

PACIFIC ECONOMIC COOPERATION COUNCIL



PACIFIC FOOD SYSTEM OUTLOOK 2004-2005

**THE ROLE OF
TRANSPORTATION
INFRASTRUCTURE
IN A SEAMLESS
FOOD SYSTEM**





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Pacific Food System Outlook 2004-2005
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FOREWORD

Transportation infrastructure plays a pivotal role in the food system of the PECC region. Food production is the most geographically dispersed industry in the region, while food demand is becoming increasingly concentrated in urban areas.

The region's urban areas will grow by 590 million people in the next 20 years, twice the growth rate of the total population. Three-quarters of the growth will be in the less developed economies of the region.

Many agricultural areas in the developing parts of the region are isolated and "taxed" by inadequate transportation access to markets, resulting in large post-harvest losses, depressed farm prices and high consumer prices.

To maintain or reduce urban food costs, policymakers must either invest in streamlining domestic supply chains—including transportation infrastructure to connect urban centers with food-producing areas—or facilitate food imports through market opening measures, or some combination of the two strategies. As the examples in this report demonstrate, major efforts are underway to expand and enhance transportation infrastructure in the region.

The Pacific Food System Outlook project participants also addressed factors affecting the food system in the near term. The 2004-05 economic outlook in the region promises the fastest growth since 2000. Economic growth rates across PECC are brisk: China is expected to grow 9.1 percent in 2004, Vietnam 8 percent, Japan 4.4 percent, and the United States 4.3 percent. Other key factors in the food system outlook are declining commodity prices as crop production has increased this year, and high oil prices, which will raise input and marketing costs, thus narrowing profit margins and curbing sales. More details are provided on the PECC web site: <http://www.pecc.org/food/>.

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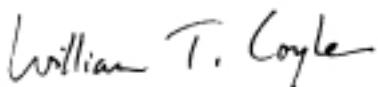
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Walter J. Armbruster
President, Farm Foundation and
Chairman, Pacific Food System Outlook, PECC



William T. Coyle
Senior Economist, Economic Research Service, USDA
Senior Coordinator, Pacific Food System Outlook, PECC

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COORDINATORS AND FORECASTING PANEL

PECC COORDINATORS

Walter J. Armbruster
Chairman, *Pacific Food System Outlook*
President, Farm Foundation, USA
walt@farmfoundation.org

William T. Coyle
Senior Coordinator, *Pacific Food System Outlook*
Senior Economist, Market and Trade Economics Division
Economic Research Service
U.S. Department of Agriculture
wcoyle@ers.usda.gov

CANADA

Brad Gilmour and José Quiroga
Research and Analysis Directorate
Agriculture and Agrifood Canada
gilmourb@agr.gc.ca,
quirogj@agr.gc.ca

Mai Dang
International Markets Bureau
Agriculture and Agrifood Canada
dangmai@agr.gc.ca

Barry Prentice
Professor/Director, Transport Institute
University of Manitoba
prentic@Ms.UManitoba.ca

CHILE

Eugenio Muchnik
Professor, Catholic University of Chile
Program Head, Agroindustrial Area
Fundación Chile
emuchnik@fundacionchile.cl

CHINA

Li Zeren
Deputy Secretary General
China National Committee for Pacific Economic Cooperation Business Forum
cncpec@netchina.com.cn

Cheng Guoqiang
Professor and Director
Agricultural Policy and Trade Development Research Center.
State Council of PRC
gcheng@drc.gov.cn

ECUADOR

Inés Mencías
Professor
National Polytechnic School
inesmencias@yahoo.com

JAPAN

Keiji Ohga
Professor
Nihon University
ohgaky@mx2.ttcn.ne.jp

KOREA

Myong-Keun Eor
Research Fellow
Center for Agricultural Policy
Korea Rural Economic Institute
myongeor@krei.re.kr

MALAYSIA

Mad Nasir Shamsudin
Professor
Department of Agribusiness and Information Systems
Universiti Putra Malaysia
nasir@econ.upm.edu.my

MEXICO

Héctor M. Peña
Economic Analyst
Apoyos y Servicios a la Comercialización Agropecuaria (ASERCA)
Secretaría de Agricultura, Granadería, Desarrollo Rural, Pesca, y Alimentación (SAGARPA)

NEW ZEALAND

Mark Walton
Senior Economist
New Zealand Institute of Economic Research
mark.walton@nzier.org.nz

THE PHILIPPINES

Salvador P. Catelo
Dean
College of Economics and Management
University of the Philippines Los Banos
scatelo@laguna.net

CHINESE TAIPEI

Ching-Cheng Chang
Research Fellow
The Institute of Economics
Academia Sinica
emily@ieas.econ.sinica.edu.tw

THAILAND

Ruangrai Tokrisna
Associate Professor
Department of Agricultural and Resource Economics
Faculty of Economics
Kasetsart University, Bangkok
ruangrai.t@ku.ac.th

UNITED STATES

Mark Denbaly
Chief
Food Markets Branch
Food and Rural Economics Division
Economic Research Service
U.S. Department of Agriculture
mdenbaly@ers.usda.gov

Betsey Kuhn
Director
Food and Rural Economics Division
Economic Research Service
U.S. Department of Agriculture
blkuhn@ers.usda.gov

James Caron
Associate Deputy Administrator
Transportation and Marketing Programs
Agricultural Marketing Service
U.S. Department of Agriculture
jim.caron@usda.gov

VIETNAM

Pham Thi Tuoc
Deputy Director
Planning Department
Ministry of Agriculture and Rural Development
ktdn@fpt.vn

Chu Thi Hao
Deputy Director General
Department of Cooperatives and Rural Development
Ministry of Agriculture and Rural Development
cthao.cnt@hn.vnn.vn

Dang Kim Son
Director of Information
Center for Agriculture and Rural Development
Ministry of Agriculture and Rural Development

Tran Kim Chung
Vice Director
Department for Research on Economic Management Science
Central Institute of Economic Management
Ministry of Planning and Investment
trankimchung@ciem.org.vn

THE ROLE OF TRANSPORTATION INFRASTRUCTURE IN A SEAMLESS FOOD SYSTEM

The most important challenge facing the PECC food system in the next two decades will be rapid urbanization, particularly in the region's less developed economies. Providing basic services, particularly quality, low-cost food supplies, is one of the most critical issues decision makers face as they work to sustain urban growth.

Transportation infrastructure—roads, railroads, inland waterways, ports and airports—

areas in the developing parts of the region are isolated and "taxed" by inadequate access to markets, resulting in large post-harvest losses, depressed farm prices, and high consumer prices. Even in the developing economies, urban areas are often well connected with the rest of the world through modern ports and airports. To reduce urban food costs, policymakers must invest either in streamlining domestic supply chains—

but also appropriate economic incentives, competitive transportation and logistic services, and policy reforms. These factors, so important inside the borders of individual economies, must be more fully integrated with negotiations to liberalize agri-food trade policies across the region.

■ Development of transportation and related infrastructure leads to more efficient resource allocation and greater economic prosperity within an

Transportation infrastructure is critical to the food system because food production is the most geographically dispersed industry in the region, while food demand is becoming increasingly concentrated in urban areas.

is critical to the food system because food production is the most geographically dispersed industry in the region, while food demand is becoming increasingly concentrated in urban areas. At the PECC Pacific Food System Outlook project's annual meeting in Hanoi, Vietnam, May 18-20, 2004, economists, government leaders and food industry representatives from the PECC region examined transportation infrastructure issues facing the region's food system.

The following key implications emerged:

- Development policies for PECC countries must recognize the critical role of transportation infrastructure in linking dispersed food producing areas with urban consuming areas. Many agricultural

including expensive transportation infrastructure to connect urban centers with food-producing areas—or facilitate food imports through market opening measures, or some combination of the two strategies.

- While critical, transportation infrastructure alone will not create an efficient food supply system. As have repeatedly been emphasized by the APEC Food System Initiative and the Pacific Food System Outlook project, the food system is a complex of economic relationships that tie the region's food producers to consumers. For the system to efficiently facilitate the movement of food to urban consumers, requires not just adequate transportation infrastructure,

economy. Infrastructure development, combined with trade policy reform, will lead to a larger proportion of labor-intensive food production occurring in emerging economies, with capital-intensive crop production occurring in the more developed economies of the region. This may well increase consumer benefits from lower prices for a greater variety of foods, and realign agri-food trade patterns in the region.

Food Supply and Demand

In the Asia-Pacific region, food production is distributed broadly around the region. With the exception of the Arctic North and mountainous regions, food production is located throughout

ECONOMIC IMPACTS OF TRANSPORTATION INFRASTRUCTURE

Poor data and difficulties in discerning quality differences have long hampered the ability to measure the economic impact of transportation infrastructure. The amount of infrastructure is generally associated with higher income levels, but its direct influence on development and the direction of causality is still debated. Several studies have found a strong positive relationship between infrastructure and economic growth, including farm productivity. Some researchers have found that infrastructure stocks—transport, power, and telecommunications—have a positive impact on long-run economic growth and reduce income inequality. Others contend that the largest economic potential from infrastructure expansion is in economies where it is least developed. Some researchers have found the impact of infrastructure by itself is weak, revealing its necessary-but-not-sufficient character.

