TRANSPORTATION INFRASTRUCTURE IN ASIA: PRIORITIES THAT WILL FACILITATE TRADE WITH EUROPE

Nikolaos Deonas, MS in Transportation, MIT June 2004, deonas@mit.edu, Ph# 617-480-4080

Carl Martland, Senior Research Associate and Lecturer, Massachusetts Institute of Technology, Department of Civil and Environmental Engineering, martland@mit.edu, Ph# 617-253-5326

ABSTRACT

This paper examines the implications of the rapid growth in demand for trade between Europe and Asia for the existing transportation network and logistics infrastructure. Trade between Asia and Europe potentially involves highways and railways, as well as ocean and air transportation. It is thus more complex than the highly developed trade between Asia and the Americas, which is of necessity focused on ports and airports.

Upgrading the infrastructure to support trade with Europe will require efforts in the following major areas: 1) transportation and logistics technologies need to be improved and made compatible with each other, 2) multimodalism and modal interconnectivity need to be fully implemented, 3) capacities have to grow, facility efficiencies need to improve, 4) planning processes, and government policies need to be updated.

The nature and extent of the required changes depend on the role of each country in the region, as well as the capabilities and utilization of the existing infrastructure. Based upon an assessment of each country's major transportation modes, their logistical infrastructure, and their use of IT, the forty-eight Asian countries were grouped into three categories according to their level of development.

Leading economies of the region appear to be very successful and are highly competitive in global trade. They possess an overall adequate network but in some cases their facilities are limited by space constraints or challenged by congestion. Suggestions include network optimization and use of high technology applications, such as ITS and EDI that can improve these countries' efficiency and capacity utilization of the existing network.

Developing countries of the region need to further implement best practices and attract funds for the development of their infrastructure. The quality and extent of their transport networks vary and there is a lack of coordination and integration among modes. A lack of paved roads and regional inequalities are the main concerns of their systems. These countries need to add infrastructure in all the different modes of transportation sufficient for international and interregional trade, finalize the connections within the rail, ocean, and trucking industry to facilitate multimodal trade and expand the capacity of existing routes to keep pace with traffic. They also need to attract foreign investment and lower taxation and tariffs in order to assist their economy and global positioning.

Poorer and less developed countries have inadequate or non-existent infrastructure. They lack public transit modes and old vehicles operate on a largely unpaved network. Freight traffic is severely hampered by low speeds on low-capacity obsolete networks, which add delays and risks to the operation. Furthermore, cooperation with their neighboring countries is almost non-existing. These countries need to build or expand their basic infrastructure in order to assist in the transportation of their own products, and they must be able to communicate much more effectively with the rest of the world. Because of their location, some of these countries could play a greater role in international trade, but only if they achieve political stability and upgrade their networks to be compatible and connected with those of their neighbors.

INTRODUCTION

Asia has been experiencing rapid economic growth for the last several decades. This progress was made possible, to a large extent, by opportunities provided by the US and others to establish partnerships that have made Asia the "world's manufacturer". For many countries in Asia, trade is the key to success. Trade on the other hand requires the implementation of a well-organized transportation and logistical network. Currently, Asia has a few major ports that are sufficient to serve trade with the US. These ports are located in the eastern part of the continent, and they have been a major factor supporting the economic growth in the region. At the same time, one can notice that development in the region seldom extends inland more than a few hundreds of miles from these ports. This one-dimensional, one-sided development has not focused on other possible trade patterns. In particular, land-based trade routes that connect Asia and Europe are not developed. The existing transportation network will need to be upgraded to handle future growth in Asia, especially as economic development extends further inland and countries in the region seek to increase trade with Europe. Trade with Europe is a priority for countries in Asia, and trade with Asia is also a growing market for countries in Europe. In order to facilitate this trade, Asia needs to improve its transportation network and provide more options for products to be transported safely, efficiently and reliably.

The goal of this paper is to investigate trends in trade between the two continents, underline the diversity of the countries within the region, and identify different approaches to upgrading infrastructure to meet the needs associated with increasing trade[1]. The analysis first categorizes the countries within the region according to their level of infrastructure. It then suggests priorities for improving infrastructure to support trade, which naturally differ significantly depending upon the existing facilities and current levels of economic activity. For many countries within the region, much more is needed than expanding port capacity or fine-tuning of existing networks.

BACKGROUND

The trade flows within Asia, and between Asia and the rest of the world, are already huge[2]. Within a continuously expanding volume of international trade, the Asia-Pacific region has been the most dynamic region in the last decade. The demand for imports and exports of this major market is anticipated to grow even more in the coming years[3].

In order for that growth to be successful and bring desirable results in terms of profits to the area, the transportation sector will have to be capable of dealing with the expected high level of demand and the operating requirements for various market segments. The physical requirements for success are a well-developed network of modes, which allows intermodality and interconnectivity, facilitates the flows of commodities and people, and operates efficiently with the help of information technology.

In particular, the level of infrastructure in Asia needs to be examined in relation to the routes towards its west. Trade between Asia and Europe has increased in recent years and is expected to grow more in the future. The European Union (EU) is the largest trading bloc in the world[4]. In recent years the dramatic depreciation of the dollar against most other currencies has been driving the Asian economies to new geographic areas of interest both for investment and for allocation of markets and funds. The Euro is a very powerful currency, so doing business with the Europeans can potentially have a significant meaning for the development of these ultimate trading economies.

Trade between Asia and Europe potentially involves highways and railways, as well as ocean and air transportation. It is therefore could be more complex than the highly developed trade between Asia and the Americas, which is focused on ports and airports. The transportation and logistical infrastructure in such a developing area plays a key role in the efficiency of the operations in the global arena of competition. If the infrastructure within the countries that want to expand their trade, as well as in the neighboring countries that are intermediates and flows need to pass through, is inadequate, their positioning in the market will not be winning and the infrastructure will be, instead of a promotion tool, their competitive disadvantage. Nowadays, missing links in distribution are observed.

Asia is home to more than half the world's population[5]; the growth rate of this population is significantly high[6]. At the same time, the urbanization level is extremely high with one in three people living in major cities. According to forecasts the urban population in Asia is expected to double by 2025, and Asia is projected to have a large number of the so-called "Megacities"[7]. Rapid growth will place heavy demands on existing, often inadequate transportation systems. This is expected to create serious

implications for mobility of people and the organization of freight movements, making trade more difficult. Poor interconnectivity among major urban areas could affect patterns of employment, production and consumption. The development of infrastructure to support this massive concentration in population and to enable continued growth in trade will be a major challenge. In Europe, the enlargement of the EU to 25 countries has created a 420 million-consumer market. This market consists of various consumer segments that attract Asian companies and create great potentials and new business opportunities at both "premium and discount level, mass and niche markets." [Fuchs, 2003] The evolution of the EU will be reflected in new trade and transport policies that could change the old traffic flow patterns in order to achieve widespread economic benefits.

The Eastern Mediterranean area, specifically Eastern Europe, the Balkans, and the Middle East, has a very strategic location as the interface between three continents, Europe, Asia, and Africa. While Africa is not a target market for consumer products, the Suez Canal is a vital route for the transport of products among these three continents and it plays a critical role worldwide. The Black Sea Region has also the potential to offer significant routes that can facilitate the trade between Europe and Asia. [Candemir, 1998]

Other countries, such as Romania, Bulgaria, Turkey, the Transcaucasian states and the Central Asian Republics are mainly concerned with the issues of integration into the world economic order. These countries will need to restructure their transportation networks and organizations so as to lead to a general globalization of their economies and their trade. New trade patterns are already emerging and are bound to develop further. All parties involved understand the great potentials for cooperation as well as the need for improvement of the existing infrastructure[8].

Europe Targets Asia and Asia Targets Europe

Europe has a long history of trade with the Far East. Although it seems that the European consumer products are sometimes too expensive for the majority of the population in Asia, a lot of European machinery and equipment are imported by Asia. Asia, being a labor-intensive area that exports consumer products mostly to the USA, is similarly interested in Europe and lately grows its trend to target the European market.

