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DU CANADA

UNDERSTANDING ASIA IN 2030

AND THE IMPLICATIONS FOR CANADIAN TRANSPORTATION POLICY

ASIA PACIFIC FOUNDATION OF CANADA
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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AEC	ASEAN Economic Community
AIS	Automatic Identification System
APF Canada	Asia Pacific Foundation of Canada
ASEAN	Association of Southeast Asian Nations
CSA	Customs Self-Assessment
ECDIS	Electronic Chart Display and Information System
FTA	free trade agreement
FTAAP	Free Trade Area of the Asia Pacific
GDP	gross domestic product
GPS	global positioning system
IMB	International Maritime Bureau
IPCC	Intergovernmental Panel on Climate Change
IT	information technology
LNG	liquefied natural gas
LPI	Logistics Performance Index
RCEP	Regional Comprehensive Economic Partnership
TEU	twenty-foot equivalent unit
TPP	Trans-Pacific Partnership

NOTE: The Asia Pacific Foundation of Canada's definition of Asia Pacific is based on Innovation, Science and Economic Development Canada's definition unless otherwise indicated. All references to Asia Pacific in this report are inclusive of the following economies:

East Asia: China,¹ Hong Kong SAR, Japan, North Korea, South Korea, Macau SAR (Macao SAR), Mongolia, Taiwan

Southeast Asia: Brunei Darussalam, Myanmar (Burma), Cambodia (Kampuchea), East Timor, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam

South Asia: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka

Oceania: American Samoa, Australia, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Fiji, French Polynesia, Guam, Heard/McDonald Island, Kiribati (incl. Tuvalu), Micronesia, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Papua New Guinea, Pitcairn Island, Samoa (Western), Solomon Islands, Tokelau, Tonga, U.S. Minor Outlying Islands, Vanuatu (New Hebrides), Wallis and Futuna Islands

¹ Statistics pertaining to China in this report refer to mainland China.

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ABOUT THE ASIA PACIFIC FOUNDATION OF CANADA

The Asia Pacific Foundation of Canada (APF Canada) is a not-for-profit organization focused on Canada's relations with Asia. Our mission is to be Canada's catalyst for engagement with Asia and Asia's bridge to Canada.

A leader in research and analysis on Canada-Asia relations for over 30 years, APF Canada partners with government, business leaders, academics, and opinion makers in Canada and across the Asia Pacific region to offer clear, specific, and actionable policy advice.

Established by an Act of Parliament in 1984, APF Canada's thematic priorities include: promoting trade, investment, and innovation; mobilizing energy assets; building skills and competencies; and, understanding Asia now.

Visit APF Canada at www.asiapacific.ca.

EXECUTIVE SUMMARY

The Asia Pacific region has become an increasingly significant player in the global economy and will continue to rise in importance over the next fifteen years. By 2030, the region will account for 45 to 50 per cent of the world's GDP. The future of the Asia Pacific will be shaped by changes in demography and society; economic development and finance; energy and the environment; technology and innovation; and security. These drivers of change will not only affect the development of the Asia Pacific region, but Canada and its transportation system as well.

The demographic and societal profile of the Asia Pacific will transform over the next decade and a half as a result of changing population trends, continuous urbanization, and growing middle classes. As a consequence, consumption patterns are likely to shift to more discretionary goods and services from abroad, causing an increase in flows of goods, services, immigrants, tourists, students, and professionals between Canada and the Asia Pacific. Canada's transportation system will be under pressure to accommodate these increased flows.

Increasing intraregional Asian trade flows and the development of the ASEAN Economic Community (AEC) will propel regional integration, but the region's ultimate success in fostering connectivity will be highly dependent on its ability to finance and build regional infrastructure and negotiate and ratify more bilateral and multilateral free trade agreements (FTAs). If Canada is to emerge as a true gateway hub between the Asia Pacific and the Americas, it too will need to strengthen its trade-related infrastructure.

Commensurate with Asia's economic growth will be an increasing demand for energy. Since the Asia Pacific's demand for energy outweighs its supply, diversification of both the types and geographical sources of energy will be needed to ensure the demand is met. Before Canada can become a viable supplier to Asia, it will need to further develop its rail and marine infrastructure and regulations to ensure safe and efficient movement of oil and natural gas via railway and tanker.

Current scientific studies project that over the next few decades climate change will lead to an increase in polar sea ice melt, rising sea levels, and natural disasters. Considering that Canada's northern territories are part of the Northwest Passage for ships, Canada should take measures to address future shipping along this passage.

Technology and innovation will also be imperative in pushing the Asia Pacific's growth forward. Rising Internet and mobile phone penetration will further drive e-commerce and m-commerce development. There is likely to be a large demand for new transportation-related technologies and innovations that can enhance transportation infrastructure and services both within the Asia Pacific and Canada.

Lastly, security threats in the Asia Pacific, such as territorial disputes, maritime piracy attacks, terrorist violence, trafficking of people and goods, and cyber attacks may affect regional stability and disrupt supply chains and their logistics. Although territorial disputes, piracy, and trafficking do not have much of a direct impact on Canada's transportation system, technology used for transportation is increasingly vulnerable to terrorist or cyber attacks.

Based on the analysis provided by this report, in order to prepare Canada's transportation system for the future, the *Canada Transportation Act Review* (the Review) should consider recommending that the following actions be taken by the relevant decision-makers:

- adjust current transportation legislative and policy frameworks to support Canada's trade competitiveness in Asia, a region of growing importance to Canada's economic health;
- further develop the Asia Pacific region's gateways and corridors;
- optimize the quality and use of transportation infrastructure capacity through, for example, improved alignment of transportation policies and regulations and/or the use of innovative financing mechanisms;
- accommodate and leverage the increasing flow of travellers between Asia and Canada;
- make the relevant Canadian transportation and logistics workforce more Asia competent; and
- address emerging environmental and security threats to ensure Canada's safe and sustainable transportation.

INTRODUCTION

This report describes global trends in Asia affecting the region's future development and Canada's transportation systems in the next 15 years. We identify major trends in the Asia Pacific under the framework of five key drivers of change: 1) demography and society; 2) economics and finance; 3) energy and the environment; 4) technology and innovation; and 5) security. The complex interplay between these trends will have important implications for Canada's transportation future. Each section features one of the key drivers of change and highlights the trends in Asia within that driver of change, the implications of those trends for Asia, and the implications of those trends for Canada's transportation system.

The report addresses the following specific issues highlighted in the mandate of the Review as they pertain to the Asia Pacific:

- the adjustments Canada must make in its transportation legislation and policies to support our trade competitiveness in Asia, a region of growing importance to our nation's economic health;
- further linkages necessary in our Asia Pacific gateways and corridors;
- how the quality and use of transportation infrastructure capacity can be optimized through, for example, improved alignment of transportation policies and regulations and/or the use of innovative financing mechanisms;
- how, as the Asia Pacific becomes a hub of technological innovation, Canada can adopt the technology for use in our transportation infrastructure and services;

- the impact of environment changes in Canada's North (sea ice melt, rise in sea level) on ports in Asia as well as the rising Asian interest in Arctic shipping routes through Canada's North along with associated security and environmental risks; and
- the increasing flow of visitors, transiting travellers, and students from Asia and their impact on Canada's air transportation system.

We end with a few key recommendations to the Review on measures that can be taken to help Canada's transportation system adapt to developments in the Asia Pacific region.

Our report complements the extensive analysis and recommendations provided by other inputs from transportation-related organizations and authorities already received by the Review.

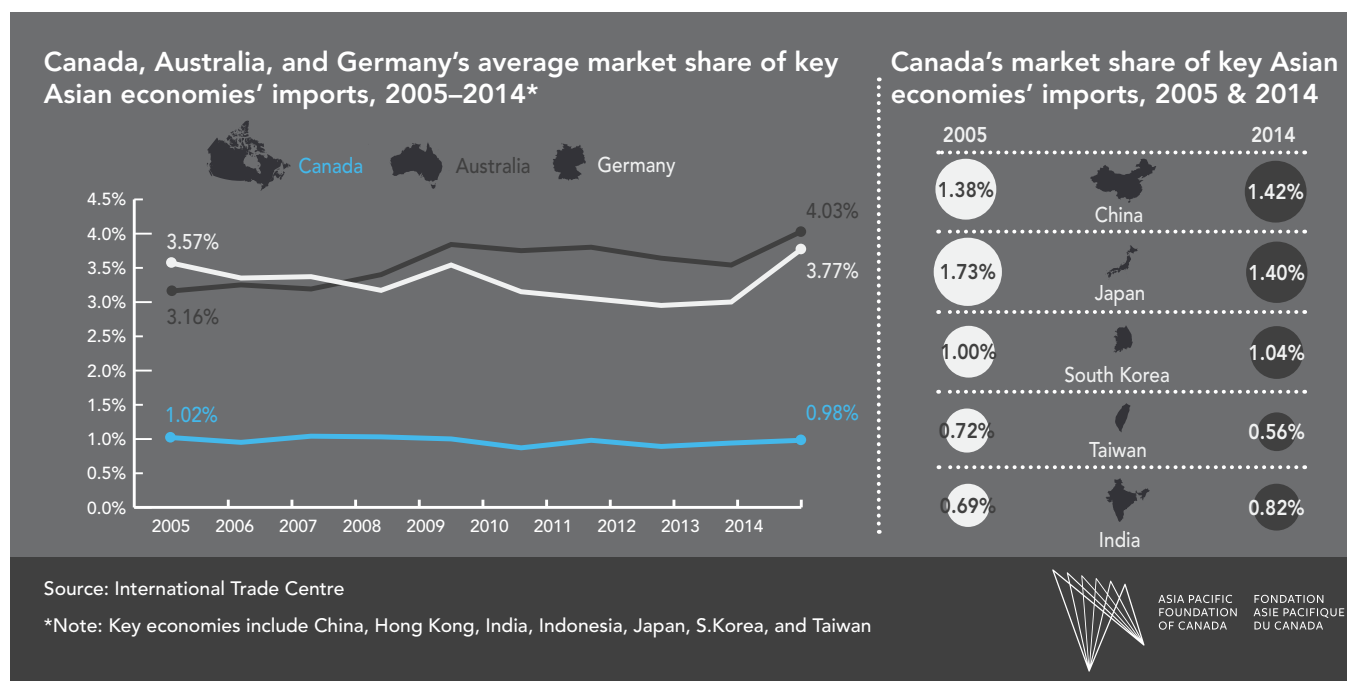
The scope of work as initially agreed with the *Canada Transportation Act* Review Secretariat did not include recommendations, but in our analysis key ideas emerged that we felt were relevant and should be brought to the attention of the Review. The recommendations take a holistic approach to improving Canada's transportation networks as they relate to future growth in the Asia Pacific and feature concepts that have yet to be covered or deserve more emphasis in terms of the context of the Review.

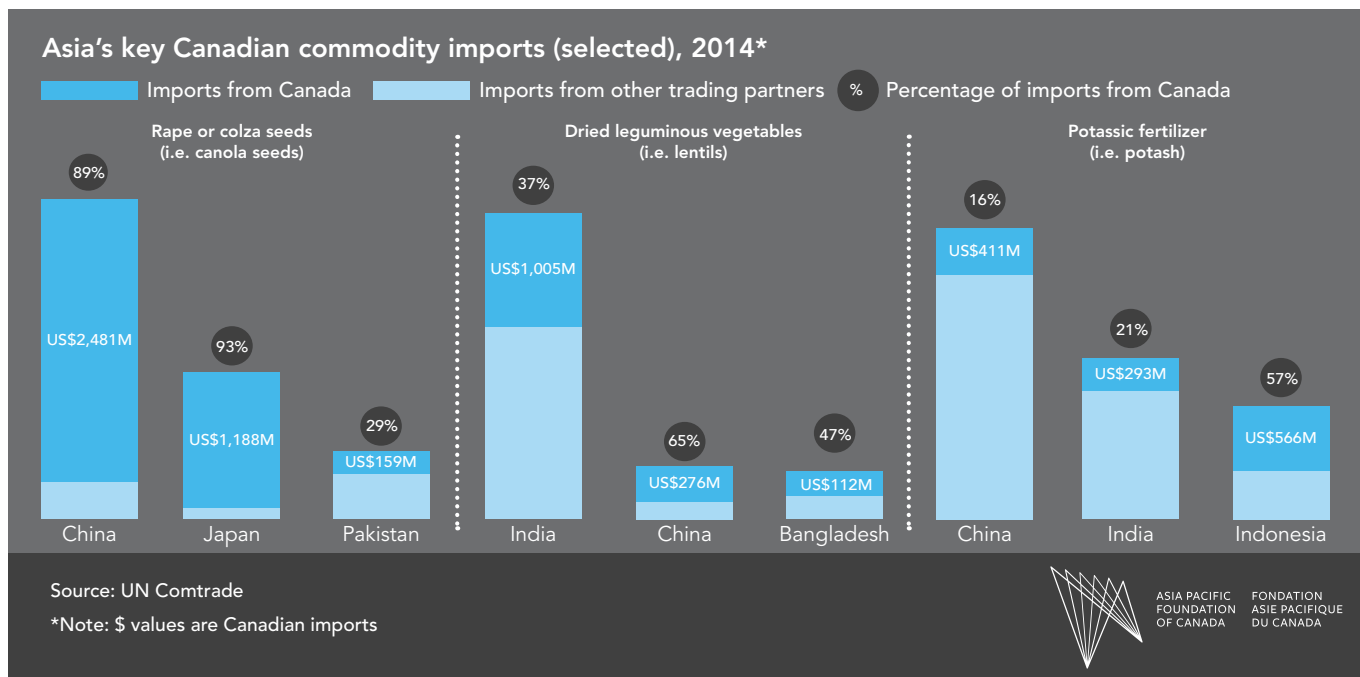
CANADA AND THE ASIA PACIFIC AT A GLANCE

Many pundits have proclaimed the 21st century the “Asian Century.” The emergence of the Asia Pacific as a political, economic, and social-cultural force will have major implications on future international systems, institutions, and norms. In 2030, Asia is expected to account for 53 per cent of the world’s population and represent nearly 50 per cent of the world’s GDP. With a growing, increasingly educated and largely urbanized middle class, the region is expected to use half of the world’s energy by 2030, and its people are expected to drive technological innovations that will revolutionize the way the world’s population lives. Coinciding with the growing importance of the region is increased competition from international partners vying to secure prosperous relations with the established and emerging economies of the Asia Pacific. It is clear that the future of the global economy and economic growth of all nations will be inextricably tied with Asia.

Canada is one of many developed countries seeking to ensure a strong future relationship with the Asia Pacific region. Canada’s two-way flows of goods, services, and people with the region are key components of this relationship.

Major shifts in the global economic landscape over the past 15 years have seen Canada, an export-oriented, resource-rich, and largely urbanized economy, expand its trade linkages with the Asia Pacific region. Between 2000 and 2014, the value of Canada’s two-way trade in goods with the Asia Pacific more than doubled from C\$74.3 billion to C\$157.3 billion. During this time, the region’s share of Canadian exports in goods grew from 5.5 per cent in 2000 to 10.1 per cent in 2014. Although the Asia Pacific’s share of Canadian exports has risen over the years, when we look at Canada’s share of imports for key major Asian trading partners, in most cases, they have shown little to no growth.