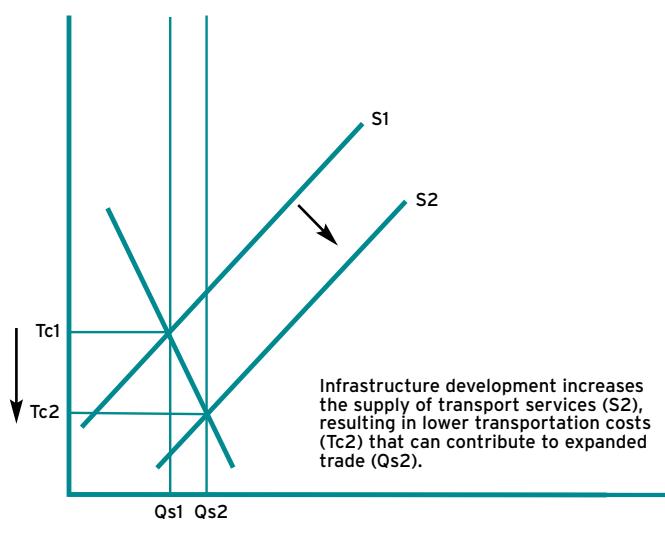
From a local perspective, building or enhancing physical infrastructure acts like the removal of a tax on farmers, lowering transaction costs for marketing products and purchasing inputs, raising returns and ultimately lowering consumer costs (Figure 1). The building of a simple dirt road with a few small bridges into a poor isolated rural area allows farmers to reach markets more quickly. Eventually they can take advantage of motorized vehicles to carry in production inputs and carry out harvested produce in larger volumes, delivering it even more quickly to local markets with less spoilage. Rural households gain better access to health care and schools, contributing to higher labor productivity on the farm. When the road is graveled or paved, costs decline even further as travel times diminish and weather is less of an obstruction to travel.

From a broader perspective, an economy's transportation network is the medium through which arbitrage and competition occur, promoting more efficient resource allocation. Specialization and economies of size result in a more efficient food system and lower food prices, key to sustaining economic development and urbanization. Infrastructure needs to be constantly maintained, upgraded and expanded to keep pace with a growing economy. It also must be complemented with competitive transportation and communication services, as well as improved coordination, performance and scheduling of transportation services to avoid bottlenecks.

Infrastructure must be thoughtfully conceived and developed, with public and private sector input and support, as well as regional planning for ports and intra regional road and rail networks. It is not automatically a good thing.

Sometimes investments are made in infrastructure to alleviate bottlenecks, when the real problem lies in regulatory policies that protect special interests. Government policy has a significant impact on transportation systems serving the food system. Reduction of tariffs and other restrictions affect the flow of food products from domestic and foreign sources. Other regulations, like cabotage restrictions, affect the service and cost of transportation providers. Finally, governments impose taxes on transportation through licenses, tolls and fuel taxes that ultimately get passed on to agricultural producers and consumers.

Figure 1 Impact of Infrastructure Development on Transportation Costs and Trade



North America, in pockets along the western coast of South America, throughout much of Southeast Asia, along the eastern and southern coastal areas of Australia, and in the eastern half of China. Some food is produced in nearly every state, province and prefecture of the region, yet many food-producing areas struggle to be economically viable. Large areas of Southeast Asia and Southern China, for example, have good soils but suffer from lack of adequate infrastructure to profitably access markets and yield-enhancing inputs, including seeds, fertilizer and pesticides.

On the other hand, food demand and food processing is geographically concentrated in or close to urban centers, a trend that is expected to continue in the future. The region's urban areas will grow by 590 million in the next 20 years, twice the growth rate of the total population, with increases of 300 million in China, 75 million in Indonesia, and 25 million in Mexico. Three-quarters of the growth will be in the less developed economies of the region, and a large part of this growth will arise from rural-urban migration.

Urban areas are where most of the middle and upper classes reside and where a disproportionate share of the economy's output is produced. Mexico City has 14 percent of Mexico's population but accounts for a third of national income. Shanghai, with 1.2 percent of China's population, generates 12.5 percent of the nation's GNP. Urban food demands are disproportionate too, with per capita diets richer in meats, fruits and vegetables than are those in rural areas. In urban locales, demand is also greater for food

services, convenience and eating away from home.

Dispersed food production and more concentrated urban-based food demand require an increasingly complex supply chain, spanning longer distances, even overseas. Densely populated urban areas require far more infrastructure per square kilometer than rural areas, although less on a per capita basis, which underscores economies-of-scale advantages for cities. Well-functioning roads and mass transit systems are needed to get large numbers of people to retail outlets on a regular basis. Sophisticated distribution systems are needed to deliver often perishable food to the point of sale. Strong linkages to the outside world are important for the provision of agricultural raw materials, and processed and fresh foods.

Linkages with foreign sources are facilitated by the coastal location of many expanding urban areas. More than half the world's population now lives and works within coastal zones that can extend 200 kilometers inland. About 60 percent of China's population live in its 12 coastal provinces, including the fast growing areas of Shanghai and the Shenzhen-Pearl River Delta area. More than half of Indonesia's population lives on 10 percent of the land area—the narrow island of Java—and almost all of Vietnam's population lives close to the coast (Hinrichsen 1999).

Status of Transportation Infrastructure in the Region

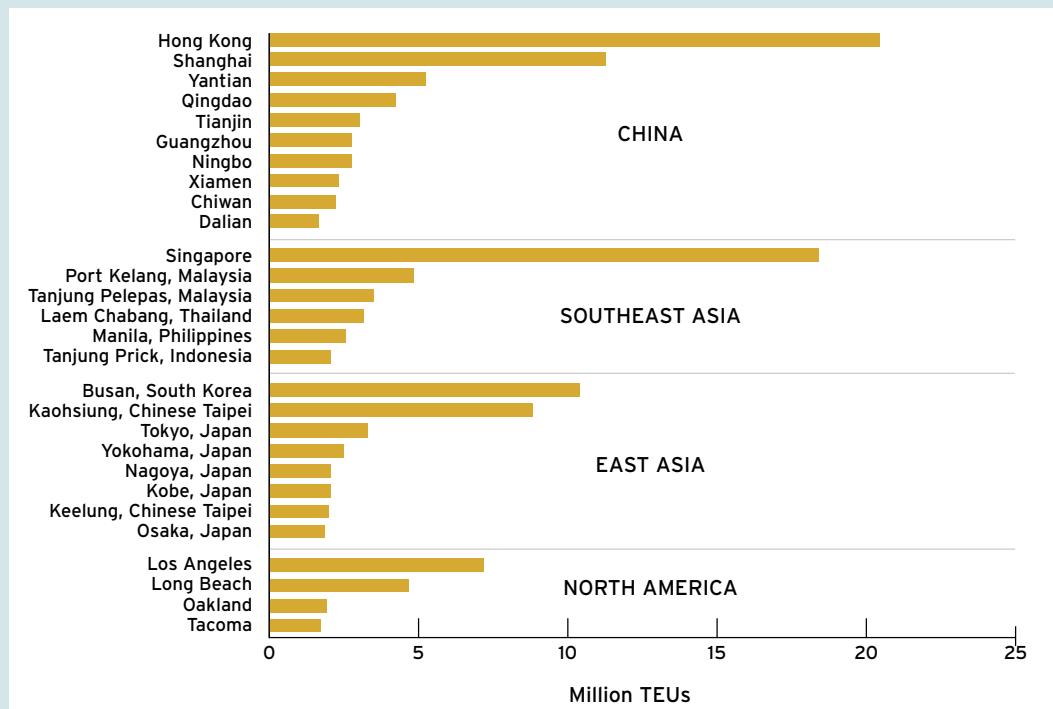
Many developing economies invest first in modernizing port facilities and airports in or near large coastal urban areas. This

allows for engagement in global trade, facilitating agri-food exports and increasing access to foreign agri-food imports. Part of this modernization may include privatization of formerly government-owned entities, with private interests providing both scarce financial support for these expensive facilities and introducing market principles. This private, market-driven motivation promotes conformity with international standards of trade and adoption of fast changing technology. Private interests have played a critical role in port and infrastructure development in the less developed economies of Malaysia, the Philippines, Mexico, Korea, Thailand and Vietnam.

Ocean transport costs are the lowest of all transportation modes over long distances. As a result, foreign suppliers can sometimes be more competitive in coastal urban markets than inland domestic producers. Inland producers may face inadequate transportation infrastructure which makes it difficult to meet the high freshness and consistency standards of higher-income urban consumers in their own economies.