At the same time, the European societies are mature societies that are well able to afford much greater imports from Asia, including both luxuries and cheap consumer items. European "High Net-Worth Individuals" or "Affluent Clients"[9] currently own 32 percent of the worldwide money in private hands. In 2001, they had the highest growth rate (6%) in worldwide wealth - an amount that has grown by 440 percent since 1986. On the other hand, a new poverty trend in Europe builds a segment of bargain hunters and discounters who are trying to combine good quality with low prices (what is called "value for money"), something that mostly Asia has to offer because of its particularly cheap workforce.

Additionally, the case of China shows that until recently the highest share of Asian products including textiles, electronics, or consumer durables are export goods for the US markets; this indicates a great dependency. According to Fuchs, in the year 2000 the US imported hard goods with a value of more than US$100 billion from China. Today approximately 60 percent of the imported consumer hard goods in the US come from China, and the remaining portion comes from other Asian countries where US companies have outsourced their production. An increasing number of Asian companies try to break this dependence and enter more dynamically into the European market.

Moreover, the weakening dollar, is giving an extra incentive to the Asian economies to look into more profitable and promising relationships with Europe. Increasing deficits in the United States may eventually lead to a reduction of imports. Asian countries may therefore have a strong incentive to find new partners and expand to new territories with high capacity markets in order to reduce their market risks.

Finally, Asia's current domestic demand is only around 70 percent of that of the EU's original 15 members. By raising trade with Europe, Asian brand companies have a great potential to access new markets and generate more revenues.

Trade In Asia: Importance of Trade for the Region

The rapid economic growth in Asia has resulted in a new geographical pattern of world production and trade. The EU, Asia, and the countries that belong to the North American Free Trade Agreement (NAFTA) dominate the world economy. Approximately 82 percent of the world's total production of

goods and services and 73 percent of world exports (compared to 65 percent of exports in 1980) originated from the three blocs in 1996. The Gross Domestic Product (GDP) of the Asian countries almost doubled in the period 1980 to 1996, reaching 24 percent of the world's GDP. The EU ranks first with 30 percent of world production followed by NAFTA with 28 percent. Even though Asia ranks in third position, it is the second largest exporter among the three regions. [Hellvin et. al., 2000]

Trade is a very significant element of the economies in the area. From an economic perspective, trade improves the macroeconomic environment of the countries and measurements of quality of life such as the GDP and the per capita income. Over time, developing Asian countries managed to improve their poverty rate while increasing their trade growth[10]. While trade becomes a more important factor for the economy (as a percentage of the GDP), there is a negative correlation with the number of people who live under the poverty level of one-dollar-a-day compensation. At the same time, in remote regions of East Asia there seems to be an increase in poverty, because of a lack of interconnectivity with the outside world. [Krumm, 2003]

The transportation infrastructure in the region is an obstacle to development and does not facilitate the expansion of trade. Nonexistent or underdeveloped modes of transportation and fragmented networks provide no interconnectivity or intermodality in large areas and therefore limit the shipping and communication alternatives in the region.

METHODOLOGY

Grouping of Countries-ABC Analysis

Asia is extremely diverse. Inequality exists in critical levels, not only when one compares neighboring countries, but also within the same country, among nearby regions. In order to group the forty-eight countries that this paper examines, the methodology used is an ABC analysis of the countries that geographically belong to the area. As used in statistics and economics for the revenue management of a company, an ABC analysis divides the products of a company into three categories, depending on the revenue that they generate from their sales. The equivalent of an ABC analysis is applied here, in order to categorize the countries according to their level of infrastructure. Depending on the volume and importance of trade for each country, as well as the type of commodities imported and exported, the countries are blocked in three different categories.

A first measure that was used in the analysis in order to categorize the forty-eight countries was the per capita GDP Purchasing Power Parity (PPP). By this criterion, the countries were actually grouped in categories according to their wealth divided by their population. Japan, Honk Kong and Singapore are the three wealthiest countries of the region. The real annual growth rate of the GDP for these countries is driven by the importance that trade plays as a percentage of the GDP[11].

The second group of countries have a much lower GDP PPP per capita, in some cases only one tenth that of the richest countries of the region; the importance of the exports as a portion of GDP is much lower than it was for the previous category of countries. The countries presented in this category have a great potential for increase of production and trade, they have natural resources, active economies, and large work forces. However, the percentage of exports in their GDP is comparatively low, and these countries will likely strive to develop further and raise this percentage.

The third group of countries have a much higher poverty rate, their growth rates are low, even negative in some cases, and exports play a small role in their GDP. For these particularly poor countries the need for development is vital.

Another analysis considered the ratio of the exports to the population of the countries. The wealthier the country and the higher the value of the commodities exported, the higher that particular ratio is. It is noticeable that the wealthy countries export either petroleum and its products, or electronics and machinery and equipment (highest value commodities). Singapore, Hong Kong, Taiwan Japan, South Korea, Brunei, Thailand and Malaysia have either no agricultural sector or its share in the GDP is insignificant. [CIA, The World Fact book, 2004; Fuchs, 2003]

The countries that belong in the middle category export either consumer goods, or finished goods that they have first imported as semi-finished, lower value commodities. The commonalities between this category and the other two are that all countries need at some point to import machinery and equipment.

The poor countries export mainly agricultural products that are lowest value commodities. All the above data reflect directly to the transportation and logistical infrastructure of the forty-eight countries.

The following analysis does not intend to be purely economic; it presents the correlation that exists between the level of infrastructure and trade for the countries in the region.

FINDINGS

"A" Countries

The 14 "A" countries include Japan, Singapore, Hong Kong and Macau (both examined separately from China, as special administrative zones), South Korea, Israel, Taiwan, and Kuwait, the United Arab Emirates, Saudi Arabia, Bahrain, Oman, Qatar, and Brunei which are crude oil producing countries which is a synonym to wealth for their economy. These are countries that seem to have a comparatively developed or very rapidly developing network of facilities with little flaws. Road transportation and rail transportation, wherever it is applicable, is modernized and improving with a steady rate. These countries are mainly producing and trading electronics, and high technology and value products that are time sensitive. The logistical infrastructure is often installed and operated by third party logistics or mature and successful companies of the West World.

Most of the above countries have the entire needed infrastructure in place, and are leading economies, and great examples for the rest. These countries simply need to keep up with the fluctuation of demand and be flexible by adopting change techniques in order to stay at the top of the competition. Sometimes these countries also need to use additional technologically advanced tools so as to improve the quality of life of the habitants (lower the travel times in urban transportation, improve the quality of the air in the congested areas), as well as maximize the utility of the restricted capacity that they have in order to respond to the demand of the market (the developed countries are small in size and have capacity limitations, see Japan, Taiwan, Singapore, Hong Kong).

Some of the above countries have a great deal of industry (South Korea, Japan and Taiwan) and some others are simply operating as freight villages (hubs) like Singapore and Hong Kong. Hong Kong is not among the countries with an extremely high industrial sector because its role has been to be the gateway of China's trade for many decades. [CIA, The World Fact book, 2004] and [Fuchs, 2003]

In the Middle Eastern countries of this category it is not surprising that we see undeveloped highway or railway networks, as this can be explained by their geographic position. Infrastructure development might not be feasible in a desert, but only by the coast where life exists and ports are the natural gateways.

The common characteristic of all the above countries is that they are comparatively smaller than the other ones in the region (Russia, China) and it has been easier for them to build infrastructure. This analysis does not examine Australia and New Zealand in the Pacific.

"B" Countries

The 18 "B" countries are rapidly developing, but fall behind in the infrastructure development that would be needed to give them a leading position in the global economic competition. These are China (excluding Hong Kong and Macau), Malaysia, the Philippines, Indonesia, Thailand, Russia, Vietnam, India, Kazakhstan, Azerbaijan, Armenia, Turkmenistan, Syria, Iran, Turkey, Sri Lanka, Jordan and Lebanon. These countries are mostly great countries that have been trying to improve their infrastructure for the past decades (China, Russia, India, Indonesia, Malaysia, and Pakistan) or smaller countries like the Philippines, Thailand, Vietnam, and Laos that have not been accepting Foreign Direct Investment historically, and concentrate on less technology-oriented production and more man-intensive industry, such as agriculture and the textile industry. That category also includes Turkey and some of the developing countries that were created after the collapse of the former Soviet Union (Kazakhstan, Azerbaijan, Armenia, and Turkmenistan).