Commodities have consistently made up the core of Canada's exports to the Asia Pacific. When looking at key commodities that Canada exports to Asia, natural resources and agricultural products dominate the mix for major trading partners in Asia. Over the past decades, Canada's two-way trade in goods with the Asia Pacific has consistently resulted in a trade deficit. In 1990, Canada's trade deficit with the region was only C\$3.2 billion, while in 2014 it was C\$51 billion. The increasing disparity in our trade balance over the past decades has been primarily exacerbated by the disproportional increase of imports from China compared to our smaller growth in exports to China. In 2014, China accounted for C\$39.3 billion, or 77.2 per cent, of our trade deficit with the Asia Pacific.

Whereas trade in goods is the primary driver of our two-way trade with Asia, trade in services also forms a key part of this relationship. From 2000 to 2014, Canada's two-way trade in services with the Asia Pacific and Central Asia has seen modest growth from C\$13.0 billion to C\$27.3 billion. Trade in services includes: travel services,¹ government

services,² transportation services,³ and commercial services.⁴ Since 2009, China has been the largest Asian recipient of Canadian services. In 2014, 18.5 per cent of all service exports to the Asia Pacific and Central Asia were to China, and these exports have grown 208 per cent between 2000 and 2014. Canada also exported a significant amount of services to Hong Kong, Australia, Singapore, and South Korea. Service exports to India have grown rapidly since 2007, more than doubling in value in 2014 to C\$829 million. While Japan was the largest source of Canada's service exports until 2008, exports to the country dropped off after the global financial crisis and only now are starting to grow beyond pre-crisis levels.

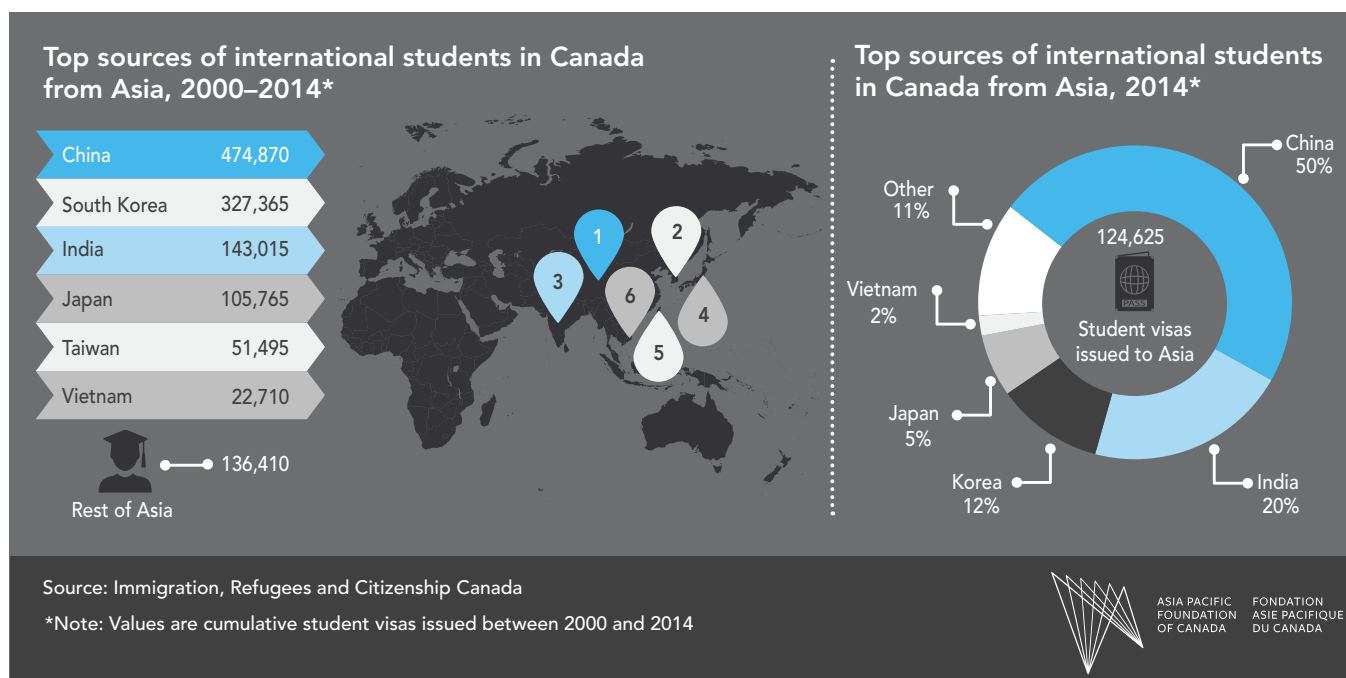
People flows – in the form of immigration and non-resident travellers – into Canada are also an important aspect of our relations with the Asia Pacific. A total of 1,903,365 immigrants came from the region to Canada from 2000 to 2014, representing 52 per cent of Canada's total immigrants who arrived in that period. Of these immigrants, a total of 1,213,080 were economic

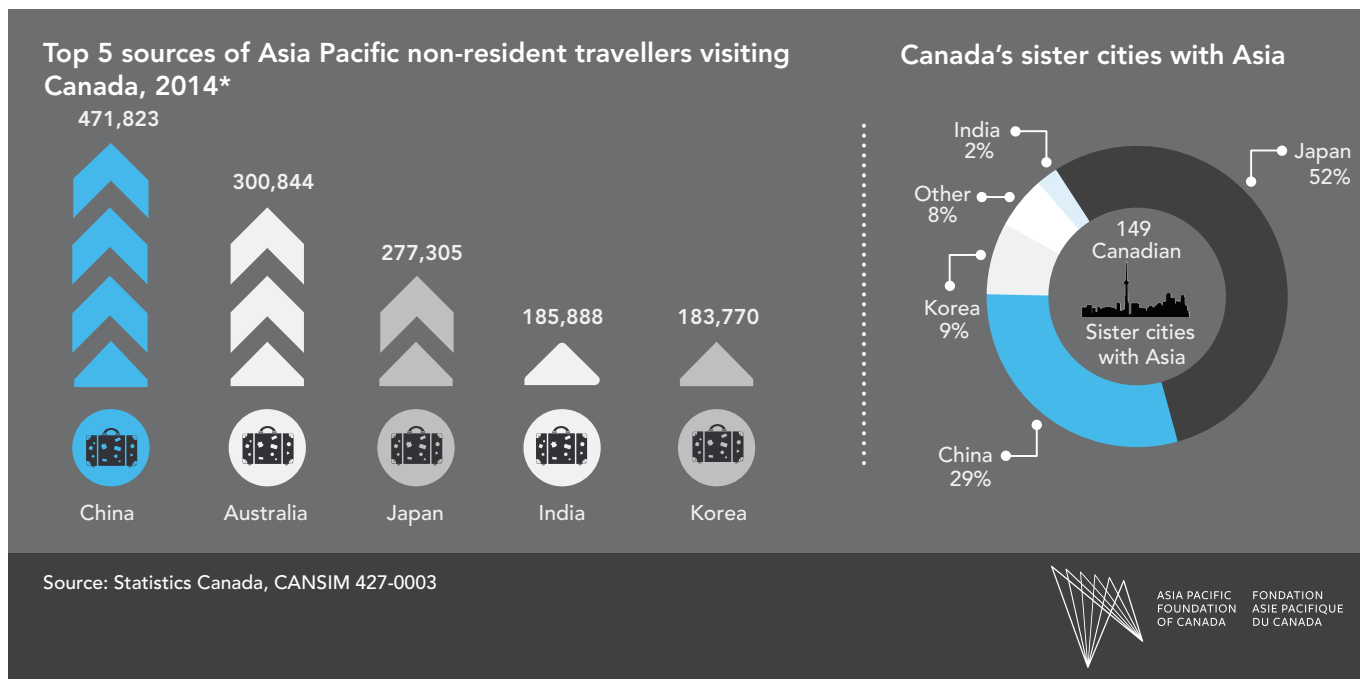
immigrants, 537,080 family class immigrants, 124,660 refugees, and 28,545 other immigrants. Immigration from the Asia Pacific to Canada has been fairly consistent since 2000 to 2014, with an average of 126,891 per year.

A total of 1,261,630 foreign students came from the Asia Pacific to Canada from 2000 to 2014, representing 58 per cent of Canada's foreign students during this time period. The highest number of foreign students from the region came from China at 474,870, representing 22 per cent of Canada's foreign students from 2000 to 2014. South Korea followed with a total of 327,365 foreign students, representing 15 per cent of the total. These two countries made up around 37 per cent of foreign students during this time period. However, while China and India showed a steady increase in numbers, with China's numbers growing from 10,220 in 2000 to 62,455 in 2014, and India's numbers from 1,615 in 2000 to 25,255 in 2014, South Korea's numbers showed a decrease from their peak of 29,110 in 2007 to 14,720 in 2014.

In 2014, Canada received nearly 2 million non-resident travellers from the Asia Pacific, reflecting an upward trend every year since the global financial crisis. In 2000, most of these Asia Pacific visitors coming to Canada were from Japan, with 540,095 visiting the country. Non-resident travellers from Japan made up 34.6 per cent of all Asia Pacific non-resident travellers visiting Canada in this year. In 2014, China was the largest source of non-resident travellers from the region to Canada, with 471,823 visiting the country. Non-resident travellers from China comprised of 24 per cent of all Asia Pacific non-resident travellers visiting Canada in this year. The numbers of non-resident travellers from Australia, India, and the Philippines have shown modest growth from 2000 to 2014; however, numbers from Taiwan, Hong Kong, and Malaysia have all experienced decline over the same period.

The flow of goods, services, and people between Canada and Asia has both direct and indirect implications for Canada's transportation systems and policies. As the regulator and administrator of transportation-related policies and programs, Transport Canada is responsible for ensuring that





Canada's transportation system is not only efficient, safe, secure, and sustainable, but also that it is maintained, expanded, and integrated to respond to the evolving needs of Canadians.

Transport Canada and other federal departments' future plans and activities will need to factor in the following elements:

- projected future trends in transportation, such as increasing vessel capacity and expansion of deep-water ports;
- the shifting of bulk shipping of commodities to container shipping;
- a decreasing labour force in many established economies;
- the lack of financing for the upgrade, maintenance, and creation of infrastructure;
- changes in how businesses use transportation in terms of reducing the share of transportation

costs relative to other costs, improving reliability or resilience, and increasing supply chain visibility in order to derive greater business intelligence and analytics;

- growing environmental and social licence concerns;
- improvements in technology in terms of tracking and securitizing shipments; and
- the harmonizing of international standards, such as border and custom procedures.

Failure to do so will jeopardize Canada's ability to continue to successfully support our country's increasingly ambitious trade-focused growth, while at the same time linking small and urbanized populations and providing communities with the goods and services they depend on in their daily lives.

Currently, Canada's transportation logistics and infrastructure scores well in global rating systems.

In both the World Bank's 2014 global rankings for the Logistics Performance Index and the World Economic Forum's Global Competitiveness Report 2014–2015 category for infrastructure, Canada ranks 12th.

When comparing Canada's shipping transit times to major Asian ports against our friendly competitors (Australia, Germany, and the United States), Canada stacks up favourably in its transit times to Shanghai and Busan.

With regard to direct flight connections, both Toronto and Vancouver prove equal in connectedness compared to the three largest cities in the United States (New York, Los Angeles, and Chicago). Canada and the United States both lack direct flights to Singapore, Bangkok, Kuala Lumpur, and Jakarta.

While Canada does have air transportation agreements with major Asian markets like China, Japan, and Korea, we still lack agreements with

many ASEAN countries. The U.S. and Australia, however, have air transportation agreements with most ASEAN nations. Furthermore, Canada should strive to have more open skies-type agreements with Asian partners. We currently have only one, with South Korea.

Although Canada is fairly proactive in bilateral air transportation agreements, in the Asia Pacific region it has only one maritime transport agreement, with China. In 2009, the agreement was amended to include periodic discussion between maritime authorities, industries, and service providers on a range of maritime topics, such as efficient transportation services between the two countries, shipping safety and prevention of marine pollution, and maritime activities related to gateway cooperation.⁵ Canada should explore maritime transportation agreements with other Asian countries to enhance maritime transportation services between Canada and the Asia Pacific.

Port-to-port transit times, 2015

	Port of Hong Kong	Port of Singapore	Port of Shanghai	Port of Busan
Port of Prince Rupert	25 days	–	25 days	13 days
Port of Metro Vancouver	19 days	24 days	16 days	15 days
Port of Halifax	49 days	31 days	36 days	31 days
Port of Los Angeles	18 days	29 days	16 days	17 days

Source: Shipping company websites, accessed August 2015

Non-stop flights with major Asian hubs, fall 2015

	Beijing	Tokyo	Hong Kong	Singapore	Shanghai	Jakarta	Kuala Lumpur	Seoul	Bangkok
Melbourne	Yes	Yes	Yes	Yes	Yes	–	Yes	–	Yes
Sydney	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vancouver	Yes	Yes	Yes	–	Yes	–	–	Yes	–
Toronto	Yes	Yes	Yes	–	Yes	–	–	Yes	–
Calgary	–	Yes	–	–	–	–	–	–	–
Berlin	Yes	–	–	–	–	–	–	–	–
Hamburg	–	–	–	–	–	–	–	–	–
Munich	Yes	Yes	Yes	Yes	Yes	–	–	Yes	Yes
Los Angeles	Yes	Yes	Yes	–	Yes	–	–	Yes	–
New York	Yes	Yes	Yes	–	Yes	–	–	Yes	–
Chicago	Yes	Yes	Yes	–	Yes	–	–	Yes	–

Source: Google Flight Analytics, accessed 10/8/15

Note: Round-trip, non-stop flights for the months of September and October, from the largest cities in our friendly competitor nations to the largest airports in Asia ("–" means there are no flights)

Bilateral air transport agreements in effect as of August 2015

	Australia	Canada	United States	Germany
China	✓	✓	✓	*
Japan	***	✓	✓	✓
India	✓	✓	✓	✓
Korea	✓	***	✓	✓
Singapore	✓	✓	✓	✓
Indonesia	**	x	✓	✓
Malaysia	✓	✓	✓	✓
Thailand	✓	x	✓	x
Brunei	✓	x	***	✓
Philippines	✓	✓	✓	✓
Vietnam	✓	x	✓	✓
Cambodia	**	x	x	x
Laos	**	x	***	✓
Myanmar	✓	x	✓	✓

* Agreement on technology transfer in the field of high-speed transport, 1975 Peking document on file at the United Nations

** Interim effect

*** Open Skies

Sources: Official government websites, except Germany which is from secondary sources retrieved on 10/8/15

ENDNOTES

1. Travel services include expenses incurred by individuals while in a foreign country, including payments for food, lodging, recreation, and local transportation; passenger fares for international travel are not included.
2. Government services include transactions arriving from official representation and military activities in a foreign country.
3. Transportation services include revenues and expenses arising from the transportation of goods or people across international borders.
4. Commercial services include international services transactions not in the other services categories (i.e., financial, advertising, cultural, and architectural and engineering services, etc.).
5. Government of Canada and the Government of People's Republic of China. 2009. Protocol amending the Agreement between the Government of Canada and the Government of the People's Republic of China on Maritime Transport.



