipate that the **sophistication of Supply Chain Management (SCM) comparable to Western standards** (inventory control, just-in-time transportation, introduction of high-frequency small-lot deliveries, etc.) in manufacturing businesses such as electronic and electric equipment and automobile manufacturing etc. in **China and ASEAN regions** will progress in the future?		
Site location of manufacturing bases			
B7	Do you anticipate that **special zones for logistics and export processing zones etc. will continue to proliferate** in the **East Asian region** in the future?		
Other logistics trends etc			
B8	Do you foresee an increase in cases of **companies established with local capital in China and the ASEAN region** involved in ground transport and warehousing, **venturing into the 3PL business** etc. in the future?		

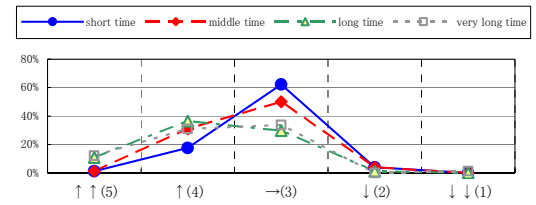
B-2. Ports and maritime transport

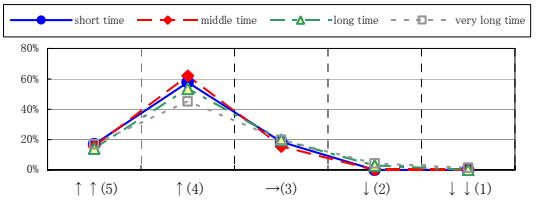
1) Trends in maritime transport demand focusing on East Asia		Number of respondents	83 people
Container and bulk cargo demand			
B12	**International marine container demand to/from the East Asian region and from/to other regions of the world with a focus on Western countries**, accounts for about 2/3 of such transport flow in the world, and in recent years (the past 5 years) has been growing at an average annual rate of about **12%**. This accounts for a large share of the world market, and slightly exceeds global average growth. In the future, what are your forecasts for the **growth rate** of such cargo, **relative to global average growth**?		

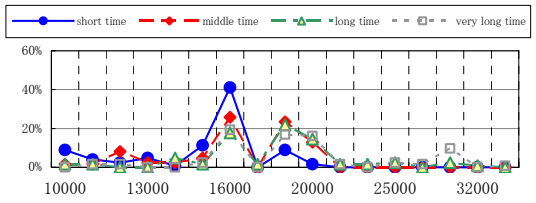
2) Shipping company strategies		Number of respondents	74 people
Shipping route formation (transshipment, empty container transport)			
B22-1	Currently, Busan, Kaohsiung, Hong Kong, Singapore, Tanjun Pelapas, Colombo, etc. are main transshipment ports (including domestic and international transshipment) in the East Asian region. As well, even with respect to mainland Chinese ports, the rate of transshipment is expected to increase in the future due to the dramatic increase of cargo volume itself and proactive port investment. 1) Name the ports you anticipate will have an increased rate of transshipment in the future (top 4 ports).		

Rank	Response	Score
1st	Shanghai	301
2nd	Singapore	163
3rd	Pusan	100
4th	Hong Kong	100
5th	Shenzhen	88

Figure 1 Excerption of questionnaire survey final results relating to international transport (1)

Effects of the Panama Canal expansion		
B24	Approx. 75% of cargo between East Asia and North America is transported by way of the North American West Coast route, while the remaining approx. 25% is transported by the North American East Coast route. Expansion work on the Panama Canal is currently underway, and by 2014, the passage of 12,000 TEU class container ships will be possible. On the other hand, observations have also been made that canal passage fees will be raised substantially. How will shares of the East Asian and North American East Coast routes be affected by the Panama Canal expansion project? If there are any other effects that you can think of, please write them in the comments column.	