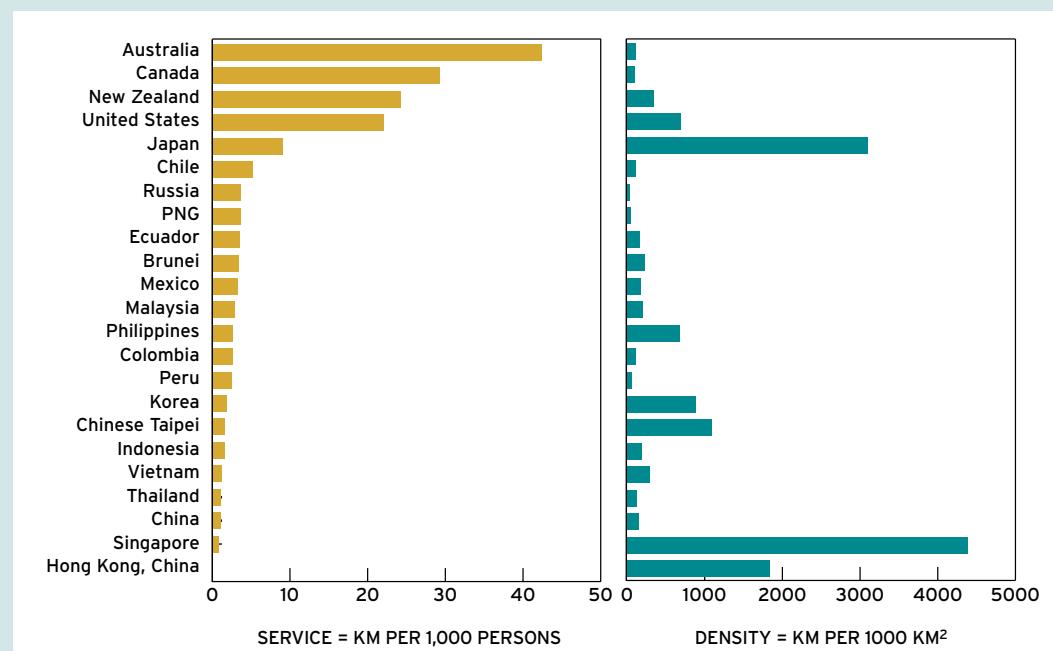
The performance of the region's ports can be assessed by container throughput or such productivity measures as "moves per crane per hour." The region has the world's three busiest container ports—Hong Kong (China), Singapore, and Shanghai (Figure 2). Containerized shipping is more and more commonly used for perishables and other processed products, but is even making inroads with bulk commodities, like grains and oilseeds. In 2003, the region's overall container throughput grew 13.5 percent, compared with 12.3 percent

Figure 2 Top Container Ports in the Asia Pacific Region, 2003



Source: The Journal Of Commerce, August 16, 2004, pp. 11A-16A

Figure 3 Road Service and Density in the PECC Region



Source: Pacific Food System Outlook and World Bank

in the rest of the world. This growth was led by Shanghai which has seen the most spectacular growth—from 500,000 twenty-foot equivalent units (TEUs) in 1990, when the port ranked 40th in the world, to 11.3 million in 2003, when it was the world's third busiest port. China's top 10 ports grew 24 percent from 2002 to 2003; Ningbo (near Shanghai) and Chiwan (one of three Shenzhen ports near Hong Kong), both grew more than 40 percent. Ports in Korea and Malaysia are also growing rapidly.

While customs regulations might make port clearance slower in the less developed parts of the region, the port facilities themselves are approaching "best practices" and are equal in productivity to ports in the more developed economies. Shanghai averaged 28 moves per crane per hour in 2003, Manila International Container Terminal 32, and Malaysia's Tanjung Pelapas 32, comparing well with Sydney at 27, Southern California ports at 26, and Rotterdam at 30. Highly productive, modern facilities in less developed parts of the region suggest that with regulatory reform, port throughput could be even greater and less costly.

Ports facilitate access by foreign food suppliers, but inland transportation infrastructure is critical to the competitiveness of the domestic agricultural economy. The quality and miles of roads and railroads vary greatly across the PECC region. As expected, road and rail systems, as measured by length of road or rail per square kilometer, are generally more comprehensive in the developed, densely populated economies, such as Singapore and Hong Kong, Korea, Chinese Taipei and

Table 1 Indicators of Transportation Infra

	Land Area (1000 Km ²)	Population 2000 (1000 people)	Railroad System Length 2000 (Km)
AUSTRALIA	7618	19153	41588
BRUNEI	5	334	13
CANADA	9897	30769	64994
CHILE	749	15224	6585
CHINA	9221	1282472	68000
COLOMBIA	1039	42120	3304
ECUADOR	279	12420	966
HONG KONG CHINA	1	6659	34
INDONESIA	1826	211559	6458
JAPAN	375	127034	23168
KOREA	98	46835	3125
MALAYSIA	329	23001	2418
MEXICO	1923	98933	19510
NEW ZEALAND	269	3784	3898
PERU	1280	28952	1829
PHILIPPINES	298	75711	897
RUSSIA	16996	145612	87157
SINGAPORE	0.7	4016	N.A.
CHINESE TAIPEI	32	22216	1108
THAILAND	512	60925	4347
UNITED STATES	9159	285003	194731
VIETNAM	325	78137	3142
PECC REGION	62231.7	2620869	537272

n.a. = not applicable

Sources: Pacific Food System Outlook, World Bank Development Indicators (2004); <http://www.indexmundi.com/>

structure

	Service (Km/1000 people)	Density (Km/1000 Km ²)	Road System Length 2000 (Km)	Service (Km/1000 people)	Density (Km/1000 Km ²)	Urban share of population 2000 (Percent)	2020 (Percent)
	2.17	5	811603	42.4	107	91	95
	0.04	3	1150	3.4	230	72	80
	2.11	7	901903	29.3	91	79	83
	0.43	9	79353	5.2	106	86	90
	0.05	7	1402698	1.1	152	36	54
	0.08	3	112988	2.7	109	75	83
	0.08	3	43197	3.5	155	63	71
	0.01	34	1831	0.3	1831	100	100
	0.03	4	342700	1.6	188	41	58
	0.18	62	1161894	9.1	3098	79	83
	0.07	32	86990	1.9	888	82	89
	0.11	7	67591	2.9	205	57	69
	0.20	10	329532	3.3	171	74	79
	1.03	14	92053	24.3	342	86	88
	0.06	1	72900	2.5	57	73	79
	0.01	3	201994	2.7	678	59	71
	0.60	5	532393	3.7	31	73	75
	-	-	3066	0.8	4380	100	100
	0.05	35	34901	1.6	1091	82	86
	0.07	8	63983	1.1	125	20	27
	0.68	21	6304193	22.1	688	77	82
	0.04	10	93300	1.2	287	24	35
	0.20	9	12742213	4.9	205	51	63

Japan. For the less developed economies in Southeast Asia, Latin America and China there is significant underinvestment in road and rail systems (Table 1 and Figure 3). A difficult challenge in Southeast Asia is overcoming the fragmented geography of its extensive archipelago nations, Indonesia and the Philippines. For example, it takes a truck three days, 850 kilometers and two ferry crossings, to deliver fruit from Manila to Davao on the southern island of Mindanao in the Philippines.

A key constraint to transportation infrastructure development is financial support from local and national governments, or from domestic and foreign private

projects worldwide (Figure 4), with particularly large programs in China and Southeast Asia. With the exception of the ADB, these programs have declined as a share of total lending since 1997. Yet, total global needs for rail and road infrastructure in less developed economies are estimated at about \$100 billion per year for new investment and maintenance (Fay 2003).

Though existing transportation infrastructure levels are low in the developing parts of the PECC region, some economies—China, Mexico, and parts of Southeast Asia, in particular—are quickly expanding or enhancing road and rail infrastructure, supporting agri-

CHINA—CONNECTING INTERIOR PROVINCES WITH POPULOUS COASTAL AREAS

China is rapidly evolving from an agrarian subsistence to an urban, market-oriented economy. More than 300 million people are forecast to be added to the economy's urban areas by 2020, fueled by rural-urban migration and natural increase. China's urban population, concentrated in coastal provinces, will surpass its rural population by 2015.

While lagging the more developed economies in the PECC region, China's infrastructure development is expanding rapidly on many fronts, some in collaboration with international lending

Some economies—China, Mexico, and parts of Southeast Asia—are quickly expanding or enhancing road and rail infrastructure.

investors. Infrastructure is a public good. Once the initial investment is made, many interests can make use of it, often without payment. This "free-rider" aspect of infrastructure means that market forces alone will result in underinvestment in infrastructure. Hence, governments play a crucial role in encouraging and funding infrastructure investments.

Bond markets have been slow to develop, limiting the ability of investors to tap the high savings rates in many of the developing Asian economies. International financial institutions have played only a modest role in the development and enhancement of physical infrastructure. Between 1997 and 2003, the World Bank, the Asia Development Bank (ADB) and the Inter-American Development Bank (IDB) averaged only \$5 billion per year in loans for transportation/ communication-related

cultural and economic development in their respective economies.