DEMOGRAPHY AND SOCIETY

WHAT ARE THE TRENDS?

Asia as a whole is undergoing major economic and societal shifts related to demographic patterns, the adoption of new lifestyles and consumption patterns, and the movement of large numbers of people within and between countries. Given the region's sheer size – by 2030, an estimated 4.5 billion people will be living in the Asia Pacific – the ripple effects of these shifts will be felt well beyond national borders. For Canada the central question will be: Will Canada be able to meet growing Asian demand for certain types of products and services?

Changing Demographic Profiles: Aging vs. “Youth Bulge” Populations

Asia is currently characterized by two quite starkly contrasting demographic trends. One trend is

occurring in developed economies such as Japan, South Korea, Hong Kong, Taiwan, and Singapore, all of which are “ageing,” meaning that population replacement rates (measured by the number of births per woman) are below what is needed to sustain current population levels. As this trend persists, these economies will find themselves having to support a growing proportion of citizens who are over the age of 65, and thus beyond the current working age. In Asia, from 2015 to 2030, the population aged 65 and older will go from 328.3 million to 565.2 million, a 72-per cent increase, with much of this concentrated in the countries mentioned above.¹

Meanwhile, several large developing economies in South and Southeast Asia face a very different demographic trajectory: a population structure that is becoming much younger, not only with more

working-age people (roughly, those between the ages of 15 and 64), but also with a high proportion of people who are under the age of 25 and thus only beginning to enter the labour market. At present, roughly half of India's 1.2 billion people are 25 or younger, and within the next decade, nearly two-thirds of India's population will be working age, with only about 13 per cent over the age of 60.² Other countries experiencing similar "youth bulges" include Malaysia, Pakistan, Indonesia, and the Philippines, which have a combined population of 560 million.³

China, Thailand, and Vietnam are interesting cases in that they do not fall squarely into a specific category. Although they are developing economies, all three have already begun to show demographic trends consistent with the ageing population trend seen in more advanced economies. China is the most significant case: whereas low fertility rates in developed economies were the product of socio-cultural shifts (such as more educated women choosing careers over family), in China, the fertility rate was impacted by government policy (the One-child Policy), introduced over 35 years ago. Between 2015 and 2030, there will be an estimated 77 per cent increase (from 132.5 million to 235 million people) in Chinese over the age of 65.

Growing Middle Classes With More Purchasing Power

Decades of sustained economic development in many Asian countries have vastly expanded the ranks of the region's various middle classes (although it should be noted that households designated as middle-class in Asia generally have lower incomes than their counterparts in Canada and other Western countries). Analysis undertaken by the consulting firm McKinsey & Co. on changing consumption patterns in Chinese cities is illustrative

of both the speed of economic transformation and of how consumption patterns could emerge in other developing economies in Asia.

According to the analysis, the number of Chinese "mainstream consumers" (urban households with disposable income of between US\$16,000 and US\$34,000) is expanding rapidly. In 2000, only 1 per cent of households were considered mainstream consumers, but by 2010, this proportion had grown to 6 per cent, and by 2020, it is expected to reach 51 per cent of Chinese households. This group is able to afford better-quality goods and small luxury items and will set the standard for consumption in China in the coming years. China's "value consumers" (households with disposable income between US\$6,000 and US\$16,000) accounted for 63 per cent of all households as of 2000, and rose to 82 per cent in 2010. Predictions indicate that by 2020 only 36 per cent of urban households will remain as value consumers because many will have risen to mainstream consumer status. "Affluent consumers," those who have more than US\$34,000 of disposable income, will be roughly 6 per cent of urban Chinese households by 2020, up from 2 per cent in 2010 and less than 1 per cent in 2000. Although the percentage may seem small, 6 per cent of China's population translates into more than 78 million people, more than twice the size of the entire Canadian population. The number of households classified as "poor consumers" (having less than US\$6,000 in disposable income) has significantly dropped over the same period. In 2000, 36 per cent of Chinese urban households comprised the "poor" category, yet by 2010, the proportion had fallen to 10 per cent, and by 2020 it is expected to reduce further to 7 per cent.⁴

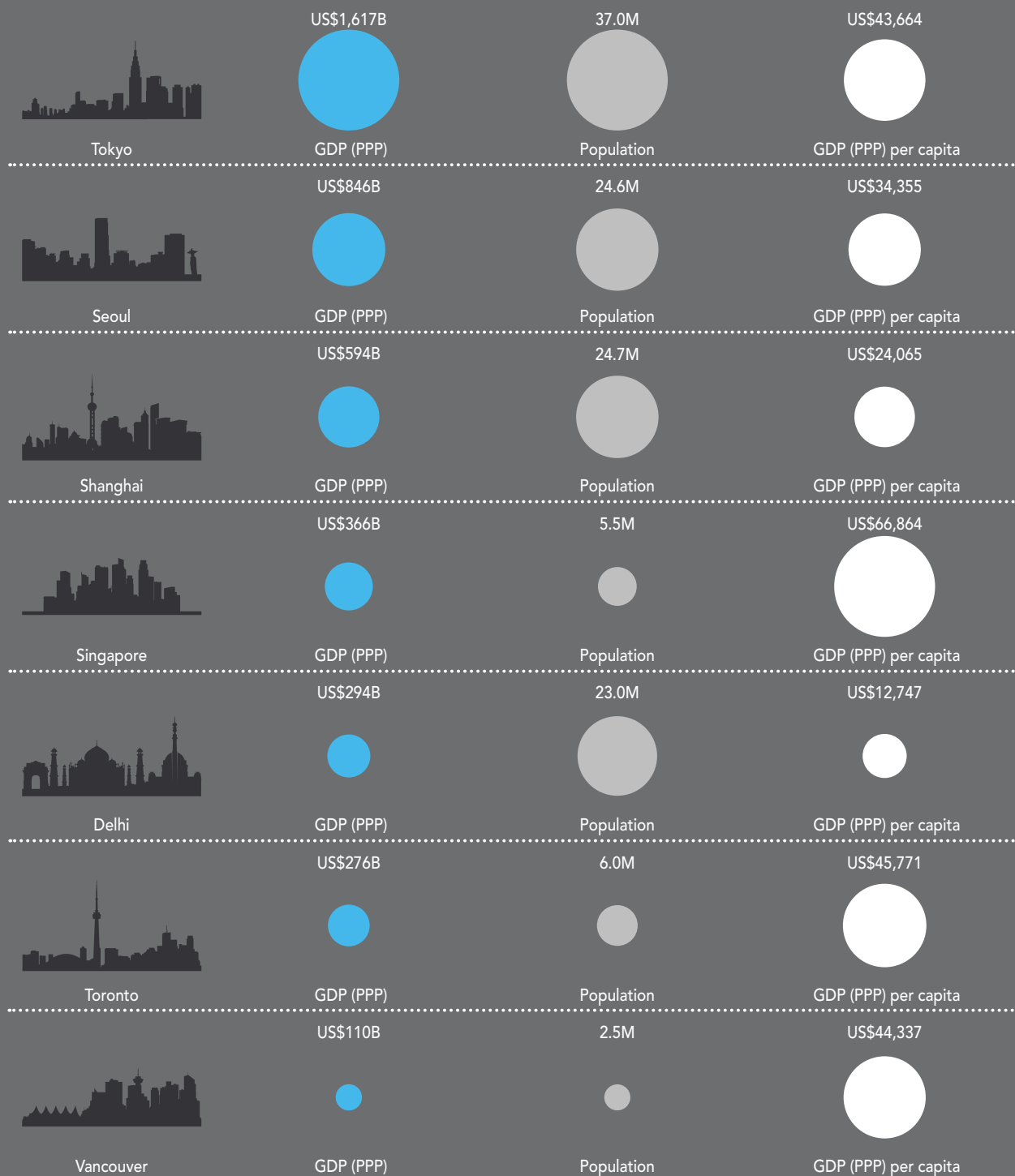
Extending the illustration beyond China, it is expected that in Southeast Asia, a combined market of roughly 625 million people, the "consuming

class,” defined as having “incomes exceeding the level at which they can begin to make significant discretionary purchases,”⁵ will grow considerably. Currently, there are 67 million households in the ASEAN region that are part of this group, and this number is predicted to nearly double to 125 million households by 2025.⁶ By way of comparison, China’s urban “mainstream consumers” are expected to number 167 million households by 2020.⁷ And according to a 2013 Deloitte report, by 2030 the size of India’s middle-class consumer market could surpass that of both China and the U.S.⁸

Mass Urbanization

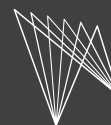
Alongside changing demographic profiles and socio-economic changes, several Asian countries are also undergoing rapid, large-scale urbanization. By 2030, an estimated 54 per cent of Asia’s total population will be living in cities, up from 37.5 per cent as of the early 2000s.⁹ Approximately 60 per cent of the populations of China and Indonesia will be living as city dwellers.¹⁰ Moreover, in China, the process is being accelerated by the state’s active involvement in transitioning people from the countryside to cities, especially to its “Tier 2” and “Tier 3” cities, which include several provincial capitals as large as eight or nine million people in the cases of Guangzhou and Chongqing, respectively. In India, there are expected to be 590 million people living in cities by 2030, 250 million more than in 2008.¹¹ In part, due to this mass urbanization, Asia, mostly driven by China’s growth, will come to represent nearly 60 per cent of global infrastructure spending, which will include costs associated with building transportation networks and housing, and with utilities and telecommunications.¹²

Comparing selected Canadian and Asian metro areas, 2014*



Source: Brookings, Global Metro Monitor 2014

*Note: PPP refers to purchasing power parity; population includes greater metropolitan population



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IMPLICATIONS FOR ASIA

These three trends – demographic shifts, middle-class growth, and urbanization – create implications for Asia in terms of consumption patterns, employment prospects, and migration flows.

Growing Demand for Certain Goods, Products, and Services

Rising incomes across Asia are allowing more businesses and households in the region to purchase consumer durables that are the hallmarks of urban, middle-class lifestyles, such as cars and washing machines, elevators, and so on. The higher-earning segment of that population is able to spend greater amounts on luxury items, many of them imported from abroad. Countries with large youth populations will be the ones to drive retail, e-commerce, and technological trends to which other countries outside the region will need to be responsive.¹³

The increase in discretionary spending also extends to consumable goods, particularly products from the agri-food sector. The expansion of the middle class has meant a fairly widespread shift in Asia from a primarily grain-based diet to a more meat-based diet. At the same time, there have been sharpening concerns about food safety and the veracity of food labels, especially among members of the Chinese public. The result has been a rising demand for food products imported from trusted source countries. This is the case with products like beef, pork, chicken, and seafood, as well as packaged foods. The expanded trade in these food products has been facilitated by relative newcomers in China's commercial landscape: overseas purchasing agents such as stores on Tmall.com (formerly known as Taobao Mall), an online business-to-consumer retailer in China that sources merchandise from outside the country.

Higher demand for both durable and consumable goods will result in an increase in shipping, transportation, and other distribution and logistics services across the region and globally. This will in turn require an increase in hard infrastructure and related services for moving goods and people within countries, intra-regionally, and internationally. Transportation policies and practices will need to respond appropriately to avoid significant increases in congestion and bottlenecks.

A quite distinct but no less important consumer trend is the growing demand for international travel. By 2030, the global number of international tourist arrivals is expected to reach 1.8 billion, up from 940 million in 2010. Almost half of this global traffic will be within Asia Pacific countries or from the region to the rest of the world.¹⁴

Growing Demand for Higher Education and Training

Another natural outgrowth of expanding middle-class status in Asia is that more families expect their children to get the type of higher education that will lead to white-collar jobs, which will in turn secure their status and incomes well into the future. However, in many Asian countries, demand for higher education has vastly outpaced supply. This is true, for example, in China, India, and Indonesia, all of which are trying to accommodate “explosive enrollment growth” in their higher education systems.¹⁵ In fact, by 2035, 42 per cent of global university enrollments are expected to be from the Asia Pacific.¹⁶

The challenge for these countries is not merely to satisfy quantity by opening up more admission spots; they also need to ensure that their national higher education institutions provide both a high quality of instruction and are also able to prepare students

in a way that responds to changing labour market demands.¹⁷ Interestingly, the quality challenge is found not just in developing economies, but also in some advanced economies such as Japan (one of Canada's major trading partners).¹⁸ Because of this widening demand-supply gap, more and more Asian parents are sending their children overseas for higher education, primarily to English-speaking Western countries.

The deficit of higher education opportunities and outflow of students has specific implications for the fields of trade, transportation, and logistics, which are reported as facing a shortage of qualified personnel. According to a 2012 World Economic Forum report, "Logistics companies and trade associations around the world are reporting problems in obtaining enough qualified staff," with specific shortages reported in India, Korea, and China.¹⁹ Reinforcing this perception are the results of a Transport Intelligence survey of more than 300 executives worldwide, which found that the skills shortage was perceived as greater among executives in the Asia Pacific (approximately 61 per cent felt there was a skills shortage) than it was among executives in North America (where approximately 45 per cent reported this shortage). Most respondents attributed this gap to a lack of good-quality candidates.²⁰

IMPLICATIONS FOR CANADA'S TRANSPORTATION SYSTEM

Looking at the implications of demographic and social trends in Asia, it is possible to point to three main implications for Canada: the need to prepare for more integrated trade in goods (which will be addressed in the following section), the need to prepare for a greater inbound flow of travellers from Asia, and the need to prepare for intensifying competition for transportation professionals who are adept at working with trading partners in Asia Pacific.

Increasing Two-Way Canada-Asia Travel and Inbound Tourism From Asia

Between 2010 and 2014, the number of Asia Pacific visitors to Canada increased by 15.5 per cent, and it is expected to continue to expand over the next decade and a half. One source of this increase is recent immigration from Asia; from 2008 to 2013, China, India, and the Philippines were the three top source countries of new immigrants to Canada. Many of these new Canadians maintain close family and business connections with their countries of origin, contributing to an increase in two-way air traffic between Canada and these source countries.

An even larger source of the increase in travel to Canada will be the growth in international tourism. By 2030, an estimated 541 million Asia Pacific tourists per year are expected to travel outside their national borders.²¹ In Canada alone, total foreign demand in tourism is expected to amount to more than C\$20 billion during this time, over C\$5 billion more than in 2010.²² With an increase of 24 per cent or more per year of Chinese tourism to Canada since 2010,²³ a big portion of the tourists will continue to come from China. A combination of factors will create more demand on Canada's entire tourism-related transportation system (air, marine, rail, and road) including Asia's more elderly populations seeking more leisure travel, and Asia's growing middle class expanding the demand for leisurely travel.

Business mobility will continue to be an important aspect of expanding trade relations between Canada and the Asia Pacific region. Services exports to the Asia Pacific and Central Asia have increased over 50 per cent in 5 years (from 2009 to 2014).²⁴ These include: international service transactions, such as financial, advertising, cultural, architectural and engineering services, and travel services, as well as revenues from the transportation of goods or people across international borders. From 2021 to 2030, merchandise export growth from Canada to

the Asia Pacific region is forecasted to grow to 11 per cent from 9 per cent during the late 2010s.²⁵ To build the necessary relations and sustain the business momentum, the demand for flights from trade partners to Canada and vice versa will grow two-way flows of business peoples, investors, and experts. Developing stronger interconnectivity between Canada and Asia Pacific transportation hubs will be critical to ensure Canadian businesses gain exposure and develop connections and linkages to business people in the region.