The above countries currently have some of the transportation network components developed but lack the complete coordination of the network or some of the modes that are necessary for the optimal and complete functioning of their system. These countries are in the process of attracting funds from international organizations and they are trying to create a niche in the area. Trade for these countries is an important means for becoming more competitive and achieving new roles internationally. Foreign investment has been or currently is seriously considered in these countries.

The share of the GDP from the industrial sector reaches up to 50 percent in countries such as China, Indonesia, Malaysia, Thailand, Vietnam, and Philippines. These countries need transportation and logistical infrastructure development in order to export their products more efficiently.

"C" and Intermediate Countries

The 16 "C" countries are Afghanistan, Georgia, Pakistan, Kyrgyzstan, Tajikistan, Iraq, Uzbekistan, Mongolia, Yemen, Laos, North Korea, Bangladesh, Bhutan, Nepal, Burma, and Cambodia. These countries have under-developed transportation and logistics networks and small shares of trade in the region. Some of these countries have a higher development rate and seem to be interested in integration (Bangladesh, Burma, and Cambodia), but others are having political instabilities in the area (Afghanistan and North Korea). Georgia, Kyrgyzstan, Tajikistan, and Uzbekistan are less developed than the other former Soviet Union countries mentioned in the previous category.

Most of the C countries still have a primitive infrastructure, with limited external and internal telecommunications. In some cases (e.g. Laos) electricity is available in only a few urban areas. The share of GDP from the agricultural sector is particularly high for small countries such as Laos, Cambodia and Burma. Moreover, they are developing slowly and have serious problems in their infrastructure because of their political instability and lack the funds and organization for improvement over the past years. Indeed, some of these countries might not seem to need infrastructure in order to export their products or import from their neighbors, but their strategic positioning makes it imperative for them to have an at least a basic, functional and acceptable network in order to facilitate international trade. These countries are called intermediate countries, and they lack coordination with their neighboring countries. It is of interest not only for these countries but also for the world community to build a basic transportation infrastructure that will permit the communication from, to, and through these mostly centrally placed countries.

Understanding the Problem

One main aspect of economic development in the end of the 20th century has been the globalization of markets. The phenomenon of the "East Asian Miracle", the "Asian Tigers", namely, Hong Kong, Singapore, South Korea, and Taiwan replied successfully to this trend. These countries aimed at US markets, managed to contribute their portion of safe and reliable international transport routes and networks, and assisted in the efficient management of infrastructure that is needed for a continuous flow of trade.

However, overall competitiveness in a global economy is limited when transport services are inadequate. Improved transportation and logistics infrastructure in the "centers of evolution", in "Megacities"[7] and huge economic centers do not always bring the desirable result, unless the peripheral development allows the existence of a well-developed network as a whole. When people discuss the optimization of the supply chain, they often take for granted that there is a transportation network in place which operates efficiently. That exactly is what is missing from the inland of Asia when considering links and routes towards Europe.

One can argue that routes to Europe exist through the ocean. Is this enough though? Trade between Asia and Europe potentially involves much shorter distances and faster travel times if highways and railways are used instead of or in conjunction with ocean. A functioning land transportation network can offer alternatives not only between northeastern European and central Asian countries, where shipping by ocean does not always make sense, but also for intermediate-landlocked countries on the routes to and from Europe.

This paper tries to identify the diverse suggestions for improvement of the infrastructure that will facilitate trade with Europe. In the analysis, the wealth, importance of trade and location of each country examined has been taken into consideration and a number of prioritized suggestions have been made.

SUGGESTIONS

Facilities Needed for the Support of Better Integrated Channels and Networks Towards Europe

Urban Transportation. Asia faces the phenomenon of "Megacities"[7]. The rapid growth of cities has led to increased demand for urban transport facilities. Sometimes this expansion has occurred with little or no

development planning and many cities in the region are facing serious problems, including congestion, pollution, accidents and inadequate access by disadvantaged groups while many cities have large growth of motor vehicle population. Although Intelligent Transportation Systems (ITS) technology can be introduced in the "A" countries in order to improve congestion, the solution to the urbanization and high congestion problem is different for the poorest countries. A centrally coordinated, integrated urban infrastructure development with clear incentives is needed, as well as the decentralization of planning and management responsibilities and resources to local governments. It is also very important that the decisions concerning urban transportation development are well supported with demand analysis and forecasting techniques, as well as space utilization analysis.

Some of the "B" countries have substantial urban transportation infrastructure, e.g. Malaysia and Thailand. Still, the cities of Kuala Lumpur and Bangkok are developing along with the rest of the countries and more sophisticated infrastructure will be needed in the future. The urban transportation infrastructure in the countries that belong to category "B", in contrast to the commonalities that all of them have in the level of infrastructure of the rest of the modes is not too much alike. Countries such as India, Indonesia, the Philippines, Vietnam, and Turkey have serious problems. In these countries trams, subways or elevated trains are missing and the bus service is not in good shape.

ITS cannot be the solution for the "C" countries either. A basic urban transportation infrastructure is missing, along with paved roads for the mass transportation to operate on. Even the bicycles themselves create congestion in cities that belong to the "C" countries. There has been no design or urban planning in most of the cases and the frequently old-technology cars that exist create jams and pollution. A basic infrastructure should be considered and placed in "C" countries. Policy measures such as taxation for vehicles and gas can also be taken into consideration.

Road Transportation. An efficient highway system and effective cross-border communication are essential for road transport, in order to contribute toward regional cooperation while reducing travel cost. [Asian Development Bank, 2000] Road safety is a serious aspect of the road infrastructure because more than 400,000 people are killed annually by road accidents and several millions are injured in the Asian region. [UNESCAP, 2001] This analysis focuses on the lengths of paved highways because they are imperative for the efficient transportation of commodities and people on the road. The unpaved roads cannot be easily chosen over other modes of transport and are not to be used regularly by trucks as basic or alternative transportation routes. Even when the road network is in place, sometimes its condition does not allow carriers to choose it and does not facilitate trade with Europe.

The size and the expansion of the road networks in Asia have been characterized by relatively slow growth, averaging less than 1 percent per year over the past five years. [UNESCAP, 2001] Moreover, the percentage of paved road kilometers shows little improvement. The "A" countries are mostly small countries with extensive highway network. Their pavement ratio is generally high[12]. They are all by the sea, thus the lack of extensive highway network does not deprive throughways to other countries. They mostly utilize their pipelines or have extensive port facilities in order to transport their exports.

The "B" countries of the region rarely reach a satisfactory density[13]. With few exceptions, their highway infrastructure is poor and their network highly unpaved. A lot of these countries are large and the low ratio can be translated as poor connectivity within the countries regions. It also means that these countries do not offer a well-developed network and a trustworthy way for other countries' commodities to be transferred through. It is vital to mention that the road transportation is mostly important in big countries such as India, China and Russia that require an intercity highway system. Small countries such as Hong Kong or Macau require a lower volume system. When the distances that need to be covered are longer, the need for an option of a carrier to choose the road in order to transport products is more important. Trade with Europe cannot occur effectively through these routes.

Corridors between the Central Asian Republics and Xinjiang are limited, because of the previous hostile relationship between the Soviet Union and China. Moreover the mountainous conditions of the area restricted even further the passage between Central Asia and South Asia. The former economic integration of the Central Asian Republics within the Soviet Union drove their transportation infrastructure toward European Russia (Moscow) so as to serve the important Soviet economy and links with neighboring countries had no priority. [ADB, 2004]

An example of the insufficient infrastructure is shown in a figure from Coyle [Source: Washington Post, Nov. 11, 2001], where it takes about the same time to ship California grapes to Guangzhou (7,500 miles), as it takes to ship them from Xinjiang by land, that is only 2,000 miles away[14]. In North America,

truck or rail movements are normally much faster than ocean shipments. Ground transport in Asia tends to be expensive as well as slow. For example, an analysis from Krumm in 2003 indicated that the land access to the port accounted for up to 60 percent of the total logistical costs for a specific shipment to the U.S.