Infrastructure Development

Infrastructure development is best viewed on a case-by-case basis because it plays a central but varied role in different parts of the region. Three examples illustrate how development of transportation infrastructure is improving the connections between agricultural areas and consumers in the Asia-Pacific region, creating a more seamless food system:

- China, connecting interior provinces with populous coastal areas;
- NAFTA, north-south linkages integrating a less developed partner; and
- Greater Mekong Subregion, linking remote agricultural areas with urban centers and ports.

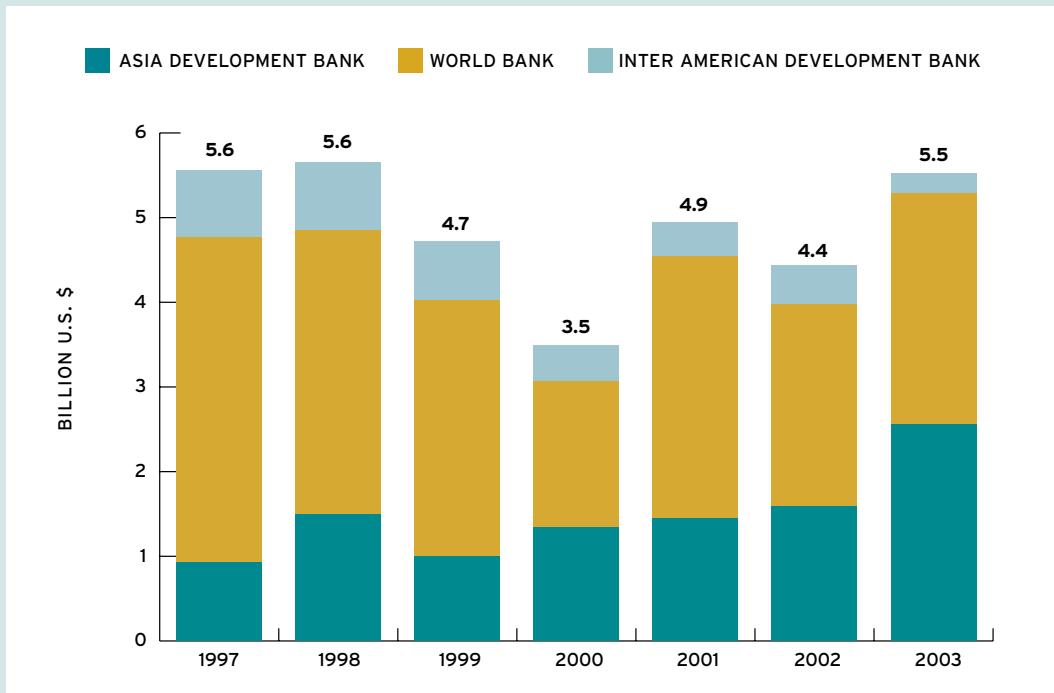
institutions (Table 2). After favoring investments in coastal regions for many years, China is now putting more emphasis on developing road, rail and waterway networks to serve and connect its interior provinces with coastal regions.

As these infrastructure networks are more fully developed, China should be better able to exploit its agricultural comparative advantage in high-value, labor-intensive perishable food products. As transport and other marketing costs fall, the broader economy will become more efficient—realigning regional production patterns, eliminating spot shortages, equalizing prices, raising farm incomes in China's interior provinces, and providing low priced, high quality foods to its growing urban areas.

Rapid expansion of roads

Improving China's road system is

Figure 4 International Bank Loans for Transportation Infrastructure Projects



Source: Annual reports from World Bank, Asia Development Bank, and Inter-American Development Bank; includes loans for all transportation and communication projects, not just in the PECC region.

a significant priority. By 2020, China's road network is forecast to reach 2.5 million kilometers (km), including a doubling of major highways to 70,000 km.

One example is a recent ADB-supported project, consisting of construction of a 173-kilometer, four-lane toll expressway from Changde to Huaihua, and upgrading 517 km of local roads servicing hundreds of poor villages. The new expressway will significantly cut travel times between Changde and Huaihua, and increase profit margins for poor farmers by lowering transport costs for both agricultural inputs and outputs (ADB Press Release, September 9, 2004).

China also plans to improve road links with its neighbors, including a highway link with Southeast Asia (see section on the Greater Mekong Subregion). These overland links will foster growth and economic integration,

particularly with remote areas where agriculture remains a dominant sector (Map 1).

Rejuvenating China's railway system

As in many economies, China's railway system has been in decline, with rail's share of the nation's cargo dropping to 50 percent in 2000 from 70 percent in 1990 (Far Eastern Economic Review, July 18, 2002).

China's leaders realize that the nation's railways require an overhaul if the economy is to continue to develop. Central goals are to connect the less developed, but resource rich northern and western parts of the economy (coal, minerals, and grain) with the more populous and prosperous manufacturing centers in the east, and to foster development outside the coastal provinces.

Public efforts to introduce

market mechanisms and competition, and to invest in improving and expanding the rail network, are improving the outlook for the rail sector. China is spending \$42 billion to add 7,000 km of new track by 2005. Physical improvements and expansion are underway on eight east-west lines—Beijing-Lanzhou, north corridor, south corridor, land bridge corridor, Nanjing-Xi'an, riparian railway, Shanghai-Kunming and southwest sea outlet corridor—and eight north-south lines—Beijing-Harbin, eastern coast corridor, Beijing-Shanghai, Beijing-Kowloon, Beijing-Guangzhou, Dalian-Zhanjiang, Baotou-Liu Zhou and Lanzhou-Kunming.

These investments are lowering transportation costs by reducing travel times and making service more reliable. For example, the improved 2,500-km Beijing-to-Kowloon (Hong Kong) railway

Table 2 China Infrastructure Projects with Asia Development Bank

Approval date/Project	Institution	Loan amount	Total cost
2004			Million US \$
YUNNAN DALI-LIJANG RAILWAY PROJECT	ADB	180	548
HUNAN ROADS DEVELOPMENT II	ADB	312.5	778.1
GUANGXI ROADS DEVELOPMENT II	ADB	200	726
HUBEI SHIMAN HIGHWAY PROJECT	World Bank	200	529
SECOND NATIONAL RAILWAYS PROJECT (ZHE-GAN LINE)	World Bank	200	1755.5
FOURTH INLAND WATERWAYS PROJECT	World Bank	91	260.4
WUHAN URBAN TRANSPORT PROJECT	World Bank	200	598.2
2003			
SECOND ANHUI HIGHWAY PROJECT	World Bank	250	631.83
XI'AN URBAN TRANSPORT PROJECT	ADB	270	762
WESTERN YUNNAN ROADS DEVELOPMENT PROJECT	ADB	250	381
YICHANG-WANZHOU RAILWAY PROJECT	ADB	500	2604
NINGXIA ROADS DEVELOPMENT	ADB	250	498
SOUTHERN SICHUAN ROADS DEVELOPMENT	ADB	300	1019
2002			
CHENGDU-NANCHONG EXPRESSWAY	ADB	250	667.2
SHANXI ROAD DEVELOPMENT II	ADB	124	294
HUBEI XIOGAN-XIANGFAN HIGHWAY PROJECT	World Bank	250	690.88
XINJIANG HIGHWAY PROJECT	World Bank	150	334.2
INNER MONGOLIA HIGHWAY PROJECT	World Bank	100	268.73
NATIONAL RAILWAY PROJECT	World Bank	160	1302.24
TOTAL		4237.5	14648.28

Sources: Asia Development Bank and World Bank

has cut travel times in half along its route. This project is revitalizing rural areas along the route by expanding farmers' access to markets, attracting outside investment, and allowing rural labor to take advantage of higher-wage oppor-

tunities in urban areas (ADB Press Release, March 17, 2003).

China's railways, however, are still hampered by the lack of refrigerated cars, containers and the supporting inter-modal infrastructure needed for efficient

transport of perishable goods to coastal markets and export positions. Shandong and Shaanxi provinces, for instance, already produce and export temperate climate fruits and vegetables to East and Southeast Asia. If rail trans-

Bank and World Bank, 2002-2004

Description
166 km railroad from Dali to Lijiang in northwestern port of Yunnan
173 km expressway; improve 517 km local roads
188 km long expressway between Nanning (Tanolou City) and Baise City in Guangxi Zhuang Autonomous Region
105.1 km Hubei section of the Shiyan Manchuangan Expressway, a 106.8 km highway linking Shiyan City in northwestern Hubei province to Manchuangan in Shaanxi province
Upgrade track maintenance on heavily used portions of Zhe-Gan line
Upgrade navigation conditions of major east-west river and other waterways in the Pearl River Delta region
Promote development of an integrated, efficient, and sustainable transport system
116 km of trunk highway; rehabilitate and improve 243 km of other highways
Construction of urban ring road; improve connector roads; urban transport facilities and services
77 km expressway between Baoshan and Longling prefectures in Yunnan Province
391 km of railway linking Yichang (Hubei Province) and Wanzhou (Chongqing Municipality).
Expressway across mountainous terrain; improve local roads servicing poor counties and townships
Expressway across hilly to mountainous terrain; improve local roads servicing poor counties and townships
208 km, four-lane controlled access highway linking Chengdu to Nanchong, Eastern Sichuan; reconstruction of 300 km of provincial and county roads
New expressway and a bridge over the Yellow River (Huanghe); improve local roads servicing poor counties and townships
Xiaogan-Xiangfan Expressway, linking major industrial, and hub cities with less developed counties in the western part of Hubei
Four lane expressway, and additional two lanes in the Kuitun-Sailimu Hu Highway
Laoyemiao-Jining highway, a divided four-lane, access controlled toll highway, connecting key industrial, administrative, and hub cities of Baotou, Hohhot, and Jining
Expansion east-west railway corridor between Baoji and Lanzhou (Bao-Lan line), by double-tracking and upgrading existing line

portation inefficiencies were overcome, North China and the eastern Loess Plateau likely could make further inroads in urban and international markets for apples, pears, vegetables and other horticultural products. Similarly,

South Central China could increase production and trade in citrus crops, semi-tropical fruit like *lichi* and *longan* and some vegetable products, as well as regain a competitive position for pork production.