One way to strengthen Canada's connectivity with Asia would be to develop more liberalized air transportation agreements with countries with which we do not have open-skies policies. Other programs that could be expanded or relaxed are Canada's transit visa programs – the Transit Without Visa Program and the China Transit Program. Currently the Transit Without Visa Program extends to Indonesia, Thailand, Taiwan, and the Philippines, while the China Transit Program extends to Chinese travellers from select airports in China and Asia. These programs enable visitors en route to the U.S. to transit without visas through the Toronto Pearson International Airport and Vancouver International Airport, thereby making them more attractive as transit hubs.²⁶

A distinct but related implication is the possibility for knowledge and training exchanges between Canada and its Asia Pacific partners. For example, according to the Vancouver Airport Authority, 10 delegates from the Changi Airport in Singapore recently visited Vancouver International Airport. Five were from customs and immigration and five from the airport administration, and they were interested in how the Vancouver International Airport facilitates faster border processing. The airport authority stated that it was in talks with other Asian airport administrations interested in how it operates.

Growing Competition for Transportation and Logistics Talent

As competition for transportation professionals who have the necessary skills and competencies for working with trading partners in the Asia Pacific increases, Canada needs to develop strategies to ensure that it is able to develop and retain talent domestically.

International students from Asia form an important pool of potential recruits; not only do they have the language and cultural skills that allow them to communicate clearly and effectively with partners in their source countries, but they also have Canadian-standard training that would prepare them to work for Canadian government ministries and companies. In 2011, there were roughly 265,000 international students in Canada (nearly half of them from East Asia). The Canadian government has stated a national priority is to raise this number to 450,000 by the year 2022.²⁷ China, India, and South Korea are currently the top three sending countries to four-year universities and colleges, and also polytechnics.²⁸

However, the ability to use this pool of Asian graduates depends on designing and implementing a successful recruitment and training plan. Recruitment requires a post-graduation pathway to a work permit, permanent residence, and perhaps citizenship. The recently introduced Express Entry visa is a useful mechanism for attracting qualified international candidates to fill specific gaps in Transport Canada's Asia-related operations.

Once recruited, Transport Canada (or other organizations that contribute to the success of the Asia-Pacific Gateway and Corridor Initiative) should have a training plan to identify and remedy any skills gaps that could limit job performance. For example, a recent report by the Conference Board of Canada found that in British Columbia, while recent immigrants and international students do have some of the skills that employers are looking for (e.g., problem solving, critical thinking, and numeracy), their lack of oral communication skills was a particular concern.²⁹ This type of skill is something that can only be improved with practice and exposure, preferably in a real work context.

The potential need for customized Asia training also extends to some current Transport Canada employees and Canadian-born recruits. As one recent Australian study noted, the line between “international” and “domestic” policy is blurring, and more and more ministries that once worked in a strictly domestic realm now find that their operations require them to engage more with partners and counterparts in other parts of the world, especially in Asia.³⁰ Yet, in Canada, aside from a few exceptions, few business programs require their students to gain much knowledge about Asia or to get experience working in Asia or with Asian partners.

Given the long lead time needed for many transportation-related projects, it is important to have some departmental staff with deep and extensive market knowledge of factors affecting the size and likely trajectories of Asia’s economic development. This could include economic or technical factors, but it could also include social, cultural, or political factors. One example is the need to understand consumer trends and tastes around global tourism.

Other possible training could include opportunities to apply classroom-based learning to real contexts,

including for the purpose of understanding how to adapt behaviour for Asian business contexts. As a 2011 Transport Canada Outlook Report notes, the talent gap even extends to university-level instructors and researchers.³¹ Therefore, Transport Canada should advocate for a talent development plan that encompasses everything from vocational and technical training – including for international students from Asian countries – to graduate-level studies. This advocacy could be targeted at the two organizations with mandates to support aligning post-secondary training with skills needs of Canadian employers: Universities Canada and Colleges and Institutes Canada, both of which represent all accredited post-secondary institutions in the country.

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ECONOMIC DEVELOPMENT AND FINANCE

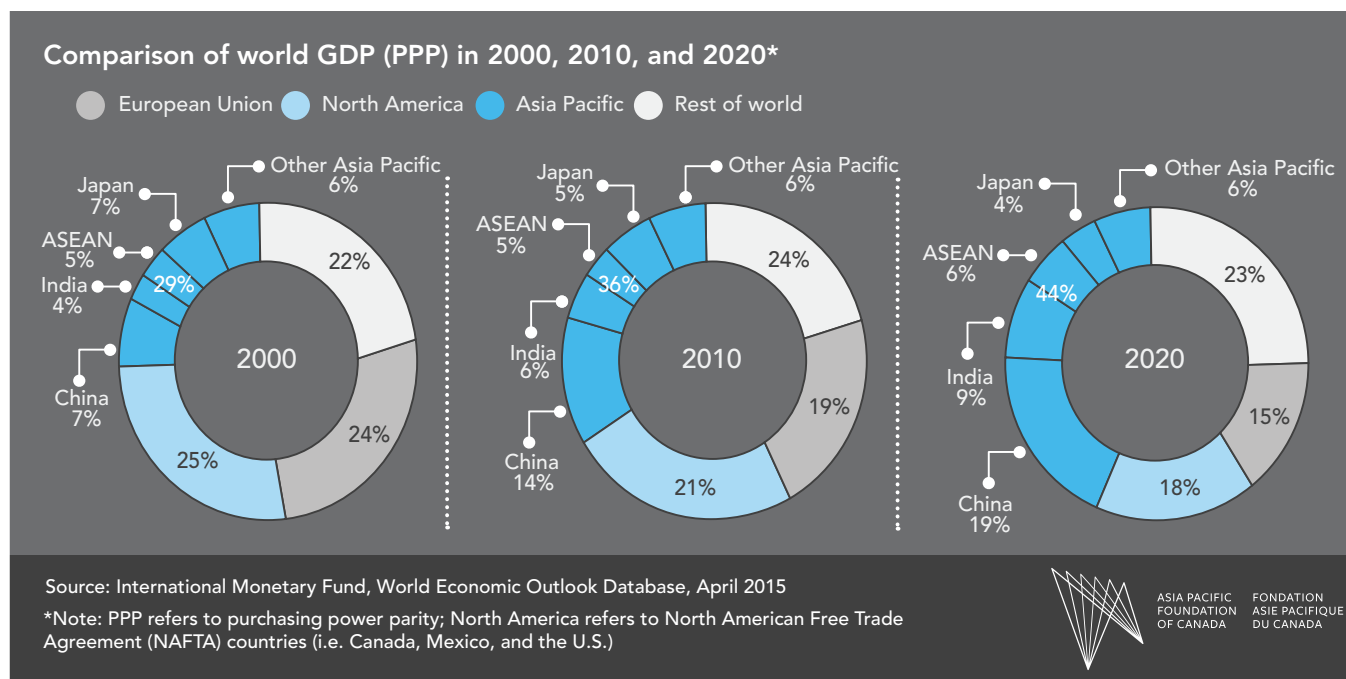
WHAT ARE THE TRENDS?

There are three macroeconomic trends in Asia with major implications for Canada's transportation system: 1) Asia's growing share of world GDP; 2) the concomitant increase in Asia's intraregional trade flows; and 3) the development of the ASEAN Economic Community (AEC).

Over the next 15 years Asia is projected to have an average GDP growth rate of 4 to 6 per cent, with the region coming to represent between 45 and 50 per cent of the world's GDP.¹ This aggregation, however, masks the diversity of economic conditions between Asian economies. Within the region, emerging and developing economies such as China and India will experience GDP growth rates in 2030 of around 4 and 7 per cent, respectively, whereas developed economies, such as Japan, Singapore, and Korea, will experience growth of around 1 to 2 per cent.

Within the class of emerging economies, China and India occupy different phases of the development continuum. While China is entering the end stage of its emergence, India is just starting to exert its presence in the world economy, especially vis-à-vis international trade. As China shifts its GDP composition away from one that is export and investment-led to one driven by domestic demand, India's GDP composition is shifting into one driven by investment.

China's changing economic composition will strengthen the country's role over the next 15 years as the region's trade hub. China's rapid deceleration in export-led growth will bring the nation roughly into line with world export growth rates, resulting in China's share of global exports increasing from 9 to 10 per cent in 2015 to 12 per cent in 2030.² Instead of focusing on export-oriented production, China is increasingly offshoring low-end production to its



Asian neighbours while also increasing its share as a market of end consumption.

As both China and India continue to evolve, the third major economic development that will transform the region, the AEC, has come online at the end of 2015. The AEC is working toward the goal of totally eliminating import duties on all products and for ASEAN member states to function as a highly competitive single market and production base.

The acceleration in India and most ASEAN members will help offset the deceleration in China and help fill the gap in low-end manufacturing left by China. As these shifts occur, improvements in the connectivity of the region become increasingly important.

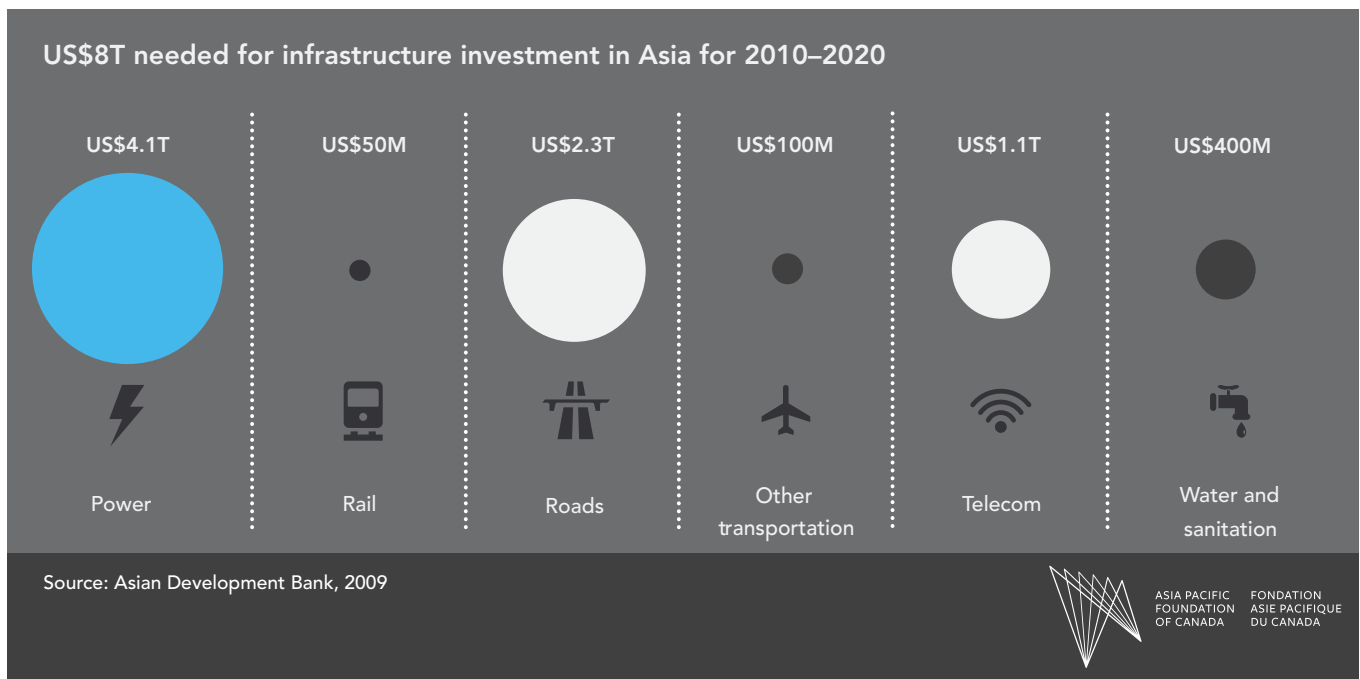
IMPLICATIONS FOR ASIA

The major implications of these trends for Asia manifest themselves in two ways: 1) the need for more infrastructure and financing of this infrastructure to facilitate greater trade flows; and 2) increased regional economic integration through free trade agreements (FTAs).

Adequate infrastructure is a necessary condition of economic growth in developing Asia. The level of investment necessary to achieve this adequate level is estimated at US\$8 trillion between 2010 and 2020, of which 68 per cent would be needed for new capacity.³ A sector-by-sector breakdown of infrastructure investment requirements for developing Asia is shown in the figure on page 29.

A 2004 study commissioned by the UK Department for International Development found that transportation costs for landlocked countries in Asia were 50 per cent higher than for coastal countries and that trade volumes in these countries were 60 per cent lower.⁴ The study found that a 10-per cent reduction in transportation costs leads to an increase of trade by 25 per cent. More recently, a 2011 working paper by the IMF found a fiscal multiplier effect: US\$1 of government investment in infrastructure in developing economies yielded US\$1.6 in returns.⁵

In the specific case of China, as it moves up the production value chain and outsources production to surrounding Asian economies, strong transportation systems and other hard infrastructure will become



increasingly valuable both to it and to its neighbours. Due to the rapidity of recent economic growth in the region, there is a large disparity in the economic connectedness of its sub-regions. Areas around the coast have developed into booming production hubs, while both landlocked areas and remote islands have thus far failed to capture the region's growing production demands.

Without the ability to finance the infrastructure projects necessary to facilitate trade and investment flows, emerging Asia will fail to live up to its economic growth potential. Accompanying this, if exports drop and economic activity slows due to a lack of investment in infrastructure, total savings in the region will fall (as will government tax revenues), and the demands on social security programs will rise. Therefore, a lack of infrastructure development in Asia not only creates a significant weak link in the export and import of goods, but may also decrease the consumer demand for goods in the region.

The government and private sector in Asia are working together to help fill the estimated US\$8 trillion infrastructure investment gap. However, many national governments face rising public debt

that constrains their ability to make investments in public infrastructure, and many countries lack developed frameworks for public-private partnerships.