In the "C" countries of the region the highway density is particularly low. When roads exist they are mostly unpaved and do not provide an efficient transportation alternative. Even the countries that were created after the collapse of the formerly rich Soviet Union have a very low highway density. The length of paved highways for these often large (Russia) or intermediate countries (Afghanistan, Uzbekistan, Tajikistan, Kyrgyzstan, Iraq) needs to be increased in order to provide links to Europe.

The current highway infrastructure in the former Soviet Union countries was developed as a regional network without taking into consideration the administrative boundaries of the currently separated countries and paid little attention to the regional economic cooperation outside of the Council for Mutual Economic Assistance countries. The network was basically designed to serve traffic within the former Soviet Union and never intended to support trade from Asia to Europe. Various newly independent countries own fragmented transport networks that frequently cross and recross the borders of neighboring countries. [Engel, 1998] "C" countries, by implementing an acceptable road infrastructure, can also facilitate their neighboring countries and interconnect with the networks.

A highway route was proposed by the United Nations that is the equivalent of an interstate highway that intends to connect and service at least all the capitals of the countries in the regions and link them together. Such routes can eventually accelerate the internal economic growth of Asia's developing countries, shorten the transit times and relative cost of transport between Asia and Europe and expand the volume of trade.

Rail Transportation. Rail transportation offers large-volume movements of low-value commodities, but requires an expensive investment. It also requires terminal facilities, in order to support the services of loading and unloading, maintenance etc. The railway route development in the Asian region has been increasing marginally, 1.5 percent annually, in the past years. The number of operating assets such as locomotives, freight wagons and passenger coaches has been reduced in most countries, reflecting the overall stagnation in traffic tasks (-1.5 percent per year for freight traffic and a marginal increase of 0.3 percent per year for passenger traffic). According to a report published by the UNESCAP, in 2002, in spite of efforts to improve asset management, the overall route productivity (efficient use of rail routes) has declined by -1.3 percent per year. This seriously jeopardizes the rail option for trade between Asia and Europe. A number of features speak in favor of a greater utilization of rail transport in Asia: [Declaration, St. Petersburg, 1998]

(i) Twelve landlocked countries are located on the Asian continent with the nearest ports often several thousands of kilometers away; these countries particularly need the railways in order to transport heavy and big loads and play the role of intermediate countries. These countries often lack highways too.

(ii) The distances linking the main origin and destination, both domestically and internationally, are of a scale on which railways find their full economic justification; Asia is the biggest continent and distances that need to be covered even within one nation may be thousands of kilometers.

(iii) The reliance on ports to connect national economies to the world's markets with the need to clear landside port areas quickly to avoid congestion; the containers and bulk loads should be redirected when unloading at ports. Railways can lower the congestion levels.

(iv) A number of countries are major exporters of mineral resources in the logistics of which rail transport plays a crucial role; the bulk properties of the minerals, their heavy weight and cheap and time-insensitive character makes a perfect match for transport with trains.

(v) The continuing surge in the volumes of goods being exchanged.

The railways' length and density in "A" countries is advantageous[15] in comparison to the rest of Asia, but many of these countries (Arabic) do not have railways at all; however, this is not an issue that constrains their transportation infrastructure. These countries are not intermediate, are particularly small, and they manage to utilize alternative modes in order to transport their commodities, as explained at an earlier section.

For the "B" countries the railway network is very undeveloped[16]. Thailand, Malaysia and Indonesia have a ratio of less than 1 percent and large countries such as China, Russia, the former Soviet Union countries of this category, and Iran have a significantly small network. Russia, China and India have

the longest network in absolute values but not relatively to their size.

In category "C" most of the countries have a severely underdeveloped network[17]. The density of these networks does not allow interconnectivity with other modes of transportation, and is not sufficient enough to reach the border and connect to other existing neighboring railway infrastructure (Trans-Siberian Railway and rest of fragmented Trans-Asian Railways).

Even though we have data about the railways' length, their condition is a very critical matter as well. The speed that can be reached on these corridors is a very important factor, as well as whether there are two lines serving the inbound and outbound of every major destination. Delays in railroads can be very long lasting when the infrastructure is not optimized. Additionally, it is estimated that 1,500 km of railroads in the region deteriorate each year, and that capital repairs have been well below annual requirements for years. Many rails use discarded track, which results in slow-speed traffic and frequent breakdowns. Moreover rolling stock is poorly maintained. Rail networks in the countries of this category reflect outdated priorities. [ADB, 2004] Trade with Europe apparently cannot depend on this mode of transportation.

In railways in countries "B" and "C" in Asia it has been very hard to meet maintenance and renovation needs, and infrastructure is deteriorating. Safety problems, which certainly need to be addressed, increase cost further. In response to the need for better railroad infrastructure and service, the ESCAP, in 1992, initiated the integrated Asian Land Transport Infrastructure Development (ALTID) project, comprising the Trans-Asian Railway (TAR) project as well as facilitation of land transport. [UNESCAP, 2002]

According to the Asian Development Bank (ADB), the single rail corridor connecting the Central Asian Republics with China is a potential obstruction to trade between Europe and Asia. All trade must pass through the Druzba-Ala Pass at the Kazakhstan-China border, and the countries in the region have disagreed about transportation access and settlement of accounts. Constructing rail or providing for inter-modal connections between the Uzbek and the Chinese rail systems would reduce the pressure on this potential choke point and provide significant internal benefits to the Kyrgyz Republic.

These proposed routes resemble the UNESCAP proposed highway routes in the Asian region. Once again, the goal is an integrated, interconnected transportation system (railway this time rather than highway) that will facilitate the trade in the region. The corridor is intended to serve the transportation of cargo initiating or ending its trip in South Asia, particularly India and Pakistan, or South-East Asia. A study by UNESCAP in 2002 added that connections to countries in South Asia could be by rail or shipping, while destinations in South-East Asian countries would be mostly reached by shipping services. The railways could serve the latter countries too with possible use of rail for the ultimate leg of the journey from the main ports, such as Singapore or Port Kelang (Malaysia) to destinations in Malaysia and Thailand.

In the long-term future, other countries in South-East Asia (Cambodia, Laos, Burma, and Vietnam) and Yunan province of China are included in the plans so as to be served, after their rail systems have been interconnected.

Water Transportation. Barges, tankers, containerships, Ro-Ro vessels, bulk and neo-bulk and break-bulk carriers are the elements of the sea transportation. In that particular mode, the characteristics are low cost service, high capacity, slow speed, service disruption because of various weather phenomena, and constraints put by the vessels' size and accessibility. It is a capital-intensive transportation mode that requires ports to operate, and pickup and delivery terminals, for inland, coastal or intercoastal transportation. Significant economies of scale have enabled the great increase of the capacity of newly built mainline container ships; the size of mainline vessels and feeder vessels is increasing too. Containerized cargoes in Asia are growing at a rate of 3.3 percent annually.

Despite the very large cargo volumes[18] that will continue to be available on the trans-Pacific route (mostly between Asia and the United States of America and Canada), the longer distances on the Far East-Europe and North America via the Suez route make more sense for very large vessel operations[19]. A Mediterranean hub port would allow the vessels to access a number of major markets without significant deviation; thus trade between Europe and Asia is an option as long as the land infrastructure in Asia becomes adequate to handle these large vessels.

Port container throughput growth in South and South-West Asia has been below the world average. It is expected that the hub ports that focus on intercontinental routes will need to be able to host vessels of this scale in order to be competitive. Under this scenario, express services with minimal port calls (efficient logistics) need to become a major characteristic of the Asian trades. This encourages the use

of even larger vessels on highly streamlined routes between key hub ports and bigger facilities. Bigger facilities are also needed because of the backlogs that occur at the ports of the West World, because of security checks for terrorism and diseases (SARS, mad cow disease, avian influenza) that keep the containers on the ships or in the ports for scanning. The ports in Asia need to face this challenge and build bigger and more technologically advanced ports in order to satisfy the demand and provide alternatives to trade with Europe.