Ports move food trade

Given the gains made through trade, it is not surprising that China has made port development and modernization a top priority. China's ports are a conduit for food exports, providing foreign

Map 1 China's Major New and Upgraded Roads



Source: Asia Development Bank

food suppliers more efficient access to the nation's populous coastal regions, and providing cheaper transport of agricultural commodities within China—for example, from northeastern producing provinces through the port of Dalian to consuming areas around Shanghai and Guangzhou (Gale 2004).

To keep pace with growing trade, China must continually develop and expand its facilities to achieve greater efficiencies in ship navigation and scheduling, berthing, cargo off loading, inspection, customs clearance, security, tracking and storage. Influencing

bulk commodity transport, accounting for less than 5 percent of total domestic freight movements. But this is changing. For example, container traffic through major river ports grew by 26 percent per year to almost 2 million TEUs in 2000, from around 100,000 TEUs in 1990. Traffic along the Yangtze, Pearl, Heilongjiang, Songhuajiang and Liaohe river systems—critical to the transport of perishable agri-food products—may grow to 7 million TEUs by 2015 and 15 million TEUs by 2030.

Official plans for the inland waterway network emphasize port

efficient marketing of the high-value frozen and perishable foods that are in growing demand in China. To accommodate domestic and international demand for perishable foods, cold chain infrastructure and management must be improved. China's cold storage capacity is estimated to be only 20 percent to 30 percent of demand. A lack of controlled atmosphere and refrigeration equipment leads to spoilage losses of up to 33 percent of perishable food. China now produces such equipment, but incentives are not yet sufficient for widespread use.

China's ports are a conduit for food exports, providing foreign food suppliers more efficient access to the nation's populous coastal regions, and providing cheaper transport of agricultural commodities within China.

port development in China and elsewhere is a globalized and highly innovative shipping industry that makes widespread use of standard-sized containers, and larger and larger vessels.

Waterways: major east-west thoroughfares

China possesses the most extensive inland waterway system in the PECC region, with 116,500 km of navigable rivers, primarily the Yangtze, Zhusiang (Pearl), Huaihe, and Helongjiang rivers. The Yangtze and its tributaries account for about half of the total. New construction is also underway to extend and increase the capacity of the Beijing-Hangzhou Grand Canal, which has a navigable length of more than 1,700 km.

Inland waterways are currently under-utilized for long distance

development and construction of 15,000 km of inland river channels in major north-south and east-west corridors. Completion of the Three-Gorges Dam and better regulation of water levels on the Yangtze River allow larger vessels and more reliable service along the more-than 2,000 km stretch between Shanghai and Chongqing. Lower transportation costs are spurring development, making this area a potential rival to the Guangdong-Hong Kong area and enhancing the movement of agri-food products to Shanghai and other coastal cities (Journal of Commerce, Dec. 17, 2003).

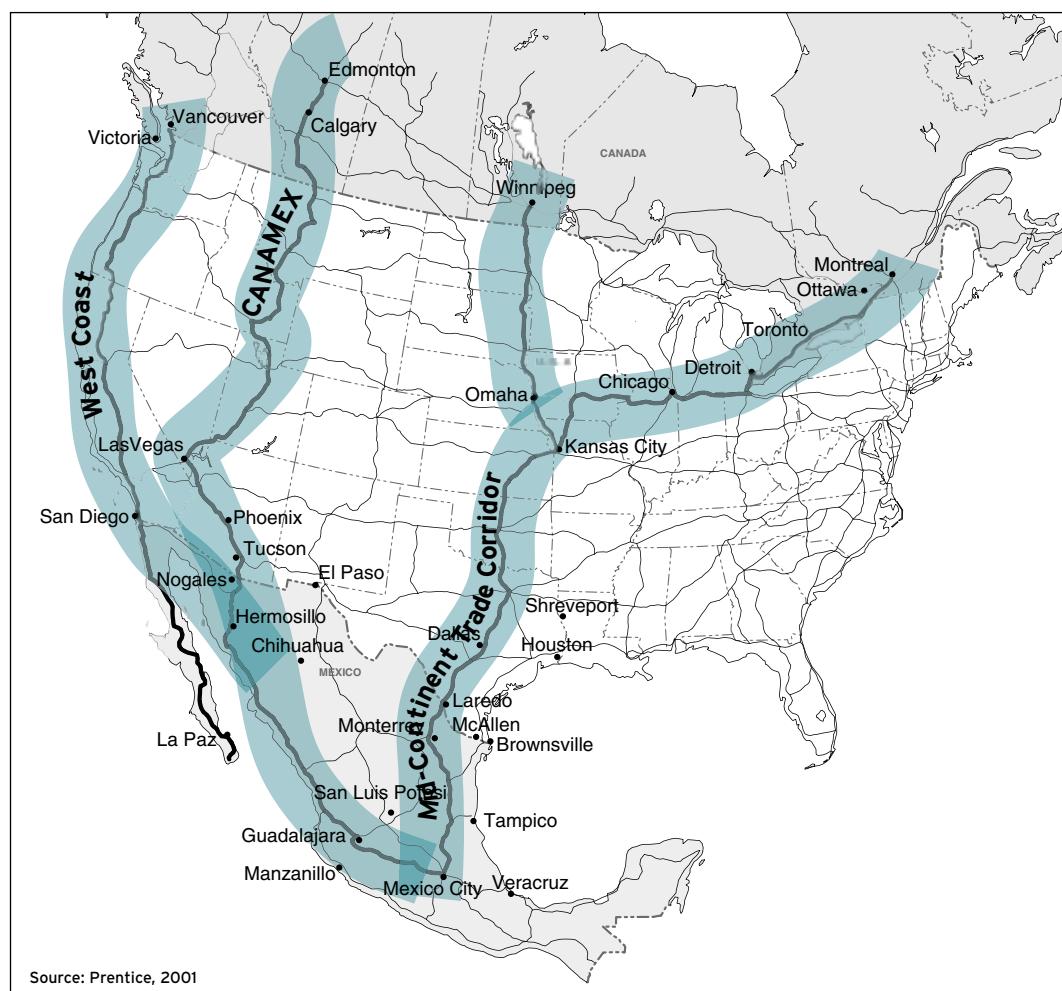
Other constraints

In addition to transportation infrastructure, warehousing and storage facilities are critical to

NAFTA: FACILITATING NORTH-SOUTH LINKAGES TO INTEGRATE A LESS DEVELOPED PARTNER

The food system of the North America Free Trade Agreement (NAFTA) faces different challenges in expanding and enhancing transportation linkages, particularly between Mexico and its trade partners, the United States and Canada. While Canada and United States have mature and well-integrated transportation networks, the Mexican system is less integrated with its northern neighbors. North-south rail and road corridors are being developed to accommodate growing trade. Cross border regulations will continue to be a problem, but their effect is being offset by innovations in information technology and advances in inter-modal systems. New technologies facilitate

Map 2 NAFTA's North-South Highway Corridors



security and product integrity inspections further from congested border crossings.

Despite physical and regulatory impediments, growth in food and agricultural trade in NAFTA has been rapid in the 1990s.

NAFTA is now the most important regional market for U.S. food and agricultural exports, surpassing East Asia and Europe. Given the long land borders separating the three economies, overland transportation modes are most significant and agriculture dominates them. In the United States, food, raw commodities, processed agri-

cultural products, and farm inputs account for one-third of total freight shipments. Trucking is by far the leading mode, with rail systems historically in decline except for recent years.

Within NAFTA, trucks account for more than two-thirds of all food shipments. Trucks are particularly dominant in the shipping of meats and other perishable because of the premium on speed and flexibility of delivery. Long haul modes—rail, barge and ocean shipping—are used for such lower-valued commodities as grains and oilseeds. Heightened

demand for high-value perishables (e.g., berries, stone fruit) has stimulated growth in NAFTA's use of air transport.