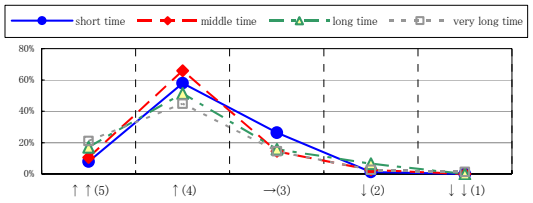
3) Development of international RORO ships and international ferry transport		Number of respondents	68 people
Formation of international RORO shipping routes and international ferry routes			
B25	Cargo transport utilizing international RORO ships and international ferries to supplement container transport and air transport, such as the Shanghai SuperExpress connecting Hakata and Shanghai, and movements to establish new international ferry routes across the Japan Sea are attracting attention. Do you foresee the **number of routes in the East Asian region for international RORO ships and international ferries** increasing in the future?	

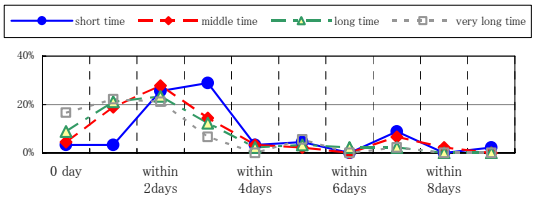
4) Building and operating of Mega-Container Ships		Number of respondents	73 people
Building of Mega-Container Ships and service routes			
B29	It is said that a 16,000 TEU class Mega-Container Ship is scheduled to enter service in the first half of 2009. To what extent do you anticipate the **enlargement of container ship** size will progress in the future? (enter the **maximum loading capacity (TEU) that you anticipate** for each period of time)	

5) Provisioning and expansion of container terminals and mega-operator trends		Number of respondents	59 people
Plans for the new construction and expansion of container terminals in East Asia			
B32-1	"Among Japan's neighboring countries, the construction of new berths and expansion of existing terminals to possess hub functions are proceeding, such as Shanghai Port, Pusan New Port, and Gwangyang Port. Considering the investment plan on port facilities in the East Asian region (such as the number of constructed and planned new berths) and future cargo demand, 1) list the ports which you anticipate have a relatively high potential to achieve their port improvement plans (or, to be implemented ahead of schedule) (top 4 ports).		

Rank	Response	Score
1st	Shanghai	385
2nd	Pusan New Port	108
3rd	Shenzhen	92
4th	Singapore	63
5th	Tianjin	32

Figure 1 Excerption of questionnaire survey final results relating to international transport (2)

6) Passenger demand (passenger cruise ship)		Number of respondents	73 people
Cruise ship demand			
B34	Do you anticipate **demand for passenger cruise ships** (including domestic and international) in the **East Asian region** including Japan will increase in the future?		

7) Maritime transport safety and security		Number of respondents	62 people
The effects of pirate attacks			
B36	Name the ocean area in the East Asian region **where you expect pirate attacks will most occur**. (top 4 areas)	Rank / Response / Score	
		1st / Straits of Malacca / 234	
		2nd / Philippine waters / 122	
		3rd / Indian Ocean / 51	
		4th / East China Sea / 48	
		5th / Indonesia waters / 30	
The effects of strengthening the U.S. Container Security Initiative			
B38	In the future, inspection of all cargo at the port of the exporting country will be made mandatory for all container cargo bound for the U.S. Due to the implementation of such policies etc., how many days do you anticipate lead time at ports will be prolonged compared to current conditions? Consider the long-term course of policies in your response.		