The "A" countries of the region have great ports that can handle the demand for services. Most of these countries' practices and operations have been the example for other developed countries around the world. Whether they are great trading countries or major oil exporters, they utilize the sea transportation efficiently.

The "B" countries have several ports and use them for a high share of their transportation needs. These facilities, with few exceptions e.g. the port of Shanghai, are not highly developed and their capacity is not adequate to satisfy the demand. The wait times in these ports can exceed thirty days for loading and unloading. Other facilities are even worse [Deonas, 2004]. Many of the "B" and "C" countries utilize their inland waterways, which sometimes reach a density of 5.5 percent in km/sq km (Bangladesh). Despite the cost-effectiveness of the utilization of these transportation paths, their relative fuel efficiency and importance for mobility, welfare and development of remote regions in the "B" and "C" countries of the region, inland waterways have suffered from a lack of adequate investment for many years. Very few countries in general are efficiently utilizing their inland waterways and integrating them with the rest of their transportation system.

Finally, the "C" countries are once again missing basic infrastructure. In most cases, their facilities cannot handle simple demand and operations are very time consuming. Many of these countries are also land-locked.

Air Transportation. Most nations in Asia are separated by large masses of water, and high-speed surface transportation is frequently nonexistent. Thus, air cargo plays an important role in the intra-Asian and Asian-Europe economic development. Typical of items moving by air within Asia are time sensitive commodities, such as computers, telecommunication equipment, semi manufactured goods, and higher-value perishables.

According to a report published by Boeing in 2003, the air cargo between Europe and Asia has grown by almost 10 percent annually since 1980 from 0.4 to 2.5 million tones, and that of intra-Asia from 0.5 to 3.5 million tones. Based on the same report, the Europe-to-Asia air trade is expected to quadruple by 2021 and reach 6 million tones, the Asia-to-Europe air trade is going to grow six times and reach 8 million tones, and the intra-Asia air trade will reach 25 million tones. Finally, the domestic air trade in China will grow five times and reach 11million tones by the same year. Air cargo growth will depend to a large extent on continued improvement and expansion of airport infrastructure. Construction has been implemented on several new airports or airport improvement projects for much of the past decade, particularly in China, but also Korea, Malaysia, and even Japan.

Three mega-airport developments have been finished recently: the new Kuala Lumpur International Airport, the new Hong Kong International Airport and Incheon International Airport near Seoul. Other major new airport completions were Macao, China; Shanghai (Pudong); and Cochin, India. New runways or terminal facilities were made, for example, in Bangkok, Beijing, Hanoi, Manila, Singapore, and Tokyo. The small in size but big trading countries of the region (not so much the small Middle Eastern countries) have a high density, in comparison to the "B" and "C" countries. Japan has the highest number of paved airports in this category.

Further investment requirements for airport and air navigation services are needed in "A" countries because these are mostly the countries that will absorb the increase in demand that was mentioned above. Trade with Europe will partly need to depend on the airlines since a large number of products manufactured in Asia are time-sensitive.

In category "B", Russia, China, India, and Indonesia have the highest number of airports in absolute numbers. These are also the largest countries of this category. The density in that category is significantly lower than in category "A"[20] and averages below 0.02. Malaysia, the Philippines, and Thailand have some good infrastructure in place. Vietnam, and Turkey's infrastructure is not very technologically advanced. Their airports cannot be utilized easily as hubs and especially in the case of Kazakhstan, Armenia, Turkmenistan, Azerbaijan, Syria, Iran, Sri Lanka, Jordan and Lebanon the situation is even worse. The exception in the "B" and "C" countries may seem to be the former Soviet Union

countries. This is not a correct measure, however, because the airports that these countries have are not necessarily good for trade, as they were mainly constructed to support military bases.

As usual, the "C" countries are missing basic infrastructure. In most of the cases, their facilities are nonexistent and cannot handle any demand for trade.

Logistical Infrastructure. In order to respond to the requirement for competitive, Just-In-Time (JIT) transportation services, the countries that want to maintain a powerful role in the global arena, that is countries in category "A", need to create or expand their multimodal transport sector. For these countries, there are a number of essential steps for the development of an efficient multimodal transport sector; these include developed transportation infrastructure, simplified streamlined documentation, liability regimes, industry standards and the legal status of intermediaries such as freight forwarders. [United Nations, 2001]

Singapore, Hong Kong, Taiwan and Japan are international logistics hubs and are on a track of improvement. They are considered to be developed countries and have proven their status with their successful examples. These countries can potentially handle the increase of demand when trading with Europe.

In "B" and "C" countries the linkages among the different types of modes, wherever applicable are often missing. These countries that will not invest in infrastructure development and modernization of logistical procedures will not have a competitive advantage and will not be the preferred customers or partners in the global trading arena. China, Thailand, Malaysia and the Philippines have been making efforts for improvement in the area. Significant investments have been placed for the development of modern and efficient cargo handling facilities at the maritime ports and warehouses. Developing countries should learn a lesson from the developed countries and pay attention to the environmental and social effects and the peripheral development in their developmental process. The challenge is to combine infrastructure investment with uniform procedures that allow for standardization across borders. When logistics capabilities are more equalized, then choices concerning the movement of goods can be based on the lowest cost and best quality provider. Our findings for the "C" countries are disappointing and logistics is not an issue that these countries should try to target at this time.

Software, Communications, IT Infrastructure. A very critical element of successful business operations nowadays is the technology that is used to facilitate the companies' trading services. Usage of new technologies, such as the Management Information Systems (MIS), Automated Control of Production, Automated Inventory Control (managed through Material Requirement Planning (MRP), Distribution Resource Planning (DRP), and Enterprise Resource Planning (ERP) in logistics), Geographic Positioning Systems (GPS) and online order placing are needed for enterprises that want to improve their efficiency. This is mainly intended for the developed "A" and rapidly developing "B" countries. Unfortunately the "C" countries cannot focus on this level of infrastructure at this point.

There is a growing importance of communications, and a need for more accurate and faster information. All "A" and some "B" countries have automated and computerized operations (Japan, the Philippines, South Korea, Singapore, and Thailand), but "C" countries do not (Bhutan, Cambodia, Laos, and Nepal). There is a potential for further improvement of the advanced countries in the region and many efforts have to be made in order for the companies to catch up with the global competition. Therefore, the governments should encourage and give motives to logistics companies, carriers, and hub providers to invest in technology, educate their workforce and become leaders in the world's supply chain.

The Trans-Eurasia Information Network is an example of the growing needs for better and more accurate communication. It was built in order to contribute to enhance exchanges and cooperation between Asia and Europe through increased and more effective information flows, and to expand and diversify speedier and more powerful telecommunication connections. The demand for this network was high and the traffic congestion occurred from the very beginning.

As an ultimate example of need for use of high technology systems, several countries begun to introduce the Automated System of Customs Data (ASYCUDA) developed by the United Nations Conference on Trade and Development (UNCTAD). However, there still remains considerable work to be done to standardize and computerize documents. EDI is coming into use in transport and trade, and EDIFACT messages may be used to replace documents. Those messages are listed, and ways to avoid overlapping documents are mapped out. EDI can reduce the number of transport documents by over 40 percent in domestic and intra-EU trade, and by about 35 percent in foreign trade. EDI results in more

savings in transport specifically than in trade more generally, on average. The usage of technology can have a positive effect to trade with Europe.

Developmental programs. The World Bank (WB), the World Trade Organization (WTO), the Asian Development Bank (ASD), the Organization for Economic Cooperation and Development (OECD), the United Nations (through the UN Economic Commission for Europe (UNECE) and the UN Economic and Social Commission for Asia (UNESCAP)), the EU (through the European Conference of Ministers of Transport (ECMT)), along with many other organizations have turned their eyes to Asia and assist in the development of transportation and logistical infrastructure. On the other side, in Asia, the Asia Pacific Economic Cooperation (APEC), the Association of South East Asian Nations (ASEAN), and the ASEAN Free Trade Area (AFTA) are from their part trying to absorb as much financing as possible for the development of the area. The APEC is working towards liberalization of investment and capital movements that will contribute to the economic progress in the region. The purpose of AFTA is to expand trade and induce more Foreign Direct Investment (FDI) into the area. It is critical for the countries that belong to categories B and C to attract funds for investments from these organizations.