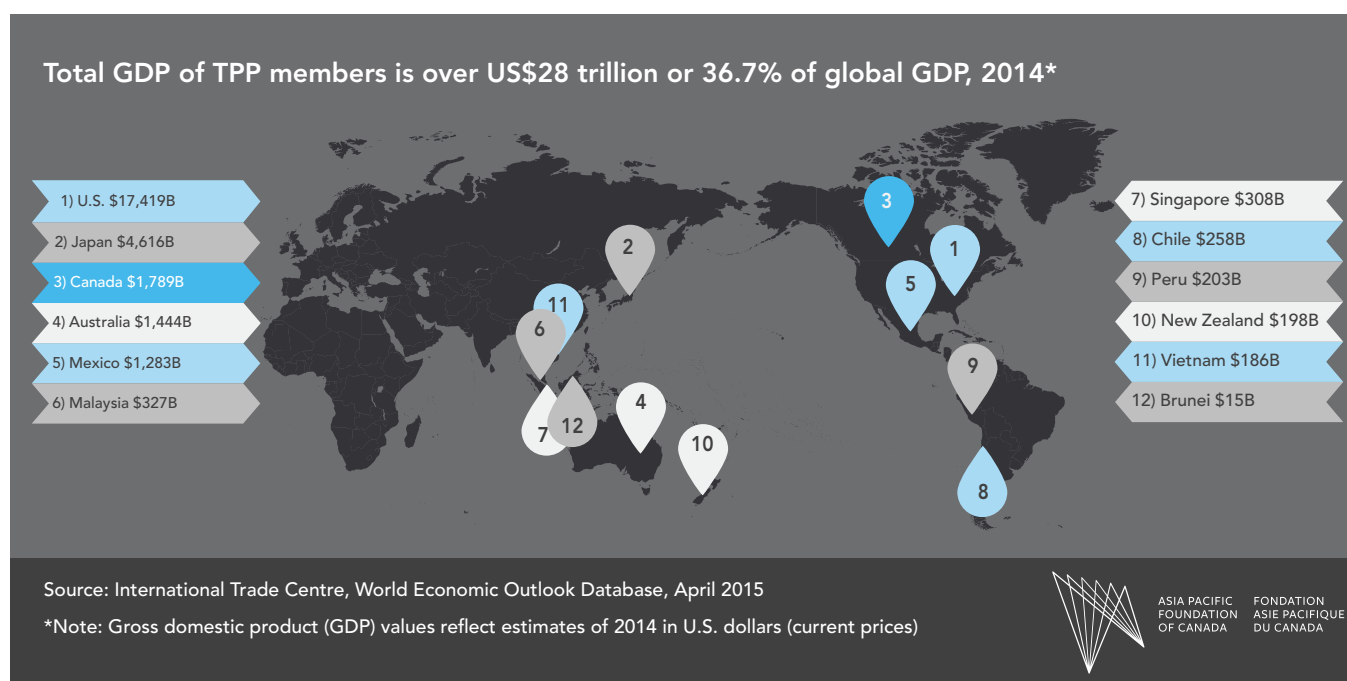
The government of China, as the regional player with the highest economic stake and a desire to enlarge its soft power, has established or co-established a number of initiatives to fix the funding gap. These include: the creation of the New Development Bank, the Silk Road development fund and most recently the Asian Infrastructure Investment Bank (AIIB).

In addition to multilateral infrastructure financing initiatives, Asian governments are keen to increase regional integration via bilateral and multilateral FTAs. The process of eliminating tariff and non-tariff barriers to trade will increase trade and investment flows within the region and enable the region to emerge as a dominant global player. While many countries within Asia have been and continue to be fairly aggressive in terms of negotiating bilateral FTAs with key partners, increasingly they have supported initiatives to harmonize existing bilateral agreements and create greater trade liberalization on a larger scale.⁶ For example, the Trans-Pacific

Partnership (TPP) originates from a much smaller agreement in 2005, the Pacific 4, between New Zealand, Chile, Singapore, and Brunei. Currently, the TPP initiative, largely recognized as a U.S.-led agreement, includes 12 different countries, which represent about 40 per cent of the global economy.⁷ Parallel to the TPP initiative is the Regional Comprehensive Economic Partnership (RCEP), a truly Asian regional agreement in terms of geography. This partnership includes the 10 ASEAN countries and the six countries⁸ with which they have already signed FTAs. The RCEP would impact some three billion people and a trade share estimated at around 27 per cent of global trade. While China is not a member of the TPP, it is considered the leading player in the RCEP negotiations. Still, the goal behind these two developing initiatives is the same for Asian countries, and that is to become increasingly competitive on a global scale by lowering barriers to trade, knowledge, and the movement of people while providing the right incentives for innovation.⁹ If the RCEP is successfully negotiated, trade liberalization is predicted to stimulate GDP growth from 0.09 per

cent to 2.11 per cent for RCEP member countries on average.¹⁰ Meanwhile, a study by the Peterson Institute has determined that by 2025, the TPP would boost global income by US\$295 billion per year.¹¹

It is possible that the TPP and RCEP negotiations will provide the building blocks toward the Free Trade Area of the Asia-Pacific (FTAAP). Originally submitted by the APEC Business Advisory Council to the APEC Leader's Meeting in 2004, the FTAAP did not gain any traction until the U.S. decided to support it in 2006. This Asian free trade zone initiative, currently being championed by China, is in the feasibility stage and is being assessed for its scope and impact by an APEC special task force. It is not clear what the relationship would be between such a free trade area and the two multilateral free trade agreements.¹² Three possibilities have been put forward by critics: (1) FTAAP could potentially consolidate the two agreements, thereby suspending their enforceability; (2) the TPP and RCEP could "evolve" into the FTAAP, and this larger agreement would cover all APEC members; and (3) the TPP



and RCEP could coexist and become components of the FTAAP.¹³ Indeed, APEC members such as China, Hong Kong, Indonesia, Papua New Guinea, the Philippines, Russia, and Thailand are keen on the idea of FTAAP since they are not party to the TPP.¹⁴ The phenomenon of integration can also be observed in the Latin American block. Colombia, Peru, Chile, and Mexico have decided to combine economic forces and join their shared access to the Pacific Ocean through a free trade agreement called the Pacific Alliance (Alianza del pacífico).¹⁵ The Pacific Alliance differs from others in the region due to its expressed interest in integrating with the Asia Pacific region.¹⁶ As a unified region, the Pacific Alliance represents the eighth-largest economy and the seventh-largest exporting unit globally.¹⁷

It is predicted that increased regional integration will eventually lead to increased regional interdependence. Many Asian economic experts agree that a stronger regional interdependence will enable Asia to be less susceptible to external shocks. As stated by Naoko Munakata, “The low interdependence among Asia is actually exacerbating the cyclical fluctuation caused by the U.S. market cyclical changes.”¹⁸ Supply chains have been and continue to be affected by regional integration as businesses now have more incentive to operate internationally and across borders to improve efficiency.¹⁹

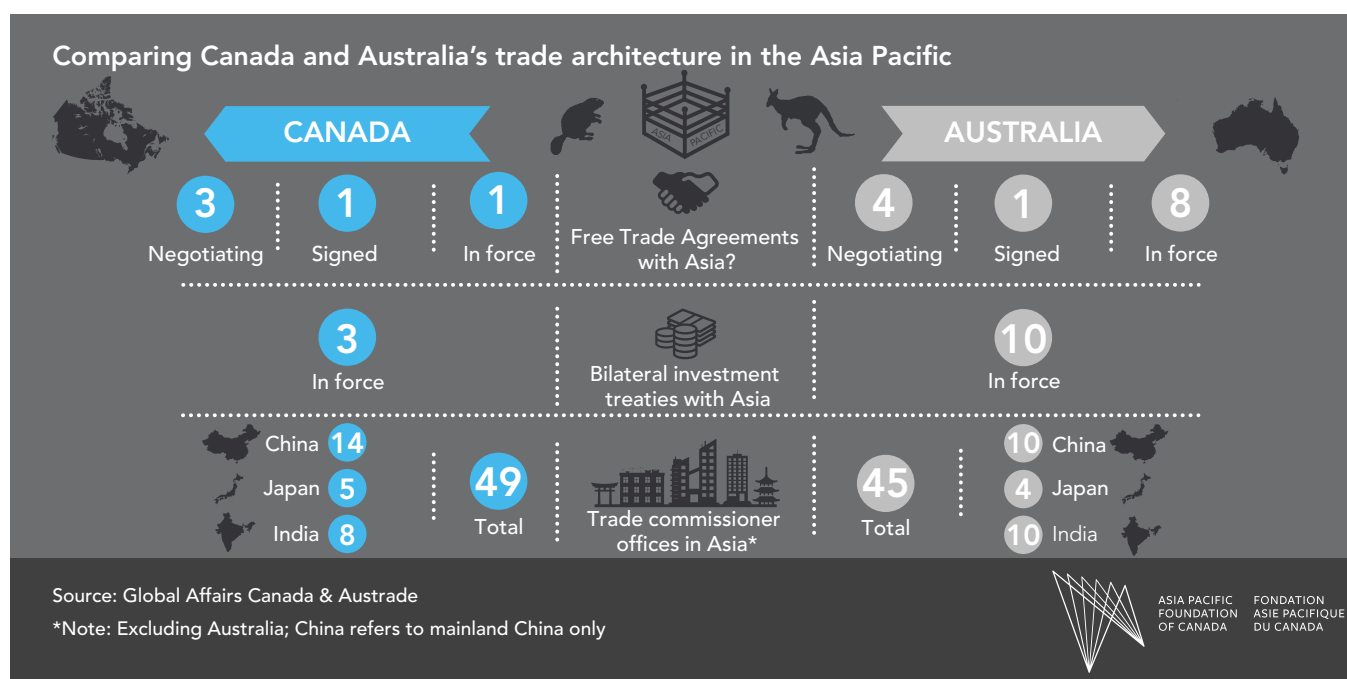
IMPLICATIONS FOR CANADA'S TRANSPORTATION SYSTEM

In order to keep up with trade liberalization within Asia and among Asian countries and international competitors, Canada will need to enhance its own trade architecture – both through bilateral and multilateral trade agreements and through continually upgrading its hard (physical) and soft (trade-related services) infrastructure.

Currently, Canada does not have an FTA with China, our largest trading partner in Asia. In 2012, an FTA negotiation invitation was put forward by the Chinese government when Prime Minister Stephen Harper visited China.²⁰ However, beyond an economic study, there has been no development on this issue. Meanwhile, Australia and China have since signed an FTA that will bring about the elimination of tariffs on 95 per cent of Australian exports to China upon full implementation. For products exported to China in which Australia and Canada compete for market share, Australian products will now have an advantage.²¹ The China-

Australia FTA is the second agreement that China has signed with a developed country, the first one being with New Zealand. It is also important to note that while Australia has eight FTAs with Asian countries, Canada only has one, with South Korea. Indeed, many trade experts have spoken out regarding Canada's lagging trade initiative with Asia, especially when compared to Australia's performance in the region. As other nations recognize the importance of strengthening ties with Asia, and as Asian regional integration develops, it is crucial for Canada to deepen ties with its Asian trading partners, particularly with China.²²

Likewise, it is important for Canada to enhance its hard and soft trade-related infrastructure. With increased trade comes increased traffic through airports, ports, roads, and railways. It is vital that as the nation builds its trade agreements with Asia, it also builds the infrastructure network needed to support increased trade.²³ Canada is well placed to act as a "gateway hub," the best transportation network enabling global supply chains between the Americas and Asia. Not only are our ports



well located in terms of east-west transportation of cargo, but due to our long history with Asia and large Asian diaspora populations, our cities could offer diverse professional services linked to trade with Asian businesses. Canada has the potential to develop into more than a “gateway hub.” It should strive to become more than a simple pit stop for cargo, but rather a true “gateway economy,” an initiative that could include the future establishment of free trade zones in strategic regions. In order to achieve this, Canada must continue development of the Asia-Pacific Gateway. This year alone, the Federal Government has approved funding of approximately C\$16.5 million for nine infrastructure projects in British Columbia. Most of the funding will be used to ease bottlenecks and congestion while building more road capacity.²⁴

The need to consistently improve Canadian facilities in order to stay competitive is highlighted by the experience of Singapore and Hong Kong. In 2012

Singapore and Hong Kong were ranked first and second on the Logistics Performance Index. In 2014, they ranked 5th and 15th respectively. The World Bank report states that while the slip in ranking does not represent a significant regression in performance, it does reflect the rapid improvement of other countries, namely EU countries, that have lately prioritized logistics-related issues.²⁵

Since 2014, Canada has ranked 12th in terms of logistics performance in the world, up two spots from 2012.²⁶ While we did improve in our ranking, one of the factors pulling down Canada’s overall logistics performance score is its ability to deal with customs. While the aggregate Logistics Performance Index score was 3.86 on a 5.0 scale, the customs score was 3.61 out of 5.0, meaning that while our overall performance is considered to be fairly good, our clearance process by border control agencies, including customs, could be improved. One way for Canada to facilitate customs procedures would be

Lloyd’s list of world’s busiest container ports, 2013 (container traffic in thousands of TEUs)

Rank	Port	Territory	2013
1	Shanghai	China	33,617
2	Singapore	Singapore	32,240
3	Shenzhen	China	23,280
4	Hong Kong	Hong Kong	22,352
5	Busan	South Korea	17,690
13	Port Klang	Malaysia	10,350
14	Kaohsiung	Taiwan	9,938
21	Tanjung Priok (Jakarta)	Indonesia	6,590
22	Laem Chabang	Thailand	6,032
24	Ho Chi Minh City (Saigon)	Vietnam	5,542
28	Tokyo	Japan	4,861
49	Vancouver	Canada	2,825
97	Montreal	Canada	1,357
–	Halifax	Canada	442

Source: Lloyd’s List (accessed via Wikipedia), Port of Halifax Statistics 2013

to strengthen U.S.-Canada border harmonization. Developments in that area have already been underway and have seen some benefits, thanks to the *Beyond the Border Action Plan*. In 2014, the Canada Border Services Agency announced the Customs Self Assessment (CSA) Platinum plan for CSA importers who provided enough internal information to ensure trade compliance. This plan enables them to apply for additional benefits that will save time and money when moving goods across the border. Furthermore, American importers, who were previously not eligible for this plan, can now apply to the CSA importer plan for the same benefits.²⁷ The *Action Plan* does state that more innovative pilot programs will be put in place for quicker customs clearance for specific sectors.²⁸ These programs could ultimately lead to the full harmonization of the U.S.-Canada border and bolster Canada's intermodal shipment qualities. This would make Canada a more attractive destination for Asian shipments to North America and might even encourage more American goods to be shipped to Asia via Canada.

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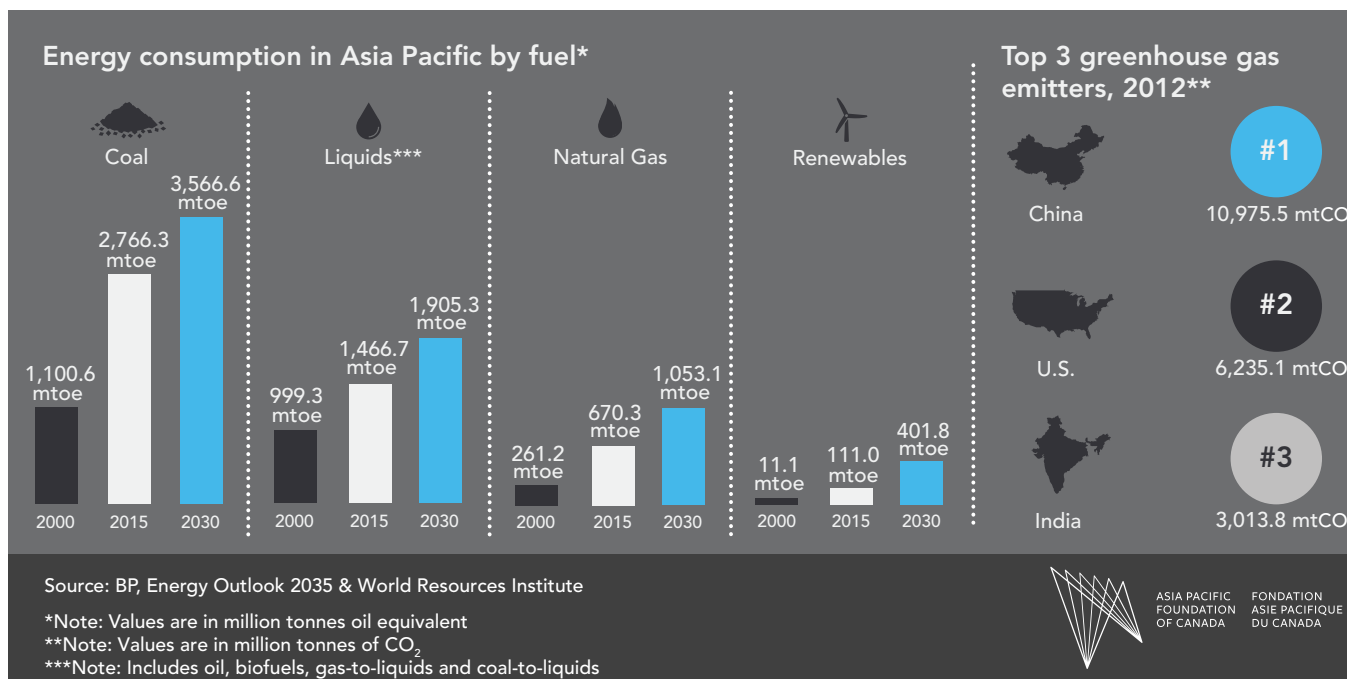
ENERGY AND THE ENVIRONMENT

WHAT ARE THE TRENDS?