B-3. Airports and Air Transport

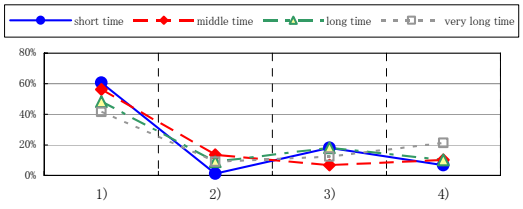
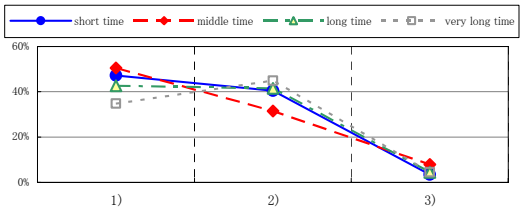
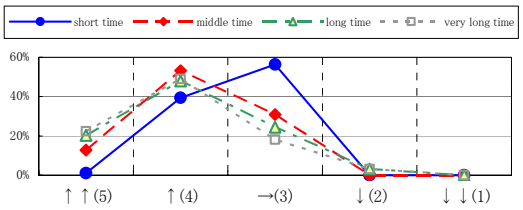
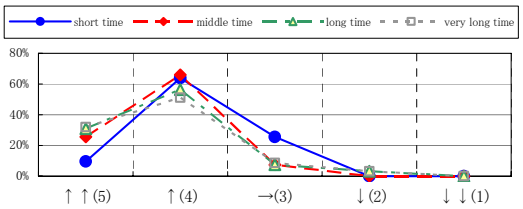
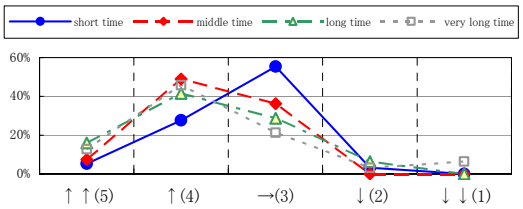
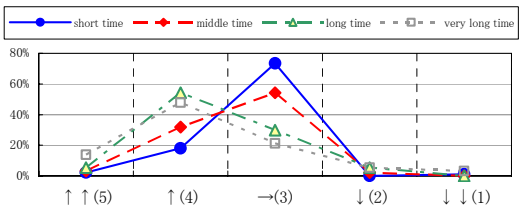
1) Air transport market trends in the East Asian region		Number of respondents	63 people
		Level of expertise	◎high 8 people / ○medium 10 people / △low 45 people
Air transport demands in the East Asian region			
Regional carriers and low-cost carriers (LCCs) in the East Asian region			
B50	Do you anticipate that **regional carriers** and **low-cost carriers** (LCCs) will increase in the East Asian region in the future? 1) Both will increase 2) Only regional carriers will increase 3) Only low-cost carriers will increase 4) Neither will increase		
Aircrafts in the East Asian region			
B55	Do you anticipate that international cargo aircraft servicing the East Asian region will grow in size? 1) They will become larger 2) They will not change in size 3) They will become smaller		

Figure 1 Excerption of questionnaire survey final results relating to international transport (3)

B-4. Inland transport and intermodal transport

1) Development of cross-border transportt — **Number of respondents: 65 people**

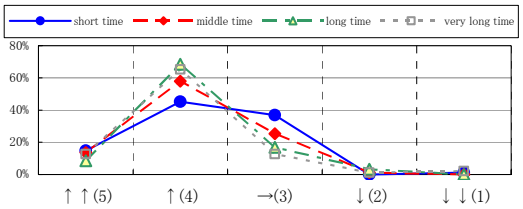
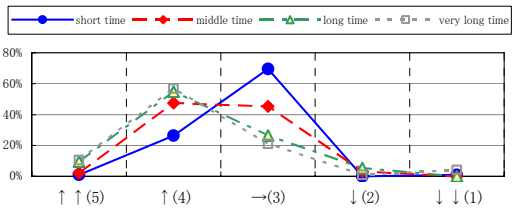
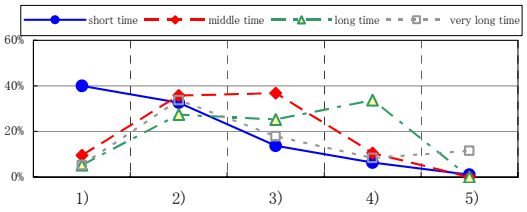
Development of cross-border transport (over a broad range)