Roads are key to the region's food system

The United States and Canada share one of the best-developed highway systems in the world in terms of quality and density. This enables trucking to dominate North American freight transportation. But Mexico's road system is not nearly as developed or comprehensive as its northern partners. It has, however, been

expanded rapidly in recent years, with substantial investment in highway construction and development of strategic nodes and feeders to connect regional and state road networks. Road length expanded by one-third between 1990 and 2000. Modern, privately-operated toll roads are still underutilized because tolls are too expensive for widespread commercial use. Thus, trucking firms continue to rely on deteriorating public roads, which follow routes that are longer and less safe.

Highway funding in the United States since NAFTA has encouraged the identification of north-south trade corridors, and given priority to investment in infrastructure that promotes trade. Over the past decade, three highway corridors have emerged as principal Canada-U.S.-Mexico trade routes: The West Coast, CANAMEX, and the Mid-Continent Trade Corridor (Map 2). These connect the horticultural producing areas of northwest Mexico with U.S. and Canadian markets; and U.S. and Canadian grain producing areas with Mexico's industrial heartland, an area outlined by Mexico's three largest cities: Monterrey, Guadalajara and Mexico City.

Productivity of NAFTA's rail system improving

For long-distance hauls, rail transportation throughout NAFTA is becoming more competitive with trucking for two reasons: mergers and acquisitions that reduced the number of Class I rail companies to 9 from 56, and privatization of Mexico's state-run rail system in the late 1990s.

U.S. mergers have generally led to greater efficiencies—fewer

companies with less rolling stock across smaller networks with fewer employees and at less cost. The impact on agriculture has been mixed with lower rates for bulk commodities but reduced services for remote agricultural areas. Privatization of Mexico's rail system led to agreements with U.S. and Canadian companies, resulting in upgraded north-south service and increased shipments.

A 1995 constitutional amendment paved the way for privatization of Mexico's rail system. The system was divided into five concessions, including three main lines: the northeast corridor from Laredo to Mexico City (Ferromex); the northwest corridor through Hermosillo and Nogales and Saltillo to Eagle Pass (Transportación Ferroviaria Mexicana or TFM); and the ports of Veracruz and Coatzacoalcos to Mexico City. Greater integration of Mexico's rail system with those of the United States and Canada, combined with investments in warehousing and inter-modal facilities, has made shipping agricultural commodities by rail an attractive alternative to trucking in some cases.

With a 26-percent stake in Ferromex, the U.S. based-Union Pacific Railroad now offers "Aztec Eagle" service between the western United States and west/central Mexico. Kansas City Southern acquired 50 percent of TFM, linking Canadian, Mexican and U.S. shippers through the heart of the U.S. corn belt. This consortium provides international freight services from the U.S. midwest to south-central Mexico, including the Chicago-to-Mexico City "NAFTA Run-Through" and "NAFTA Express" services. A rail-

car loaded with grain in the interior of the United States now can go directly to Mexico City, compared with the three handlings needed for a competing alternative: barge, ship, and truck via New Orleans, Veracruz and Mexico City.

North-south ocean shipping: an uncertain outlook

Most intra-NAFTA trade is overland. Ocean shipping is an economic alternative to overland transit in some instances. The ocean share accounts for 40 percent to 50 percent of total U.S.-Mexican grain shipments, primarily via U.S. gulf ports through Veracruz, Mexico. Rates for grain and oilseed shipments are about 10 percent to 15 percent lower than rail (Hall 2001). Large containerships now offer rates and transit times from the Pacific Northwest to the Mexican port of Manzanillo that are comparable to trucking for high-value commodities. Mexican importers of apples from British Columbia and the state of Washington, for example, have found that refrigerated container service via ocean is cost effective, reduces product damage and takes only slightly longer than by truck. Ocean container movements between Manzanillo and Long Beach now offer a substantial price advantage over both trucking and rail.

Port privatization in Mexico in the 1990s led to increased investment in infrastructure, intensified competition among service providers, and improved port productivity. At Mexico's major ports of Veracruz, Manzanillo, Lázaro Cárdenas, and Tampico/Altamira, fully mechanized terminals are replacing outdated equipment and facilities.

While ocean shipping may be cheaper, its dependence on other transport modes for final delivery causes uncertainty and raises costs. Rapid trade growth, for example, threatens to increase congestion, undermine productivity, and raise costs at the ports of Long Beach-Los Angeles, the most important NAFTA-Asia gateway. Shippers are being forced by new economic realities to consider alternative, more distant ports, even on the East Coast.

Regulatory environment imposes trade costs

Freight movements in NAFTA are hampered not just by inadequate infrastructure, particularly in Mexico, but by an array of protectionist and other regulations across all three economies. Greater border surveillance in the aftermath of September 11, 2001, is also a factor.

Among the measures that can impede the flow of trade and impose costs are *cabotage* restrictions, which are designed to protect domestic trucking and ocean shipping services by limiting pickup and delivery of cargo within an economy to national carriers. In the United States, for example, the Jones Act restricts ocean shipments of goods between coastal points in the United States to vessels built in U.S. shipyards and owned and crewed by U.S. citizens. This law inhibits shipments of grain by water within the United States, making it cheaper in some instances for southeastern U.S. livestock producers to use Brazilian soybeans or Canadian feed grains. *Cabotage* policies raise costs to U.S. shippers and producers.

Given the predominant role of trucking in NAFTA, the absence of a cross-border trucking agreement between the United States and Mexico has been a significant barrier to efficient transportation in the region and contributes to delays at the U.S.-Mexico border.

Under NAFTA, trucks from the United States and Mexico were to be given access to states on either side of the international boundary in 1995, and full nationwide access by 2000. However, a prohibition remained in place because of U.S. concerns about the safety of Mexican trucking—overweight trucks, lack of operational logs, and no limits on number of hours driven per shift.

In June 2004, a U.S. Supreme Court ruling lifted the last legal obstruction to reciprocal U.S.-Mexico truck. Reciprocal access should commence as soon as there are sufficient resources at the border to certify that Mexican trucks are in compliance with U.S. law. However, the continuation of a complicated three-step transfer system still causes delays at the Laredo border. Removing such bottlenecks would reduce travel time between Chicago and Monterrey, Mexico by as much as 40 percent, according to estimates by Texas A&M International University.

Customs regulations have tightened along all international boundaries in NAFTA since September 11, 2001. Time-consuming customs procedures are likely to continue. Some north-bound delays result from efforts to interdict drugs and undocumented immigrants. Other delays arise from inspections for agricultural pests and diseases. Despite greater surveillance since September 11, 2001, traffic volumes across inter-

national boundaries continue to grow (*Journal of Commerce*, April 14, 2004).

Technological innovations and expanded inter-modalism promote trade

Innovations in information technology and expansion of inter-modal systems are reducing delays caused by inadequate infrastructure and customs and other regulations at international borders. Intelligent Transportation Systems (ITS), including electronic toll collection systems, vehicle X-ray and weigh-in-motion devices, electronic data interchange systems, and vehicle-to-roadside communications systems, help reduce congestion, infrastructure needs and environmental pollution.

The expansion of inter-modalism is also lowering transaction costs and promoting a more efficient food system. Standardized shipping containers can be more efficient and versatile than truck trailers or rail cars. These containers can be double stacked on flat railcars, transported by the thousands via containerships, and set onto truck chassis. This efficiency and versatility, however, depend on well-developed inter-modal links between rail and truck, truck and marine, and rail and marine. Trucking continues to begin and end most freight movements, but a growing combination of modes will be employed on the long-haul portion of transportation routes.

THE GREATER MEKONG SUBREGION: INTEGRATING REMOTE AGRICULTURAL AREAS WITH URBAN CENTERS AND PORTS

The Asia Development Bank (ADB) is supporting an ambitious

Map 3 Greater Mekong Subregion's Road Development



Source: Asia Development Bank

integration with six countries in the Mekong River region—Cambodia, China, Laos, Myanmar, Thailand and Vietnam. Initiated in 1992, the program is designed to integrate the roads, railways and electric power of these six countries, and connect them with other parts of the region. The program has the potential to improve the economic conditions of 70 million people who live in the Mekong basin, many of whom are subsistence farmers (Far Eastern Economic Review, August 26, 2004). In addition to improvement and expansion of transportation infrastructure, customs procedures and practices across the six economies will be streamlined to reduce time spent at border checkpoints.

At the heart of the program are three major road projects (Map 3):

- North-South Economic Corridors between southern China and Bangkok, Thailand and southern China and Hanoi, Vietnam;
- East-West Economic Corridor between Myanmar and Da Nang, Vietnam; and
- Southern Corridor between Bangkok, Thailand and Ho Chi Minh City, Vietnam

The North-South Economic Corridor will connect Kunming in southwestern Yunnan Province, China, with Bangkok, Thailand, covering a distance of 2,000 km. This corridor, along with established roads from Bangkok to Singapore, and Kunming to Beijing, will provide a 4,500-km continuous, all-weather overland route between Singapore and Beijing. Several sections of the road are under construction or are being upgraded, primarily in China and Laos, but significant

sections are still impassable during the rainy season. Mountainous terrain in some sections in Yunnan has required the building of numerous tunnels and bridges. Another link will connect Kunming with Hanoi and the ports of Haiphong and Cai Lan.