THE POLICY AGENDA: BIG PICTURE

Governments in all three categories of countries seem to understand the value of extending their trade patterns towards Europe[21]. At the same time, infrastructure is only one part of the logistics policy. The current situation in the Middle East and the war in the former Yugoslavia have put obstacles in the development of trade routes. The ongoing procedures that will eventually carry peace to the region and eliminate terrorism and fear are going to assist the overall efforts of building new connections between the two continents.

A coherent, interconnected and harmonized development of transport infrastructure, the elimination of physical and non-physical obstacles to passage of freight flow between the countries, the coordinated tariff/price policy for future creation of through tariff system, and the simplification of border procedures are some of the policy decisions that will facilitate trade with Europe.

The wide recognition of the need and importance of a well-developed transportation and logistical network, according to a report published from the UNESCAP in 2002, combined with improved political stability in most parts of the Asian continent, led the involved countries to express a common desire to try harder to improve the infrastructure and connect the various fragmented national networks to form regional and sub-regional transport systems.

Initially, the domestic integration is an important prerequisite before the international integration. All of the benefits of improved logistics and trade apply first to domestic trade and then to international trade. It may be foolish to talk about accessing international markets when it is difficult to access internal markets. Below are the most critical of all policy steps that governments need to take in Asia.

Private Sector Partnership. The governments in Asia (even these in category "A") cannot finance the increased demands for capital investment in order to support increasing trade with Europe. The private sector will need to provide a significant share of this investment along with the related risks and benefits. Countries in categories "B" and especially "C" need to open their borders to foreign direct investment in addition to the financial aid that they are receiving by the international organizations. Governments in collaboration with their financial institutions could implement mechanisms that allow public-private partnerships. These partnerships will offer varying risk levels, resource inputs and involvement of the partners and will contribute partially in the assets, resources, technology, management and operational expertise. China, India, Malaysia, Pakistan and Thailand have been exploring various types of financing. New approaches, such as the Build-Operate-Transfer (BOT) as well as the use of tolls and sales taxes offer new opportunities. [UNESCAP, 2001]

Tariffs, Taxes, Liberalized Environment. Developing countries in categories "B" and "C" have much to gain from trade by quitting their trade-restricting policies and practices. The available evidence suggests that open economies have faster growth rates than closed economies. Liberalization by developing countries is as critical as the infrastructure itself. Competitive domestic markets are a necessary condition for improving their rate of growth. It is not enough for the intermediate countries to support trade by

providing a basic infrastructure; they also need to open their borders to the rest of the world and facilitate mobility of freight.

Manufacturing exports from developing countries to developed countries face an effective tariff 4 times higher than that on exports between developed countries. Tariffs on trade between developing countries are also much higher than those in developed countries. A study published by the EU Commission claims that of the $400 billion gains from liberalization, developing countries would gain $140 billion a year; more than the EU ($92bn) and the US ($45bn). In "C" countries, import quotas, export licensing requirements and transport restrictions, as well as cumbersome, arbitrary and often corrupt bureaucracies do not facilitate trade and need to be changed.

Trade with Europe demands a liberal environment. Trade liberalization can also help the alleviation of poverty. In Eastern Asia there are examples where the opening of the markets led to higher wages and lower poverty. Trade openness and the "invisible hand" of Adam Smith benefit the productivity rate, the adoption of new technologies and the attraction and implementation of investment. This is how trade leads to economic growth. Still, it is not rare that the potential of a developing country to become more competitive sometimes gets trapped behind the barrier of institutional and regulatory reforms.

Intermodal Integration. This is a priority for all the countries of the region. The "A" countries have managed to achieve it and the majority of "B" countries are working on it. Intermodal integration is needed in urban transportation, as well as for the increasing volumes of freight that place great stress on the land transport interface and generate a need for faster and more efficient intermodal connections to the hinterlands; exactly the case when trading with Europe.

"A" countries need to use sophisticated planning and forecasting tools in order to keep their competitive advantage and be able to respond to the continuously increasing volumes. "B" and "C" countries should identify the bottlenecks in their network and implement efficient intermodal transport and logistics systems. Process times add cost to the value of the imported and exported items and logjam the port, airport and road systems.

Sustainable Transportation. All the countries of the region need to implement sustainable economic, environmental and social development; both these that have infrastructure in place and have some externalities and these that need to build basic infrastructure for the first time. Governments need to conceptualize a transport strategy, evaluate the economic feasibility and determine the revenue allocation, and finally implement an overall balanced regional and peripheral development. Sustainable transportation is not a priority that trade with Europe specifically demands but it is a healthy way of developing infrastructure for the viability of the network.

In Asia the Environmental Impact Assessment implementation has been unsatisfactory [Deonas, 2004], with no continuity or follow-up. The responsible agencies' roles have not been well defined, and have resulted in severe lack of coordination and monitoring. Little commitment has been noticed from the governments' side. The environmental awareness should be high because the environment is of primary importance in the project planning, design and construction. It is not a formal procedure that needs to be executed simply for the project approval, but a sign that will later on reflect whether the project was successful or not.

Last but not least, the governments need to eliminate the inequalities and keep a balance in the developmental process of their projects. In a recent article found in The Economist, "China's development: String of Pearls", it is mentioned that while Zhongshan's output grew by twice the national average, misdirected spending from the part of the government resulted in the creation of five airports within 90km (60 miles), no rail connection, and postponement of the planned superhighway that would link to Macau and Guangzhou. At the same time smog blankets the urban areas in the region.

SUMMARY

This paper was motivated by the anticipated growth of demand for imports and exports between Asia and Europe. It analyzed and emphasized the importance of transportation and logistical infrastructure in facilitating trade. It also examined the existing transportation and logistical infrastructure in the diverse Asian countries, making a comparison among them and pointing out the sectors that need to be improved. Better-organized and more extensive networks can be utilized to develop diversified economies, improve

existing conditions and attract more investment to undeveloped or underdeveloped regions. In Table 1, one can see the Asian countries divided in three categories by their level of infrastructure. Depending on the volume and importance of trade for each country, as well as the type of commodities imported and exported, the countries are blocked in three different categories.

Table 1 Countries categorized according to their level of infrastructure based on the ABC analysis

"A" countries	**"B" countries**	**"C" countries**
Japan	China	Afghanistan
Singapore	Malaysia	Georgia
Hong Kong	Philippines	Pakistan
Macau	Indonesia	Kyrgyzstan
South Korea	Thailand	Tajikistan
Israel	Russia	Iraq
Taiwan	Vietnam	Uzbekistan
Kuwait	India	Mongolia
United Arab Emirates	Kazakhstan	Yemen
Saudi Arabia	Azerbaijan	Laos
Bahrain	Armenia	North Korea
Oman	Turkmenistan	Bangladesh
Qatar	Syria	Bhutan
Brunei	Iran	Nepal
	Turkey	Burma
	Sri Lanka	Cambodia
	Jordan	
	Lebanon	

The level of infrastructure for each examined sector is presented in Table 2. The evaluation of these areas and the suggestions that were made focused on the transportation needs of all Asia facing the potential of a significantly growing trade with Europe. For every category the level differs, and some immediate steps of action are suggested. Those that belong to category "A" are developed countries with a mostly well-integrated transportation network in place. Their margin for improvement involves the extensive use of high-technology applications and the implementation of optimization methods.

The "B" countries are rapidly developing. Trade already plays an important role in their economies and is about to have an increasing importance in the future. Their network is not sufficiently developed with few exceptions that appear to have a "locality" character. There is no optimal integration

among the various modes, which signifies the inability to have a dependable service option that aims to satisfy the demand for trade towards any direction, including the rising demand for trade with Europe. As a result, this "locality" factor, as far as the level of infrastructure is concerned, has created great inequalities with both social and economic consequences.