Asia needs energy to fuel growth: the region is expected to use half of the world's energy and contribute up to 44 per cent of global GDP by 2035. The *BP Energy Outlook 2035* predicts that most of the 60 per cent increase in energy consumption in the Asia Pacific between 2013 and 2035 will come from fossil fuels, which already provide the majority of the region's energy needs. Coal use is anticipated to increase 38 per cent, oil 41 per cent and gas almost 100 per cent. Renewables will experience high annual per cent growth, but from a relatively small base.¹ As a result, the use of renewables will make a small contribution to 2035 energy requirements relative to fossil fuels.²

By 2035, most Asian countries will have low energy self-sufficiency, producing less than half of the energy they need. Many countries that were once self-sufficient in fossil fuels have already become net energy importers. Furthermore, some countries face substantial energy access challenges. For example, over 300 million people still lack access to electricity in India.³

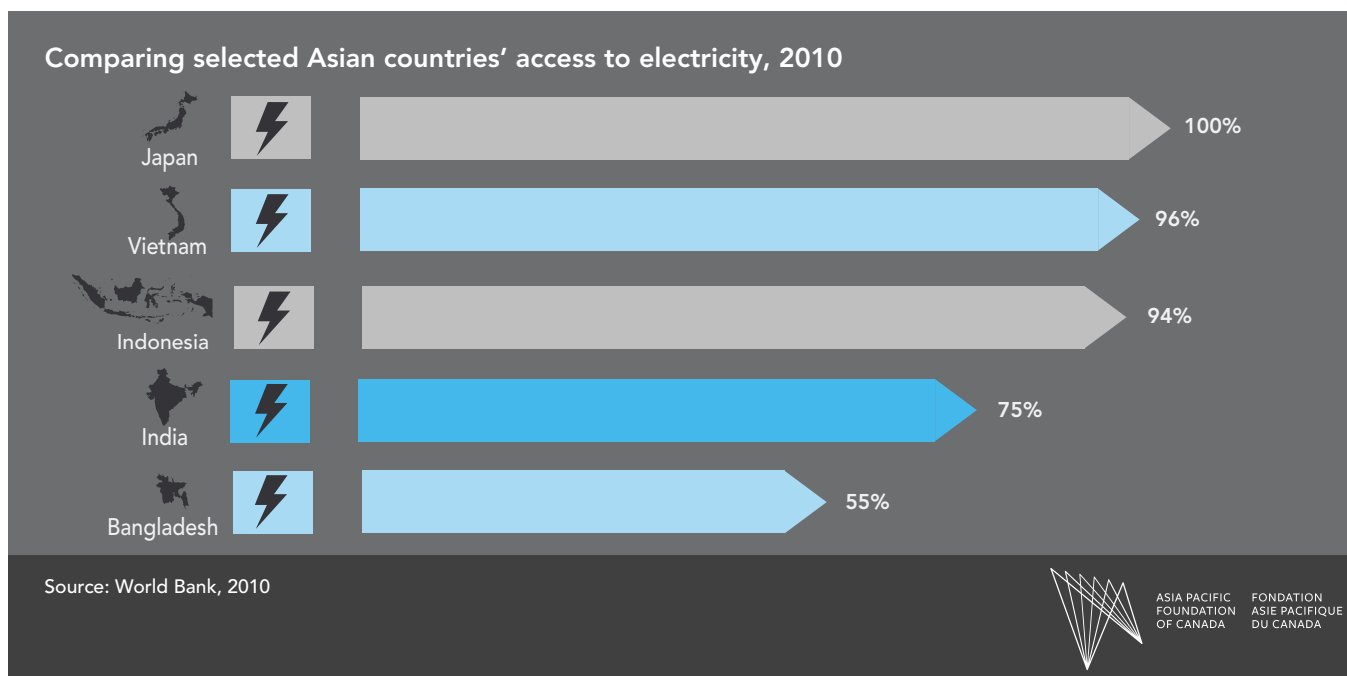
Sub-regions rely on different energy mixes: natural gas occupies a larger share of the energy mix in Central Asia than in the other sub-regions; and coal dominates the energy mix of China and India, and will become more important for countries in Southeast Asia.



From now until 2025, China will drive growth for all energy types; after 2025, India will be the dominant force behind the growth and demand.⁴ Already, China is showing changing patterns in energy use, such as increased energy efficiency, and an absolute drop in coal use last year.

Oil

Oil will remain the dominant component of Asia's energy mix. Diversification away from oil has been largely unsuccessful in the Asia Pacific due to accessibility and infrastructure issues with



natural gas and environmental concerns about increasing coal use. Oil is used for many purposes; however, the petrochemical industry (which uses oil as a feedstock) and the transportation sector are projected to lead growth in the near term.⁵

Oil's dominance in the transportation sector is no longer unchallenged due to the spread of electric or natural-gas powered vehicles. Further, for end use such as power generation, industrial production, and space heating, oil is being challenged to some extent by "cleaner fuels," such as natural gas or renewable energy, or cheaper sources of fuel, like coal.⁶ Nevertheless, oil is projected to remain the dominant source of fuel in the region's transportation sector (89 per cent of fuel used in the sector in 2035).⁷

Coal

Coal is and will remain an important source of fuel for electricity generation in Asia.⁸ However, not all coal is used to produce power. For example, metallurgical coal or coking coal is used as an input for the production of steel. Coal is also used as an energy source for high-temperature kilns in cement production.

The Asia Pacific region, and China in particular, is driving global demand for coal of all types – China alone has been responsible for four-fifths of global coal use growth since 2000.⁹ However, coal consumption growth in China is slowing – in 2013 consumption was lower than the 10-year average and in 2014, decreased in absolute terms for the first time.¹⁰

Whether this absolute drop in coal use will continue in the immediate term is highly debated among analysts. For instance, a report by Bernstein Research suggests that coal consumption of all types will continue to decline in absolute terms from 2014 onwards,¹¹ whereas the International Energy Agency projects that coal consumption will continue to grow (at 2.5 per cent a year) from 2013 to 2019.

Forecasts do agree on one thing, however: structural factors are contributing to a long-term downward trend in coal use for power generation in China. The slowing of economic growth; a shift away from energy and labour-intensive exports to consumption-oriented growth based on services sector; and improved energy efficiency are resulting in decreased power demand. Government policy is encouraging a decrease in coal consumption for power generation.

However, many countries in Asia are showing the opposite of China's long-term coal reduction trend. In India, coal consumption increased 11 per cent in 2014,¹² and countries in Southeast Asia are rapidly building coal-fired power plants in order to make up for declining supplies of natural gas.¹³ For many of the developing countries in the region, coal will remain relevant well into the future, as achieving universal access to electricity and minimizing reliance on energy imports take priority over environmental protection or the development of non-fossil fuel technologies. Nevertheless, this growth in demand in the rest of Asia will not make up for declining demand in China, and global growth in coal demand is expected to slow relative to the 10-year average.

Natural gas

Natural gas produces smaller amounts of greenhouse gas emissions and atmospheric pollutants than other fossil fuels. However, it makes up a relatively small portion of the energy mix in most Asian countries (about 5 per cent in China and 6 per cent in India).

Since the mid-2000s, many Asian countries have made plans to expand their use of natural gas to 1) reduce dependence on imported oil; and 2) lower environmental pollution from the use of coal.¹⁴ Some countries, such as Indonesia, are substantial natural gas producers. The growing severity of urban air pollution in many developing countries will contribute to an increase in the use of natural gas

in the transportation sector. For example, Indian legislation requires buses and taxis in Delhi to switch to compressed natural gas, and government policy in South Korea promotes the use of compressed natural gas in buses.¹⁵

For some markets, such as Japan, South Korea, and Taiwan, the only way to acquire natural gas is by importing liquefied natural gas (LNG). Other markets where natural gas demand has outstripped domestic production, such as China and India, have begun to import LNG.¹⁶ There are, however, a number of factors that will limit expansion of LNG imports. For instance, in India, the lack of terminal and domestic pipeline capacity will hinder the growth of LNG imports;¹⁷ and in China, the growing pipeline capacity and new supplies via pipeline coming from Russia and Central Asia may decrease the need for Canadian imported LNG.¹⁸

Nuclear and Renewables

Non-fossil fuel sources, such as nuclear and renewable energy, will play a growing role in the energy mixes of many Asian countries and will impact demand for fossil fuels.

Nuclear energy is expanding substantially in China and to some extent in India, and has been a major part of the energy mixes in South Korea and Japan. In 2013, Japan shut down all of its reactors for inspection in response to the 2011 Fukushima accident. Facing energy security and pollution problems, the Japanese government has been advocating for nuclear restarts, but has faced public opposition. The first reactor restart was initiated on August 11, 2015, at Japan's Sendai nuclear power plant. In Southeast Asia, the countries leading the region's ambition to acquire nuclear power generating capabilities are Vietnam, Indonesia, and Malaysia.

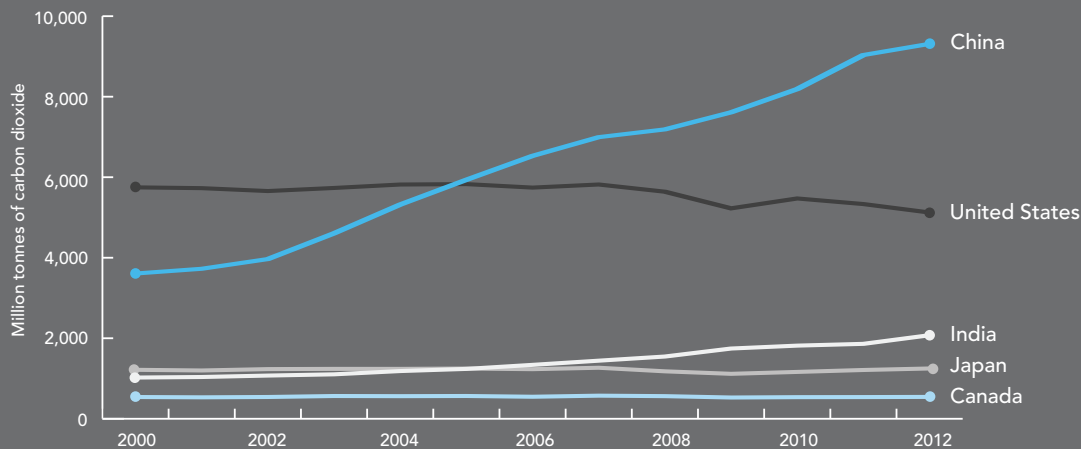
Environmental policies have driven the recent growth in the deployment of renewable energy in Asia. China is a leader in renewable energy investment (making US\$41.5 billion worth of new investments in the clean energy sector in the first two quarters of 2015) and has been a major driver in bringing down the cost of solar panels.¹⁹ Developed Asia and China are increasingly exporting renewable energy technology worldwide, including to Canada. Despite impressive growth, renewables will face challenges in reducing coal and oil use in the region.

Environment

Energy extraction, transportation, and use have a negative impact on the environment. As energy use has increased in Asia, so too have greenhouse gas emissions. China is a case in point: the country's primary energy consumption increased approximately 78 per cent between 2004 and 2012,²⁰ while total CO₂ emissions increased 75 per cent in the same period.

Rising CO₂ emissions and other greenhouse gases contribute substantially to climate change. The United Nations Intergovernmental Panel on Climate Change (IPCC) predicts that every continent will experience a continual rise in temperature over the medium to long term. The IPCC predicts a 0.2-degree-Celsius warming per decade over the next two decades, with scenarios estimating an increase between 0.6 and 4.0 degrees Celsius in 2090 to 2099 relative to 1980 to 1999. Arctic average temperatures have increased twice the global average over the last few decades and this trend will likely continue. Climate change is contributing to increased polar sea ice melt, rising sea levels, and more frequent and devastating natural disasters.²¹

International shipping and transportation is a major contributor of greenhouse gas emissions. Since 1970, transportation-sector emissions have

Total CO₂ emissions of selected economies, 2000–2012*

Source: World Resources Institute

*Note: Total CO₂ emissions exclude land-use change and forestryASIA PACIFIC
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grown faster than any other energy end-use sector, and they account for about a quarter of the world's greenhouse gas emissions. Eighty per cent of this increase has been from road-based vehicles. With significant global investment in trains, large ships, and aircraft – and despite efforts to reduce emissions through technology advances – transportation emissions will continue to grow in the near term.²² In 2013, Canada's transportation sector accounted for 23 per cent of the country's greenhouse gas emissions.²³

Glacier and polar ice melt and the rise in sea levels caused by climate change will dramatically affect Asia's and Canada's coastal regions. Even a modest rise in sea level will disproportionately affect Asia (see figure on page 42). Many coastal areas and some island countries will completely disappear or become uninhabitable, requiring massive spending in infrastructure and/or population relocation. Submerged coastal areas and islands will also increase political and economic uncertainty, partially because the UN Convention on the Law of the Sea, which provides that coastal states can