By 2006, the all-weather Southern Corridor will connect Bangkok, Thailand, with Ho Chi Minh City, Vietnam.

According to the ADB, this project will also improve 540 km of feeder roads, reduce travel times and transport costs, and provide broader access for farm products in the region's major urban markets.

Road improvements completed to date are already strengthening economic linkages between Cambodia and Vietnam, particularly in agriculture and agribusiness. This has enhanced transport reliability, helped raise agriculture productivity, and improved income opportunities. Traffic volumes are expected to continue to grow at 7 percent annually. Vietnamese trucks carrying fruit and other products are increasingly using the highway; likewise Cambodian trucks with agricultural products are supplying markets in Ho Chi Minh City. Fruit vendors and restaurant owners along the highway between Phnom Penh and the Vietnamese border are benefiting from increased traffic and the availability of cheaper food supplies.

The East-West Economic Corridor stretches almost 1,500 km from Vietnam to Myanmar. It is the only land route that traverses mainland Southeast Asia east to west. Improvements scheduled for completion in 2006 include rehabilitation of a 130-km segment of highway in Laos, building a sec-

ond international bridge across the Mekong River, and constructing a tunnel between Hue and Da Nang. When combined with improvements in north-south routes, the corridors will promote development in remote areas, growth of secondary towns, and improved access to coastal markets and ports. Laos and Northeastern Thailand will gain access to Vietnam's port of Da Nang. Ports on the western end of the corridor will provide farmers and processors better access to South Asian markets (Asia Development Bank, 2002a).

Conclusions

These three examples illustrate how major transportation infrastructure development is taking place throughout the PECC region, linking dispersed surplus food-producing areas with urban consumers, and contributing to a more efficient, seamless regional food system.

But transportation infrastructure is only one of the necessary elements of an efficient food system. As has been repeatedly emphasized by the APEC Food System Initiative and the Pacific Food System Outlook project, the region's food system is not limited to production agriculture but encompasses the entire complex of economic relationships and linkages that tie the region's food consumers to producers. To complement well-functioning transportation infrastructure requires competitive transportation and logistics services and policy reform.

Transportation infrastructure development allows for the freer play of comparative advantage by expanding or enhancing the ability of price signals to be transmitted

GLOSSARY OF TERMS

CABOTAGE: A French term for trade along the coast. It refers to a certain set of laws implemented by many economies requiring national flag vessels to provide domestic inter-coastal service. The term now also applies to other transportation services.

CONTAINERIZATION: A system of inter-modal cargo transport using standard containers that can be loaded on container ships, railroad cars and trucks. Three common standard lengths are 20 foot, 40 foot and 45 foot. Container capacity of ships and ports are measured in 20-foot-equivalent units (TEUs).

GLOBALIZATION: The integration of local, national and regional economies into one global economy. This integration can be measured by the increase of cross-border flows of materials, products, technology, money, people and ideas. These increasing flows are made possible by advances in transportation and communication technology, as well as international agreements, treaties, protocols and institutions that facilitate and attempt to remove barriers to the flows of products, people and capital.

INTER-MODAL: Involving more than one form of transportation service (rail, truck, marine, air) during a single journey.

LOGISTICS: A framework for the management of materials, services, information and capital flows, including the complex information, communication and control systems required for today's business environment.

PANAMAX: A class of ship that will fit through the locks of the Panama Canal, having dimensions of about 294 meters in length, 32 meters in width, and draft of 12 meters.

SUPPLY CHAIN: All the activities involved in delivering a product from raw material through to the customer. This includes sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities. Supply chain management coordinates and ideally integrates all of these activities into a seamless process and links all of the partners in the chain, including departments within an organization and the external partners including suppliers, carriers, third-party companies and information systems providers

TEU: A 20-foot equivalent unit. One TEU is a measure of containerized cargo equal to one standard 20 foot (length) by 8 foot (width) by 8.5 foot (height) container.

throughout an economy and region. Infrastructure development, combined with trade policy reform, will lead to greater production of labor-intensive food products in less developed parts of the PECC region, and production of more capital-intensive crops in the more developed parts of the region. More efficient resource allocation will generate greater volumes of trade, realign agri-food trade patterns and lower consumer food costs across the region.

To meet the food demands

needed to sustain urban growth, the private and public sectors must invest either in streamlining domestic supply chains—including expensive transportation infrastructure to connect urban centers with food-producing areas—or negotiate trade agreements to open domestic markets to foreign food imports and supplies, or some combination of the two strategies. Creating modern infrastructure, improving related services and reforming policies will help build a more seamless Pacific food system.

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- **World Bank Group, Research, Infrastructure:** <http://econ.worldbank.org/topic.php?topic=14>
- **World Bank, Projects and Programs:** <http://web.worldbank.org>

ABBREVIATIONS USED IN THE PACIFIC FOOD SYSTEM OUTLOOK

ADB—Asia Development Bank	PECC—Pacific Economic Cooperation Council
APEC—Asia Pacific Economic Cooperation Forum	TEU—Twenty-foot Equivalent Unit
IDB—Inter-American Development Bank	WTO—World Trade Organization
NAFTA—North America Free Trade Agreement	



PECC MEMBERS

PACIFIC ECONOMIC COOPERATION COUNCIL

Pacific Economic Cooperation Council International Secretariat
4 Nassim Road
Singapore 258372
Tel: 65-6737 9822
Fax: 65-6737 9824
<http://www.pecc.org>

AUSTRALIA

Australian Pacific Economic Cooperation Committee (AUSPECC)
JG Crawford Building
Australian National University
Canberra ACT 0200
Australia
Tel: 61-2-6125 0567
Fax: 61-2-6125 0169
<http://sunsite.anu.edu.au/auspecc/aust.html>

BRUNEI DARUSSALAM

Brunei Darussalam National Committee for Pacific Economic Cooperation (BDCPEC)
Department of Multilateral Economics
Ministry of Foreign Affairs
Bandar Seri Begawan BD 2710
Brunei Darussalam
Tel: 673-2-261 177
Fax: 673-2-261 620

CANADA

Canadian National Committee for Pacific Economic Cooperation (CANCPEC)
Asia Pacific Foundation of Canada
666-999 Canada Place
Vancouver, BC, V6C 3E1
Canada
Tel: 1-604-684-5986
Fax: 1-604-681-1370
<http://www.asiapacific.ca/>

CHILE

Chilean National Committee for Pacific Economic Cooperation (CHILPEC)
Chile Pacific Foundation
Av. Los Leones 382, Of. 701
Providencia
Santiago, Chile
Tel: 56-2-334 3200
Fax: 56-2-334 3201
<http://www.funpacifco.cl/ingles/index.html>

CHINA

China National Committee for Pacific Economic Cooperation (CNCPEC)
China Institute of International Studies
3 Toutiao Taijichang
Beijing
China 100005
Tel: 86-10- 8511 9648
Fax: 86-10- 8511 9647
<http://www.pecc.net.cn/>

COLOMBIA

Colombia National Committee for Pacific Economic Cooperation (COLPECC)
Ministry of Foreign Affairs
Calle 10 No. 5-51
Santafe de Bogota
Colombia
Tel: 57-1- 5667 140
Fax: 57-1- 5667 145

ECUADOR

Ecuadorian Committee for the Pacific Economic Cooperation Council (ECPECC)
Av. Carrión & Páez Str. (corner), ZURITA Bldg, Mezzanine
Ministry of Foreign Affairs, Quito, Pichincha,
Ecuador, South America
Tel: 593-2-2501-197/2561-215 (ext. 253)
Fax: 593-2-2508987

HONG KONG, CHINA

Honk Kong Committee for Pacific Economic Cooperation (HKCPEC)
Trade & Industry Department
17/F, Trade & Industry Department Tower
700 Nathan Road
Kowloon
Hong Kong, China
Tel: 852-2398-5305
Fax: 852-2787-7799
<http://www.hkcpec.org/>

INDONESIA

Indonesia National Committee for Pacific Economic Cooperation (INCPEC)
Centre for Strategic and International Studies (CSIS)
Jalan Tanah Abang III/23-27
Jakarta 10160
Indonesia
Fax: 62-21-386 5532
Tel: 62-21-384 7517

JAPAN

Japan National Committee for Pacific Economic Cooperation (JANCPEC)
The Japan Institute of International Affairs (JIIA)
11F Kasumigaseki Building
3-2-5 Kasumigaseki, Chiyodaku
Tokyo 100
Japan
Tel: 81-3-3503 7744
Fax: 81-3-3503 6707
<http://www.jiia.or.jp/>

KOREA

Korea National Committee for Pacific Economic Cooperation (KOPEC)
Korea Institute for International Economic Policy (KIEP)
300-4, Yeongok-Dong, Seocho-Gu
Seoul 137-747
Korea
Tel: 82-2-3460 1242
Fax: 82-3-3460 1244