Finally, the least developed countries belong to category "C". In their case the infrastructure that is in place is generally inadequate to handle any kind of demand, either this is local or international. Several of the countries that are put in category "C" are landlocked and missing critical infrastructure that isolates them from the rest of the world. There is no integration among the few existing modes; moreover these countries function as obstacles in the development of options for their neighbors that would benefit from the utilization of adequate infrastructure in order to trade with Europe alternatively through the massive Asian continent.

Table 2 Level of infrastructure and characterization of the Asian countries

LEVEL OF INFRASTRUCTURE/ COUNTRIES	"A"	"B"	"C"
Urban	Adequate, needs ITS and better synchronization of the public transit modes to reduce congestion	Varies, mostly existent, needs improvement of coordination among the various modes of public transit, faces serious problems of congestion	Inadequate, lack of public transit modes, old vehicles operate on unpaved roads, danger for the environment
Road	Adequate, needs optimization techniques	Varies, mostly existent, needs to connect to the other modes of transportation, and a higher pavement ratio	Inadequate, largely unpaved network, lack of connectivity among modes
Rail	Adequate, technologically advanced in many cases, fast and reliable service	Varies, mostly implemented, needs expansion in order to connect with the rest of the modes	Inadequate, lack of mode in some cases, lack of corridors, technologically obsolete, unable to handle freight traffic, low speeds, low capacity
Sea	Adequate, port facilities in good condition, challenged by the increasing vessel size	Varies, few adequate ports, lack of integration to the whole transportation system, capacity constrained	Inadequate, wherever applicable port facilities are not sufficient to be utilized by carriers
Air	Adequate, advanced airports, high pavement ratio	Varies, numerous airports are not paved and have low capacity capabilities	Inadequate, few paved airports that are not strategically placed or developed in order to facilitate trade and handle freight capacity
Logistics	Adequate, facilities limited by space constraint, implementation of supply chain management techniques	Varies, lack of integration within the modes is an obstacle	Inadequate or nonexistent
	Adequate, integrated part of the operations,	Varies, introduced but not	Inadequate, inexistent

IT	improving	widely implemented	
Policies	Beneficial, open capitalized markets, attracting FDI and receiving support	Diverse, mostly open to private funding and attracting FDI, need strategies for better cooperation and lower taxation and tariffs	Limiting, high taxation and tariffs imposed, low cooperation with neighboring countries

The needs and priorities for the transportation network, the existing facilities and the policies in the countries of the region are presented in the table below. For every category the priorities rank differently starting from the top with the most critical one. In order for the Asian countries to facilitate trade particularly with Europe they need to target these areas and create a complete set of transportation options through the existence of a coherent, including surface, air and sea, infrastructure. The prioritization of these "next steps" in infrastructure was based on the needs of each group of countries, given their current role and position in the global trade arena and goes beyond solely fine-tuning of existing networks.

Table 3 Priorities that need to be implemented in the Asian countries to facilitate trade with Europe

"A" countries	"B" countries	"C" countries
Improve capacity utilization of the existing network	Add infrastructure in all the different modes of transportation sufficient for international and interregional trade	Allow allocation of funds to transportation and logistics
Add connections to the network that will minimize travel times	Finalize connections within the rail, ocean, and trucking industry to facilitate multimodal trade	Create basic infrastructure in all the different modes of transportation sufficient for international and interregional trade
	Expand the capacity of existing routes to keep pace with traffic	
Implement ITS, GPS, e-commerce, EDI and other new technologies to a full extent	Allow allocation of funds	Connect the modes that are available
Facilitate freight mobility in congested urban areas	Respond to congestion	Maintain a political stability in the region
	Expand and improve the terminal facilities	
Expand and improve the terminal facilities	Allow paperwork clearance for inland travel of containers	Allow unfettered foreign investment in transport/logistics services
Optimize the network	Consolidate rail, ocean, trucking regulatory agencies to facilitate multimodal trade	Remove taxation and tariffs from the freight that intends to pass through the network
Sustain security in the network	Allow unfettered foreign investment in transport/logistics services	Remove distortionary queuing priorities for commodities accessing transport system

Use efficient warehousing techniques (storage, production management, order placing, and product tracking)	Remove distortionary queuing priorities for commodities accessing transport system	Transparency of applicable laws and minimization of legal barriers to market entry

Table 4 below mentions some specific priorities for infrastructure to facilitate trade between Asia and Europe. These are general issues that need to be addressed so that the region manages to implement an adequate transportation and logistical network that will serve as successfully as the old "Silk road".

Table 4 Holistic Infrastructure priorities in the region to facilitate trade between Asia and Europe

Vision of an interstate highway system that will interconnect all the countries in the region
Implementation of rail connections throughout the continent
Security along major international routes through "intermediate countries"
Creation of adequate logistics support facilities across the routes
Tax and Tariffs policies that allow trade and mobility
Creation of alternatives in transportation, implementation of intermodality and interconnectivity

CONCLUSIONS

The paper reviewed the current transportation infrastructure in Asia and examined the priorities that will facilitate trade with Europe. The countries in the region are not at all consistently developed, as far as their infrastructure is concerned, and their roles, capabilities and potentials differ according to their socioeconomic status. The countries were therefore divided into three categories, based upon an assessment of transportation infrastructure and its ability to support increased trade with Europe.

In some cases the network was non-existent or there was a lack of interconnectivity among the different modes, and in other cases there were findings of a non-fully developed network or of major flaws within the systems. The infrastructure level in each country was examined by looking at the size of the road, rail, port, and air facilities, as well as their quality, e.g. the ratio of paved to total roads. The paper first considered how problems, issues, and policies differ in the "A", "B", and "C" countries; it then identified appropriate priorities and policy options for each category.

The analysis showed that countries that belong to category "A" are developed and have the entire range of necessary infrastructure in place. These are leading economies that set great examples for the rest of the region. In order to cover additional demand with Europe and remain highly competitive, these countries need to be flexible and adopt additional technologically advanced tools that will optimize their networks. Their main concern should be about the gaining the maximum utilization of the restricted capacity that they have in order to respond to the increasing demand of the market, especially the countries that already have severe capacity limitations, e.g. Japan, Taiwan, Singapore, Hong Kong).

The countries that belong to category "B" are rapidly developing countries that currently have some of the transportation network components developed, but lack the complete coordination of the network or some of the modes that are necessary for the optimal and complete functioning of the system. Trade for these countries is an extremely important means that will make them more competitive and give them a new role internationally. Accordingly, the necessary steps for these countries are to put in place the missing infrastructure and connect all the modes. They need to develop equally, rather than depend on only one mode of transportation (e.g. sea) and only towards their east, because the European challenge calls for a better implementation of a consistent transportation network. They also need to drastically attract funds from international organizations, and private parties. Foreign direct investment has been and should be even more seriously considered in these countries. These countries priorities should help them establish their identity as trade parties and create a niche in the Asian region.

Finally, the countries that belong to category "C" are undeveloped or slowly developing and have serious problems regarding their inadequate infrastructure. These are commonly countries that have had political instability over the past years and lack the funds and organization for improvement. These countries are definitely not wealthy and cannot necessarily be influenced directly from trading with the Europeans. They might not have products that they need to trade but could potentially gain from providing a basic, but at the same time trustworthy, infrastructure. Their strategic positions makes it imperative for them to have at least a basic, functional and trustworthy network in order to facilitate international trade; these countries are also known as intermediate countries. These countries' first priority is the allocation of funds to transportation and logistics infrastructure.

This paper has attempted to emphasize the inadequacies, inequalities and mismatches in the Asian transportation network as a whole. It did not consider only the rich countries that have long been active in trade and in the development of transportation and logistics infrastructure. Instead, the paper considered all of the countries in the region. While the "A" countries have transportation and logistics needs similar to other developed countries in Europe or North America, the "B" and "C" countries need much more basic investments. In many countries, large parts of the transportation systems are inadequate or missing entirely. Improving transport and logistics capabilities of this region will therefore require very substantial planning, cooperation, and investment. If development and trade are to benefit the entire region, and not just the locations near the major ports, then extensive development of the ground transportation system will be necessary.