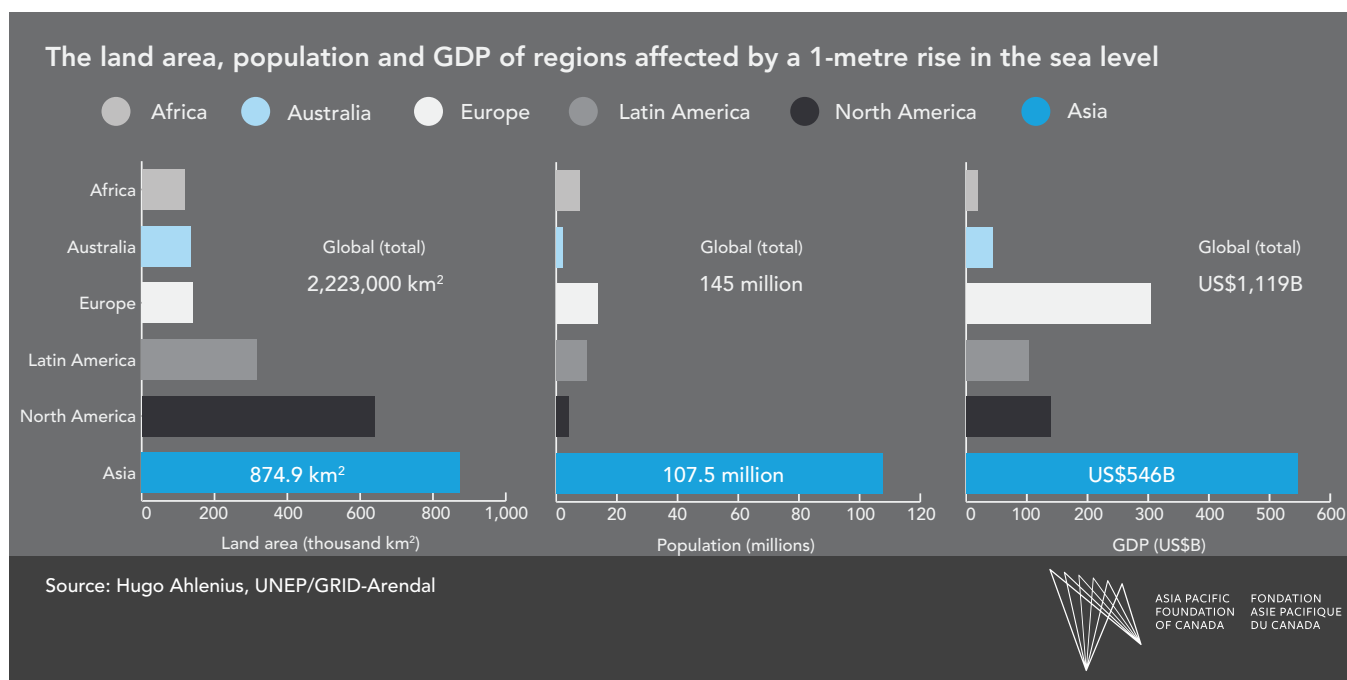
claim a 200-nautical-mile exclusive economic zone off their coastline, does not account for drastically altered coastlines or the submergence of islands. This means that some states could lose their entire land base; others may lose significant coastal areas, which will put their exclusive economic zones in question.²⁴

Small island states and developing markets in Asia will be the most affected, but have the least ability to cope; the most commonly cited prediction is that by 2050 there will be 200 million people forced to relocate because of climate change.²⁵ Rising sea levels could submerge 18 per cent of Bangladesh, forcing 35 million people to relocate. Up to 10 million people in Vietnam's lowlands may face similar relocation challenges. The potential of forced migrants in these two countries alone nearly matches the current estimates for the world's internally displaced peoples.²⁶ It is possible that Canada may have to deal with a significant number of these migrants and refugees.

The consequences of climate change on infrastructure may be similarly costly: coastal ports will either lose important infrastructure or require substantial upgrading. Canada's coastal communities and ports, including Port Metro Vancouver, Prince Rupert Port Authority, and the Port of Halifax, will face similar challenges (see figures on pages 42 and 43). This is problematic for cargo shipping traffic, which is expected to increase over the next 30 years, requiring larger and more frequent container ships, and hence larger ports.

The IPCC and the Asian Development Bank predict that climate change will increase the number of damaging storms in Asia and result in extreme precipitation, cyclones, and droughts.²⁷ Between

1980 and 2008, earthquakes and storms accounted for nearly 82 per cent of the 3,341 natural disasters in Asia, killing over one million people and affecting over four billion people. The Pacific is home to the so-called Ring of Fire, a belt that accounts for about 90 per cent of the world's earthquakes. Some of the most recent and notable disasters include the 2004 Indian Ocean earthquake and tsunami, the 3/11 Tohoku triple disaster (earthquake, tsunami, and nuclear meltdown), and the 2015 Nepal earthquakes. The 2004 Indian Ocean tsunami affected 15 countries, killed about 230,000 people, displaced a further million people, and caused about US\$10 billion in infrastructure damage.²⁸ Comparatively fewer people died in the 2011 triple disaster in Japan (about 25,000), but the overall



costs were immense: nearly half a million people were relocated by the government or moved of their own accord, around 130,000 buildings were destroyed, and the country incurred US\$360 billion in losses.²⁹

Severe earthquakes and tsunamis could occur along Canada's west coast and impair or destroy coastal cities and infrastructure.

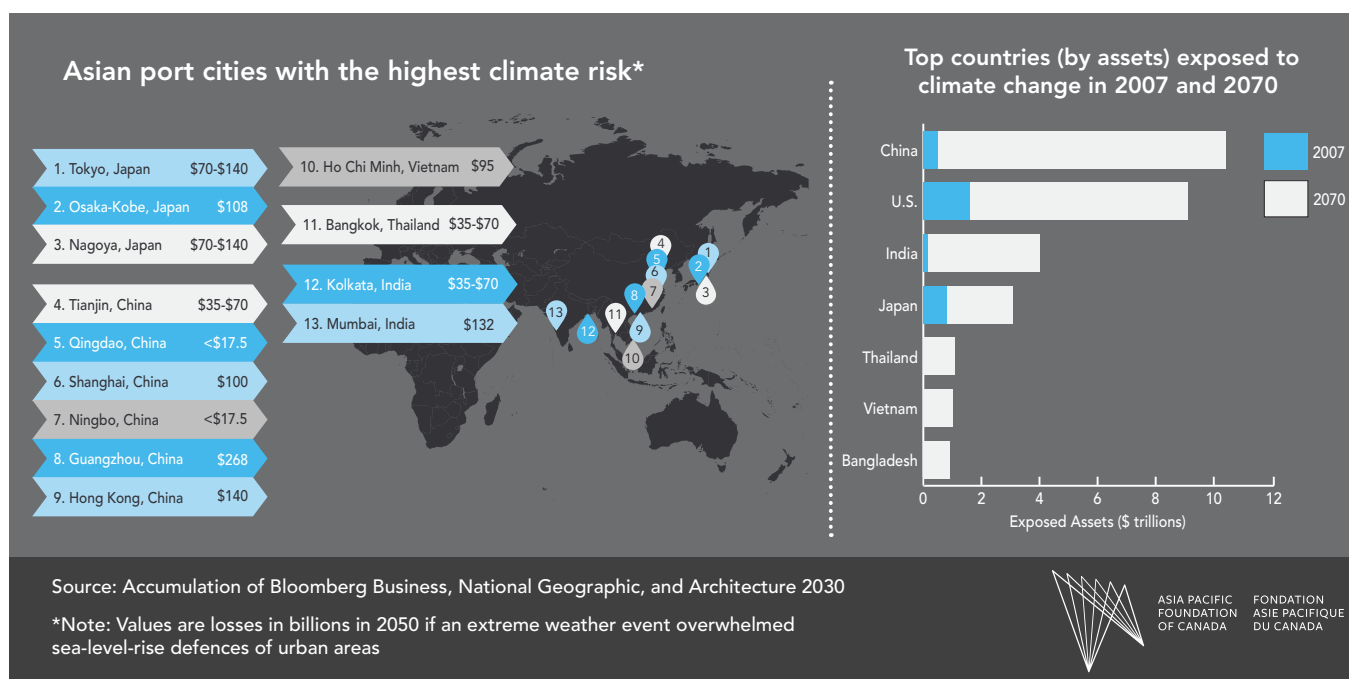
IMPLICATIONS FOR ASIA

Both growing demand for energy and the progressive depletion of certain domestic fossil fuel reserves are resulting in a number of Asian countries becoming increasingly dependent on energy imports. This has led them to diversify their energy supply sources. At the same time, given the trends described above, there is a growing awareness that efforts must be made to balance energy needs with environmental imperatives.

Many Asian countries are seeking to reduce import dependency by increasing domestic production of available energy resources, such as oil, gas, and renewables. Nevertheless, challenges with stimulating certain types of production (such as shale gas development), the sheer volume of incremental energy demand, and the absence of domestic resources in some countries means that Asia's import needs will remain high.

Therefore, many countries in the region are attempting to diversify both the types and geographical sources of the energy they use in order to ensure uninterrupted supply of energy imports. For example, China aims to increase natural gas from 5 per cent to 10 per cent of its energy mix by 2020 to reduce dependence on coal and oil.

Geographical diversification is essential to ensure that energy imports are not interrupted by political instability or extreme price increases. Countries in the Asia Pacific region are highly dependent on the



Middle East for oil and, in some cases, LNG imports. Japan, for example, is dependent on the Middle East for over 80 per cent of crude oil imports.³⁰ Asian countries have been investing in North American oil and gas assets as one means of diversification (the trade-off being higher transportation costs).

Finally, severe air pollution and the growing evidence that climate change is directly linked to fossil fuel usage have meant that some governments in the region are taking environmental policy more seriously. China is an excellent example. In November 2014, Chinese President Xi Jinping announced that China aimed to increase the share of non-fossil fuels in its energy mix to 20 per cent and to peak carbon emissions by 2030.³¹ These targets have been accompanied by strong efforts to reduce coal consumption. In September 2013, for example, the State Council issued the *Air Pollution Prevention and Control Action Plan* mandating that the share of coal in primary energy consumption in China as a whole should fall to 65 per cent by 2017 from over 70 per cent in 2013.³² The country has also rolled out seven pilot emissions trading schemes to price carbon.

IMPLICATIONS FOR CANADA'S TRANSPORTATION SYSTEM

Rail

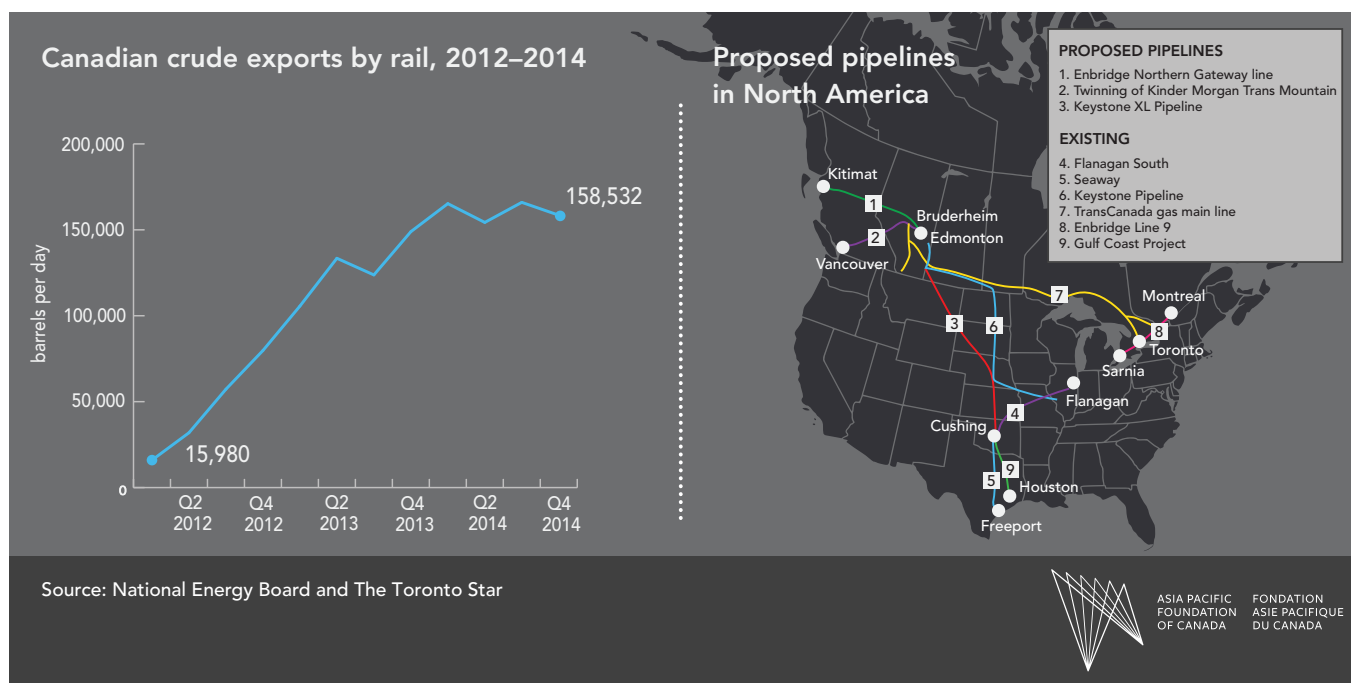
Canada lacks the transportation infrastructure to move oil and natural gas from extraction sites in Alberta and British Columbia to the West Coast for transportation to Asia, and is also feeling constraints on oil pipeline capacity to the U.S. There are at least four major oil pipeline projects at various stages of development that are intended to alleviate this situation, but they are facing public opposition.

The lack of pipeline capacity has meant that oil is being transported via alternative export routes – mostly via rail. In 2011, Canadian National and Canadian Pacific, the two major rail companies, moved approximately 5,000 and 13,000 rail cars of crude oil respectively. A year later, the numbers increased to 30,000 for Canadian National and 53,500 for Canadian Pacific (while the increase is significant, it still accounts for only 4 per cent of Western Canada's 2012 oil supply).³³ By the end of 2014, approximately 173,000 barrels of crude oil were exported per day by rail.³⁴

The dramatic increase in oil cargoes by rail over the last five years has created greater competition among commodities, such as forestry, agriculture, and energy products, for available rail capacity. In order to ensure transportation of agricultural products, the Federal Government issued a "minimum quantity order" in March 2014 (which expired in March 2015), requiring rail companies to transport a stipulated amount of grain product.³⁵

While the collapse of oil prices may mean that oil production from Western Canada may plateau or decline in the longer term, projects under construction will continue to add oil production for the next three years (until 2017). Projects coming online in 2015 alone will add 340,000 barrels per day of capacity.³⁶ Low oil prices reduce the economic viability of shipping bitumen by rail. However, this new oil will need rail to access markets given the available pipelines are already operating near their full capacity.³⁷

Aside from oil, other energy sources may soon resort to rail for transportation: natural gas and thermal coal. After the "unexpected" success of crude by rail, gas companies have begun to consider transporting natural gas to places beyond the reach of pipelines.³⁸ Consequently, companies are now in the process of developing and perfecting the technology to



transport gas, most likely LNG, by rail. While this is a possibility, LNG is “uncertified” by the US Federal Railroad Administration,³⁹ meaning that no tank car is permitted to carry LNG on (U.S.) rails.⁴⁰

With respect to coal, Canadian coal producers export almost exclusively metallurgical coal. As demand growth for metallurgical coal slows in China, exporters may need to look to non-Asian markets such as Latin America to expand exports. Canadian thermal coal producers may seek to export coal to Asia as Canadians consume less thermal coal (Ontario for example phased out coal for electricity generation in 2014)⁴¹ while consumption increases in developing Asia. However, Canadian producers are unlikely to pursue substantially higher exports in today’s low-price environment for coal.