MALAYSIA

Malaysia National Committee for Pacific Economic Cooperation (MANCPEC)
Institute of Strategic and International Studies (ISIS)
No. 1 Pesiarian Sultan Salahuddin
P.O. Box 12424 50778 Kuala Lumpur
Malaysia
Tel: 60-3-2693 9366
Fax: 60-3-2693 9430

MEXICO

Mexico National Committee for Pacific Economic Cooperation (MXCPEC)
Paseo de la Reforma No. 175
Piso 10, Col. Cuauhtemoc
06500 Mexico, DF
Tel: 52-55- 5327 3001
Fax: 52-55- 5327 3134

NEW ZEALAND

New Zealand National Committee for Pacific Economic Cooperation (NZPECC)
c/o Statistics New Zealand
Private Bag 92003
Auckland
New Zealand
Tel: 64-9- 9209 132
Fax: 64-9- 9209 055

PERU

Peruvian National Committee for Pacific Economic Cooperation (PERUPEC)
Ministry of Foreign Affairs
Jr. Lampa 545, 4th Floor
Lima
Peru
Tel: 51-1-311 2570
Fax: 51-1-311 2564

THE PHILIPPINES

Philippine Pacific Economic Cooperation Committee (PPECC)
c/o Philippine Foundation for Global Concerns
43/F, Philamlife Tower
8767 Paseo de Roxas
Makati City, Philippines
Tel: 632-885 0924
Fax: 632-845 4832

RUSSIA

Russia National Committee for Pacific Economic Cooperation (RNCPEC)
19 Novy Arbat St., Office 2035
103025 Moscow
Russia
Tel: 7-095- 244 9033
Fax: 7-095- 244 3917

PACIFIC ISLANDS FORUM (PIF)

Pacific Islands Forum Secretariat
Private Mail Bag
Suva, Fiji
Tel: 679-3312600/ 3302375
(Direct)
Fax: 679-3300102

SINGAPORE

Singapore National Committee for Pacific Economic Cooperation (SINCPEC)
School of Accountancy #07-12
469 Bukit Timah Road
Singapore 259756
Tel: 65-6822-0150
Fax: 65-6338 0596/ 6338 8236

CHINESE TAIPEI

Chinese Taipei Pacific Economic Cooperation Committee (CTPECC)
Taiwan Institute of Economic Research (TIER)
5F, 16-8, Tehwei Street
Taipei
Chinese Taipei
Tel: 886-2-2586 5000
Fax: 886-2-2594 6528
<http://www.tier.org.tw/pecc/ctpecc/index.htm>

THAILAND

Thailand National Committee for Pacific Economic Cooperation (TNCPEC)
Department of Economic Affairs
Ministry of Foreign Affairs
Sri Ayudhya Road
Bangkok 10400
Thailand
Tel: 662-643-5248
Fax: 662-643-5247

UNITED STATES

United States National Committee for Pacific Economic Cooperation (USNCPEC)
1819 L Street, Second Floor
Washington, DC 20036
USA
Tel: 1-202-293-3995
Fax: 1-202-293-1402
<http://www.pecc.org>

VIETNAM

Department of Multilateral Economic Cooperation
Ministry of Foreign Affairs
#8 Khuc Hao Street
Ha Noi, Viet Nam
Tel: 84-4-199 3700
Fax: 84-4-199 3618

SPONSOR PROFILES

Agriculture and Agri-Food Canada

<http://www.agr.gc.ca/>
http://www.agr.gc.ca/spb/rad-dral/home_e.php

Agriculture and Agri-Food Canada (AAFC) provides information, research and technology, and policies and programs to achieve security of the food system, health of the environment and innovation for growth. The mandate of AAFC's Research and Analysis Directorate (R&A) is to provide top quality, relevant and timely economic information and advice on the agri-food sector and public policy. R&A strives to ensure that accurate, objective and credible information on the structural, economic and financial situation in the sector is generally and widely available.

Economic Research Service

<http://www.ers.usda.gov>

The Economic Research Service (ERS) is the main source of economic information and research in the U.S. Department of Agriculture. ERS economists and social scientists develop and distribute a broad range of economic and other social science information and analysis to inform public and private decision making on agriculture, food, environmental and rural issues.

The ERS's timely reports are distributed to public and private decision makers to assist them in conducting business, formulating policy, and learning about the farm, rural and food sectors. ERS publications are available to the public and the news media in both print and electronic form.

The agency's three divisions—Food and Rural Economics, Market and Trade Economics, and Resource Economics—conduct research, perform commodity market and policy analysis, and develop economic and statistical indicators. The executive and legislative branches of the U.S. federal government use ERS information to help develop, administer and evaluate farm, food, rural and resource policies and programs.

In addition to research reports and commodity analyses, ERS publishes *Amber Waves*, a magazine covering the full range of the agency's research and analysis, including the economics of agriculture, food, rural America, trade and the environment.

Farm Foundation

<http://www.farmfoundation.org>

Farm Foundation is a publicly supported nonprofit organization working to improve the economic and social well-being of U.S. agriculture, the food system and rural communities by assisting private and public sector decision makers in identifying and understanding forces that will shape the future.

Serving as a catalyst, Farm Foundation partners with private and public sector stakeholders, sponsoring conferences and workshops to understand forces shaping the competitiveness of agriculture and the food system; encouraging transfer of research into practical tools for increasing human capital; promoting informed dialogue on public issues and policies; and building knowledge-based networks for U.S. agriculture and rural people.

Farm Foundation does not lobby, or advocate positions or policies. Its 70-year reputation for objectivity allows it to bring together diverse stakeholders for quality discussions on issues and policies, providing a solid basis for informed private and public-sector decisions.

Transport Institute

<http://www.umti.ca>

The Transport Institute, part of the I.H. Asper School of Business at the University of Manitoba, builds on three decades of experience in transportation and logistics research and education. The Institute is a Canadian leader in transportation research, with a focus on economics and policy issues as well as on the technical side of transportation.

The Institute is increasingly involved in the area of supply chain management through professional associations, teaching, and hands-on work in the logistics process of individual enterprises. The Institute's forums provide a neutral setting where senior industry, government and academic representatives address pressing concerns specific to the transportation and logistic industry.

Vietnam Chamber of Commerce and Industry

<http://www.vcci.com.vn>

The Vietnam Chamber of Commerce and Industry is a national organization which represents the business community, employers and business associations across all of the country's economic sectors. The Chamber represents the interests of the Vietnamese business community in domestic and international relations; promotes the development of business enterprises, entrepreneurs, and cooperation among business entities; and offers assistance in trade and investment, economic and technological cooperation, and other business activities in Vietnam and abroad.

PACIFIC ECONOMIC COOPERATION COUNCIL

The Pacific Economic Cooperation Council (PECC) is an independent, policy-oriented organization devoted to promoting economic cooperation in the Pacific Rim. PECC brings together senior government, academic and business representatives from 24 economies to share perspectives and expertise in search of broad-based answers to economic problems in the Asia Pacific region.

Founded in 1980, PECC now comprises member committees from the economies of Australia; Brunei; Canada; Chile; China; Colombia; Ecuador; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Pacific Islands Forum Secretariat, Peru; the Philippines; Russia; Singapore; Chinese Taipei; Thailand; the United States; and Vietnam, as well as the Pacific Island Nations. France (Pacific Territories) and Mongolia were admitted as associate members in April 1997 and April 2000, respectively. The Pacific Basin Economic Council (PBEC) and Pacific Trade and Development Conference (PAFTAD) are institutional members of PECC.

PECC's governing body is the Standing Committee, which meets twice a year and consists of the chairs of PECC committees in each member economy. The day-to-day administrative and coordinating functions are carried out by an International Secretariat based in Singapore. Each member committee sends a high-level tripartite delegation from government, business and academia to the PECC General Meeting which takes place every two years.

In addition, PECC establishes forums, projects and networks to concentrate on particular policy areas. These groups meet periodically, organize seminars and workshops, conduct studies, and publish their conclusions and recommendations for the benefit of the Pacific community. In 2001, PECC initiated forums on trade, finance and community building. PECC supports networks and projects on food, minerals, energy, telecommunications, air transport and transportation, and publishes annual editions of *Pacific Economic Outlook* and *Pacific Food System Outlook*.

At the regional level, PECC's most important link with government is through APEC. PECC is the only nongovernmental organization among the three official APEC observers. PECC representatives attend APEC ministerial meetings, senior officials meetings, and working group meetings. PECC also works with other international organizations, such as the World Trade Organization, the Organization for Economic Cooperation and Development, the Asian Development Bank, the World Bank, and United Nations' agencies.

For more information, contact the PECC International Secretariat, 4 Nassim Road, Singapore 258372, Tel: 65-6737 9823, Fax: 65-6737 9824, email: info@pecc.org



The *Pacific Food System Outlook* represents the first regionwide coordinated effort to provide the outlook for the Pacific food system. The food system includes not just production agriculture, but also the whole complex of economic relationships and linkages that tie the region's food consumers to producers. The goal of the *Pacific Food System Outlook* is to help increase knowledge about the diverse components of this vital segment of the global economy.