B74	Do you anticipate that various policies for cross-border infrastructure development and cross-border barrier reduction implemented in the **North East Asian region** (South Korea, North Korea, Russia, Mongolia, North East China) will accelerate the **reduction in cross-border transport** (cargo and passengers) **barriers**?	
B75	Do you anticipate that various policies for cross-border infrastructure development and cross-border barrier reduction implemented in the **South East Asian region** (South China, Vietnam, Laos, Cambodia, Thailand, Myanmar, Malaysia) will accelerate the reduction in cross-border transport barriers?	
B76	Do you anticipate that various policies for cross-border infrastructure development and cross-border barrier reduction implemented in the **Central Asian region** (West China, Russia, Kazakhstan, Uzbekistan, Turkmenistan, Kirghiz, Tajikistan) will accelerate the reduction in cross-border transport barriers?	
B77	Do you anticipate that various policies for cross-border infrastructure development and cross-border barrier reduction implemented in the **South Asian region** (South West China, Nepal, Bhutan, India, Bangladesh, Pakistan) will accelerate the reduction in cross-border transport barriers?	

Development of cross-border transport (individual routes)

B81	A **total of 6 routes** have been proposed as **transcontinental transport infrastructure connecting North East Asia and Europe**, including the Siberia Land Bridge passing through Russia, and the China Land Bridge passing through China, Central Asia, and Russia. What do you anticipate will be the **most important (largest demand) routes** in order of descending priority?	Rank	Response	Score
		1st	Siberia Land Bridge	229
		2nd	China Land Bridge	168
		3rd	Mongolia and Tianjin Trade Corridor	128
		4th	Tumen River Trade Corridor	93
		5th	Suifen River Trade Corridor	72
B82	In the **Greater Mekong Sub-region (GMS)**, the development of economic corridors called the East West Corridor, the North South Economic Corridor, and the Southern Economic Corridor is proceeding. In future trade in this region which utilizes surface transport networks including the above economic corridors, what routes do you anticipate will have the **greatest economic benefit** in order of descending priority?	Rank	Response	Score
		1st	North South Economic Corridor	230
		2nd	East West Corridor	222
		3rd	Southern Economic Corridor	199

Figure 1 Excerption of questionnaire survey final results relating to international transport (4)

2) Investment into inland transport infrastructure		Number of respondents	66 people
Transcontinental infrastructure			
B83	Do you anticipate development of the **road network proposed by UNESCAP's Asian Highway plan** will accelerate overall in the future?		
B84	Do you anticipate development of the **railway network proposed by UNESCAP's Asian Railway plan** will accelerate overall in the future?		
Development of inland centers			
B90	In the East Asian region, do you expect **development of inland centers** for inland depots etc. will progress? As well, if you expect development will progress, **what benefits** can most be anticipated? (response numbers) 1) Development will not progress 2) Hubs interconnecting roads, railways, and rivers (development of intermodal transport) 3) reduction of lead time at ports and airports through the handling of loading and customs clearance procedures by agency 4) Reduction in transport costs and traffic volume through more flexible handling of empty containers etc. 5) Other effects		

B-5. Common transport policies

1) Common transport policies in East Asia		Number of respondents	93 people
Realization of a seamless Asia			
B91	To realize a seamless Asia such as through sustainable development for Japan and each country in Asia, as well as through the formation of continuous international transport networks, **what issues and themes should be dealt with immediately**? (top 4 issues)	Rank	Response / Score
		1st	2) Delays in development of hard infrastructure such as roads, railways, ports, and airports etc. — 203
		2nd	4) Cross-border transport barriers caused by differences in structural, safety, and environmental standards for automobiles, trains, ships, and aircraft etc. — 196
		3rd	5) Cross-border transport barriers caused by differences in cross-border administrative procedures including customs, immigration control, quarantine etc., as well as insurance system — 191
		4th	3) Discontinuities in the domestic transport network and cross-border transport infrastructure accompanying delays in infrastructure development and upgrades — 166
		5th	1) Delays in introducing the principle of competition for the transport sector — 74

Figure 1 Excerption of questionnaire survey final results relating to international transport (5)