ENDNOTES

1. This paper is based on the analysis conducted for the development of the MIT MS thesis in Transportation by Deonas, N., and C. D. Martland. "Logistical and Transportation Infrastructure in Asia: Potential for growth and development to support increasing trade with Europe", MIT, Cambridge, MA, 2004.
2. For example, China's imports and exports reach to more than US $295 billion and $325 billion a year respectively http://globaloutlook.worldbank.org/globaloutlook/outside/eaptradetool.aspx, visited on February 6th, 2005.
3. Only China's trade (imports and exports) growth rates reach 35% annually (same source as above).
4. According to information gathered from the Delegation of the European Commission to Australia and New Zealand website, the EU is the world's largest exporter of merchandise goods and world's biggest exporter and importer of services, http://www.ecdel.org.au/eu_and_australia/KeyFacts_Oct2004.htm, visited on February 6th, 2005.
5. Central Intelligence Agency, The World Fact book, world population estimated at 6.38 billion people
6. A study presented by the Population Reference Bureau explains this trend http://www.prb.org/Content/NavigationMenu/PRB/Educators/Human_Population/Population_Growth/Population_Growth.htm, visited on February 6th, 2005.
7. "Megacities" are known as cities with population larger than 10 million. Examples of such cities in Asia are Tokyo and Mumbai with 26 million people in 2015, Dhaka (21 million), Karachi (19 million) etc., see also Coyle, 2003.
8. Pointed out in various meetings: International Euro-Asian Conference on Transport, Declaration, St. Petersburg, 12-13 May 1998; European Conference of Ministers of Transport (ECMT), Kyiv Declaration Black Sea Transport Conference, 1997; ECMT, Meeting of the Ministers of Transport for the Development of the Corridor VIII, Bourgas (Bulgaria) 1-3 September 1997, etc.
9. Wealthy people in marketing terms, found on Fuchs, 2003.
10. Examples of countries that improved their poverty rate while increasing their trade growth as a percentage of the GDP are China, Indonesia, Vietnam and the ASEAN countries collectively. It appears that while the trade as a percentage of the GDP grows, there is a negative correlation with the number of people who live under the poverty level of one-dollar-a-day compensation in the area or the countries presented [Deonas, 2004].
11. Especially for Singapore and Hong Kong, trade is the leading factor of the economy and imports and exports account for more than twice the countries' GDP, (same source as above).
12. About 100% (same source as above).
13. With few exceptions, "B" countries seldom have highway density of more than 20% (km/sq km) and typically 40-80% of these roads are unpaved, (same source as above).

14. Given that the average speed of a commercial boat is about 12-15 miles an hour (knots), about one fourth of this figure gives us the average speed of land transportation between the northwestern and the southeastern parts of China (max. of 4 miles/h). This extremely low speed indicates a very serious problem with highway transportation system.
15. Railway density km/sq km averaging between 3-4%, (same source as above).
16. Railway density km/sq km mostly a bit less than 1%, (same source as above).
17. Railway density km/sq km mostly less than 0.4%, (same source as above).
18. The data show an average of 11 per cent per year throughout the 1990s, reaching 95 million TEU in 1999, which is more than half the world's total port container throughput [Krumm, 2003].
19. Significant economies of scale have enabled the increase of the capacity of a newly built mainline container ship from 4,000 TEU in 1991, to 6,800 TEU in early 2000. Newly built vessels may reach 12,000 TEU in the next 5 to 10 years. Moreover, as the size of mainline vessels is increasing, so is the size of feeder vessels, which have generally nearly doubled their capacity to 2,000 TEU [UNESCAP, 2001].
20. Mostly around 0.1, reaching up to 4 per sq km [Deonas, 2004].
21. Asian Development Bank http://www.adb.org/Economics/default.asp, visited on December 14th 2003 and Association of Southeast Asian Nations Secretariat http://www.aseansec.org/, visited on December 14th 2003.

BIBLIOGRAPHY

Boeing publication, http://www.boeing.com/commercial/cargo/pdf/Intra_A.pdf, visited on December 14th 2003.

Bookbinder, J. H., and C. S. Tan. "Comparison of Asian and European logistics systems", International Journal of Physical Distribution & Logistics Management, ABI/INFORM Global, 33, ½, (2003): 36.

Candemir, Y. "New Trade Patterns: New Transport Demands in the Black Sea Region", Conclusions, Antalya, Turkey, 21-22 October 1998.

Chen, A. H. "A new perspective on infrastructure financing in Asia", Pacific-Basin Finance Journal 10, (2002): 227– 242.

Central Intelligence Agency, The World Fact book, http://www.cia.gov/, visited on December 14th 2003.

Coyle, W. "Asia Goes Shopping: Do Transportation and Infrastructure Matter?", USDA Agricultural Outlook Forum 2003, February 21, 2003.

Deonas, N., and C. D. Martland. "Logistical and Transportation Infrastructure in Asia: Potential for growth and development to support increasing trade with Europe", MIT, Cambridge, MA, 2004.

Engel, M. "New Trade Patterns: New Transport Demands in the Black Sea Region, Present Economic and Political Situation, Specific Modal Implications, Strengths and Weaknesses of Road Transport in the Black-Sea Region, Antalya, Turkey, 21-22 October 1998.

Fuchs, H. J. "Fareast Goes West-New Opportunities for Asian Brands in Europe", Asia Pacific Journal of Marketing and Logistics, Volume 15, Number 3, (2003): 20-33.

Hellvin, L., and L. Nilsson. "Trade Flows Between Trading Blocs: The Case of the EU's Trade with Asia and NAFTA", Ministry for Foreign Affairs. Stockholm, Sweden, April 2000.

Kazi, A. S. "Modeling and forecasting Asia's infrastructure growth", AACE International Transactions, ABI/INFORM Global, (1999): NT41.

Krumm K. "Building Transport and Logistics into East Asia's Trade Policy Agenda for Shared Growth", World Bank Transport Forum 2003, EAP.

Powell, D. “Governments and Industry Working Together to Implement Modern Logistics”, Transport and Communications Bulletin for Asia and the Pacific, Economic and Social Commission for Asia and the Pacific, No. 71, Logistics for the Efficient Transportation of Domestic Goods, United Nations, New York, 2001.

Sauna-Aho, Jussi, New Trade Patterns: New Transport Demands in the Black Sea Region, Present Economic and Political Situation, Specific Modal Implications, EDI in Trade and Transport: A Case Study from Finland, , Antalya, Turkey, 21-22 October 1998.

Singh, K., and G. F. Steinber. “Integrated Urban Infrastructure Development in Asia”, Conference Report, Habitat Intl., Vol. 20, No. 1, (1996): 1-3.

Tam, C. M. “Build-operate-transfer model for infrastructure developments in Asia: reasons for successes and failures”, International Journal of Project Management, Vol. 17, No. 6, (1999): 377-382.

Tennenbaum, J. “Asia Can Be the Motor of Economic Recovery for Europe”, Executive Intelligence Review, June 27, 2003.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Asian Highway - The Road Networks connecting China, Kazakhstan, Mongolia, the Russian Federation, and the Korean Peninsula, United Nations, New York, 2001.

UNESCAP, Development of the Trans-Asian Railway, Trans-Asian Railway in the North-South Corridor, Northern Europe to the Persian Gulf, United Nations, New York, 2002.

UNESCAP, Maritime Policy Planning Model (MPPM): Regional Shipping and Port Development Strategies Under a Changing Maritime Environment, United Nations, New York, 2001.

UNESCAP, Multistage Environmental and Social Impact Assessment of Road Projects, Guidelines for a Comprehensive Process, United Nations, New York, 2001.

UNESCAP, Policy Guidelines for Road Transport Pricing, A Practical Step-by-Step Approach, United Nations, New York, 2002.

UNESCAP, Review of Developments in Transport and Communications in the ESCAP Region 1996-2001, Asia and the Pacific, United Nations, New York, 2001.

UNESCAP, The Economic Regulation of Transport Infrastructure Facilities and Services -- Principles and Issues, United Nations, New York, 2001.