Following the Lac-Mégantic tragedy in 2013, the public has heightened concerns over energy commodities being handled by freight rail.⁴² Although much has already been done by Transport Canada, together with authorities in the U.S.,

further development of regulation will be necessary to improve public trust. Safety concerns over the movement of natural gas by rail are likely to become a major policy issue despite the fact that more volatile liquids like ethylene and propane already travel on rail.⁴³

Ports and Shipping Lanes

Coal, natural gas, and oil for export to Asia will need to travel through Canada’s ports. The three busiest ports for international markets are located off the coast of British Columbia: Port Metro Vancouver, Prince Rupert Port Authority, and Port of Kitimat. For example, 8.4 million tonnes of fuel are shipped from Vancouver alone.⁴⁴

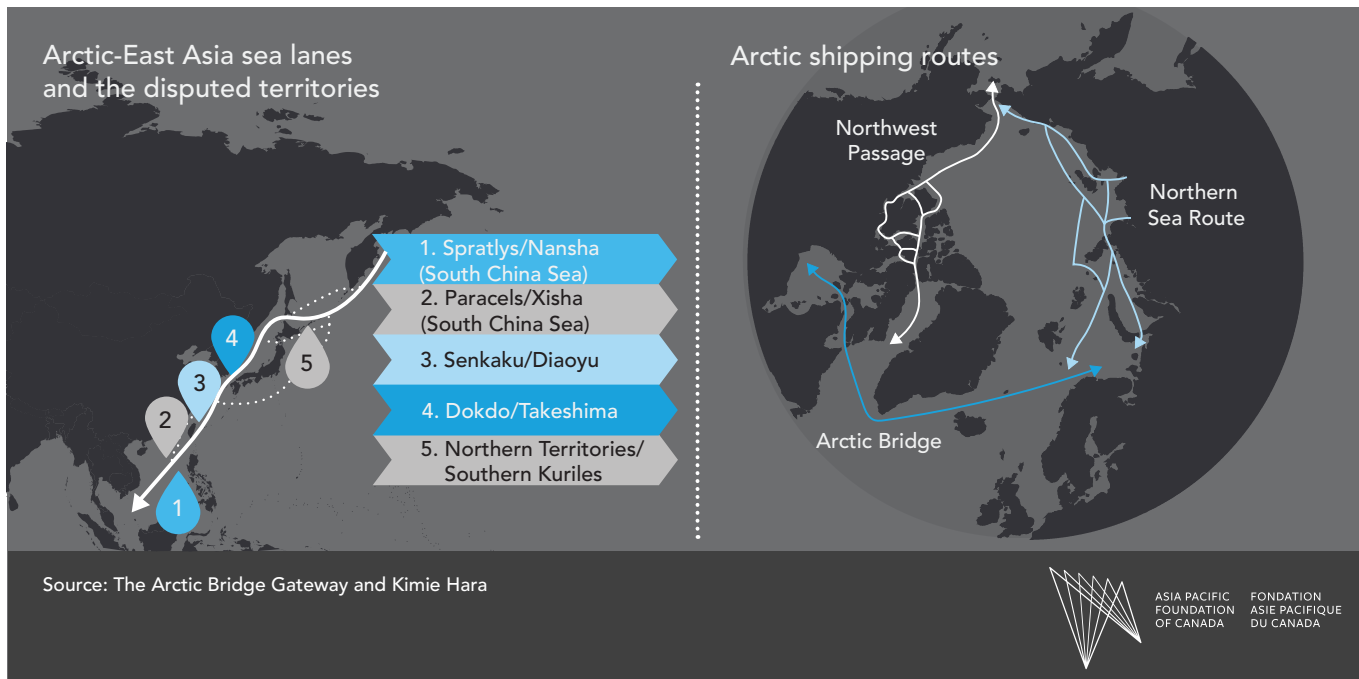
The increased volume of energy shipments from Canadian ports requires Canada to update regulatory and enforcement practices, tailored to the specific nature of the energy commodities. As B.C. has 20 proposed LNG export projects – of which one (Pacific NorthWest LNG) has received

a conditional final investment decision – it will become especially important to regulate private marine terminals that fall under the purview of national and international legislations to ensure safety of residents and ecological integrity.⁴⁵

With respect to coal, Canada's West Coast ports have tended to operate very close to capacity when high coal prices encourage exports. While expansion projects are underway at the Westshore facility, Ridley Terminal, and Fraser Surrey docks to accommodate greater exports, port capacity may again become strained during a coal export boom.⁴⁶ In recent years, there has also been interest from U.S. thermal coal producers in using Canadian ports to export coal to Asian markets. When coal exports from Canada are high, ports have only been able to accommodate small volumes of U.S. coal relative to potential volume of coal that could be shipped to Canada for export.

Asian interest in Arctic shipping lanes will increase in line with receding arctic sea ice (see figure

below). This could lead to new environmental and security threats in the Asia Pacific and Canada's northern regions. Rising sea levels, coastal erosion, and permafrost melt will further complicate the already challenging northern land transportation infrastructure plans for future ports, port expansion, and land connections over increasingly unstable permafrost, such as the permafrost at Churchill, which will need to be carefully engineered.⁴⁷ Canada will need to take measures to address increased shipping in the Northwest Passage, including possible overflow shipping from Russia's Northern Sea Route. Canada should remain watchful of the region's disputed territories because shipping routes from Asia to the Arctic pass through or near most of them (see figure below).



Melting sea ice and eroding coastlines may increase the plausibility of northern shipping but in no way decrease its dangers. Therefore, increased traffic in the Northwest Passage will also require increased rescue, disaster, and spill response. This will require planning for shipping infrastructure in northern environments, increased military capabilities in the Canadian Arctic to protect and service sea lanes and ports, and collaboration with the Arctic Council to create standardized Arctic shipping regulations. Each of these steps must actively engage northern Aboriginal communities.

Finally, as concern about environmental outcomes increases in Asia, countries in the region may introduce new environmental standards that could have implications for Canada's transportation system. For example, when making energy import decisions, specific Asian countries could choose to take into account the volume of emissions that an energy source produces from extraction through final use. While unlikely in the near term, if such a regulation were to be implemented, Canada's systems for moving energy products from production sites to ports may need to reduce emissions if Canada's energy products are to be competitive in the regulated markets.

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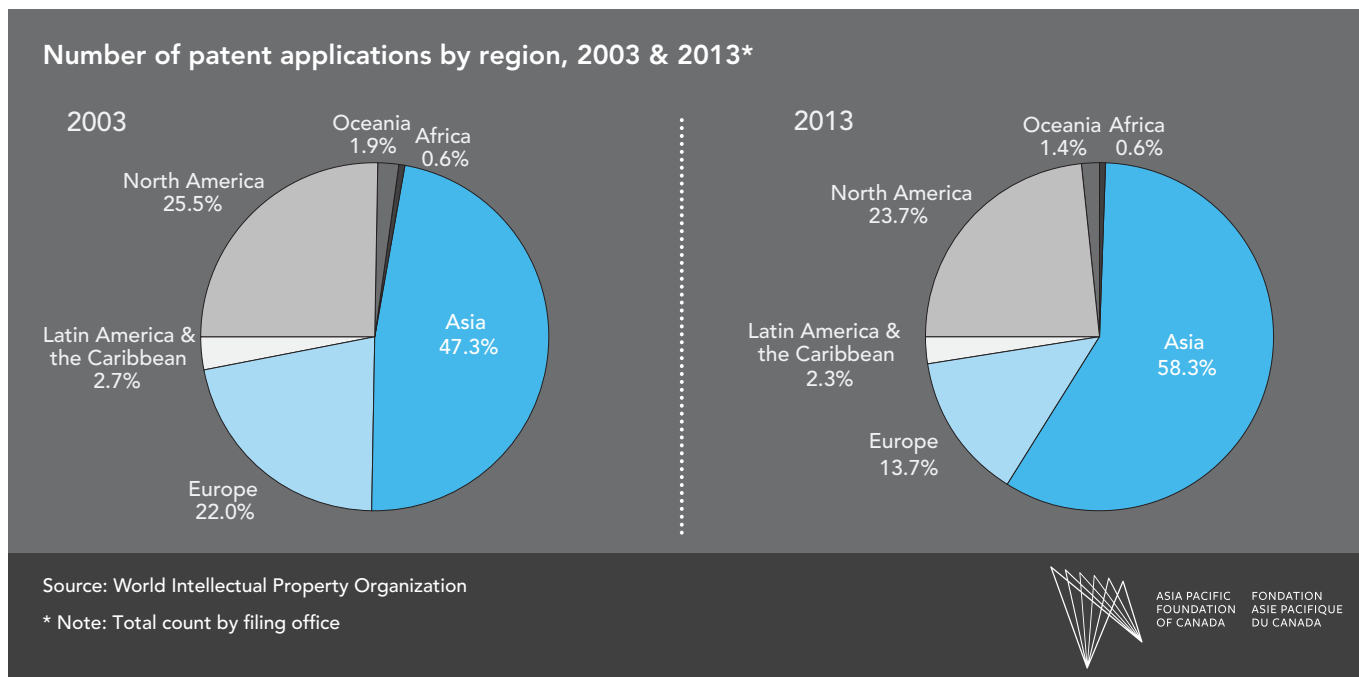


TECHNOLOGY AND INNOVATION

WHAT ARE THE TRENDS?

Reports show that Asian countries are now “winning the innovation race.”¹ *Bloomberg’s 2015 Innovation Index* ranked nine Asian countries or economies as part of the top 50 most innovative countries in the world, with South Korea emerging on top, Japan 2nd, Singapore 8th and China 22nd.² Asia’s rising prominence in the innovation space is partially reflected in its increasing share of patent applications globally. While Asia accounted for 47.3 per cent of patents applications globally in 2003, it increased to 58.4 per cent by 2013.³

Higher levels of innovation in Asia can be attributed, in part, to the flourishing innovation ecosystems in Asian countries. Admittedly, some countries are in more nascent stages than others. What all countries share, however, is the determination to catch up in the technology startup scene. China is now considered the second-largest startup market in the world.⁴ China and India have the third- and fourth-largest venture capital markets, respectively.⁵ In places such as Cambodia and the Philippines, social enterprise businesses are on the rise. A combination of government policy support,⁶ a large market⁷ boasting more than four billion



in population, technological advancements, and increasing opportunities for financing all provide Asia with fertile ground for the development of the world's next Silicon Valleys. A plethora of Asian banks, private-sector investors, government-backed sovereign wealth funds, technology companies, and venture capital firms have all demonstrated their willingness to invest in homegrown startups in the region.⁸

Asia's innovation ecosystem must not be seen as existing in a vacuum. Of key importance to Asia's flourishing innovation ecosystem is its growing interconnectivity with innovation ecosystems all over the world, particularly North America. Not only are foreign startups increasingly interested in setting up shop in Asian capitals, multinationals and technology giants such as Google, Facebook, and Amazon are also joining the scene – establishing startup campuses and investing in startups in the region that have a strong advantage in their markets.⁹ Foreign incubators and accelerators are also expanding their presence in Asia, offering local startups mentorship, funding, and linkages to the

market.¹⁰ As global firms continue to shift their investments in technology innovation to Asia, startups in the region increasingly gain easier access to global capital.¹¹

But the flow of capital goes both ways. Asian technology companies such as Alibaba, Tencent Holdings, SoftBank, and Rakuten are now investing outside their traditional markets to gain a foothold in Silicon Valley. This flood of capital has led to increasing valuations of startup companies in North America as Asian technology giants compete for access to the most promising ideas and technologies.¹²

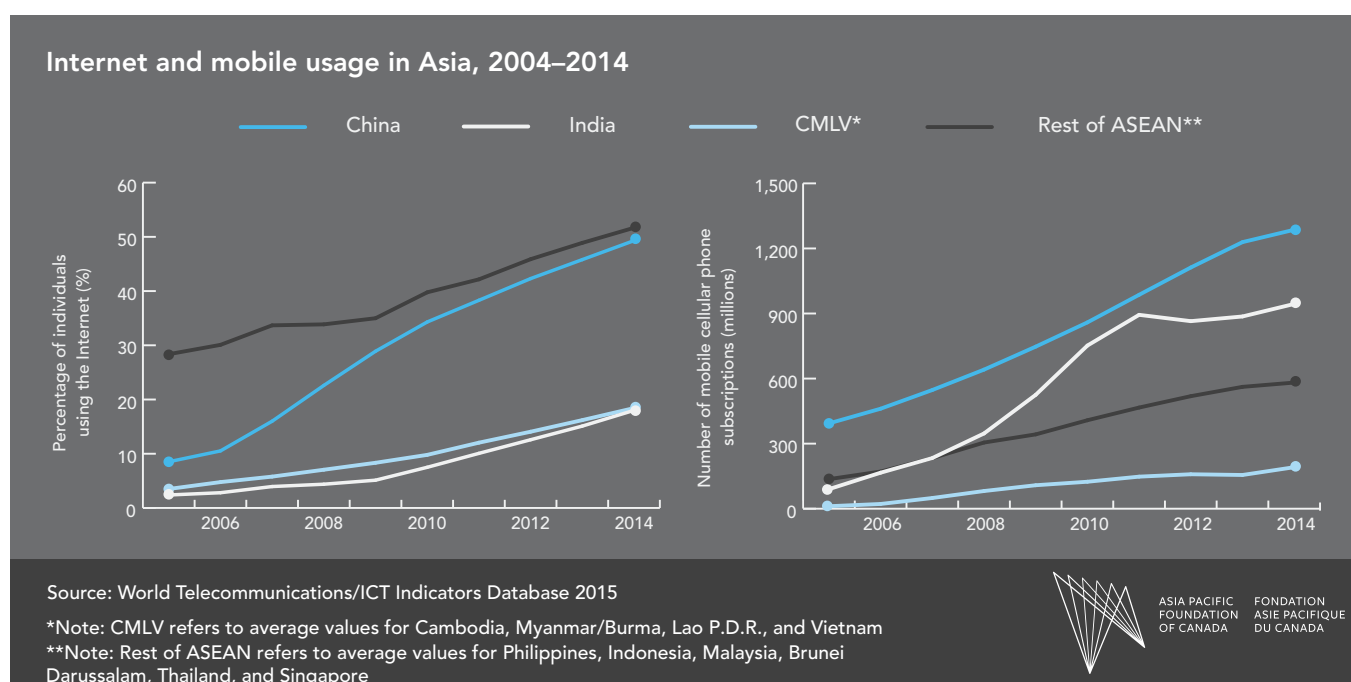
Asia's flourishing innovation ecosystem would not be possible without a parallel movement toward digital transformation in the region. In ASEAN countries, newer technologies such as the Internet, mobile communications, and big data are expected to have an economic impact of \$220 billion to \$625 billion annually by 2030.¹³ Of utmost importance is rising Internet and mobile phone penetration. Rising rates of Internet penetration

will be a key factor in driving productivity gains as the region moves from a consumer-driven economy to an enterprise-oriented one. New Internet applications are expected to account for up to 7 to 22 per cent (or RMB4 trillion to RMB14 trillion) of productivity growth in China's GDP by 2025, with the difference depending on government policies and industry efforts.¹⁴

Mobile Internet penetration accounts for a large proportion in the rise of Internet penetration. Mobile devices represent the first points of Internet access for many users, particularly those in Southeast Asia, who choose to skip over the personal computer stage and proceed directly to accessing the Internet through their phones.¹⁵ This penetration is expected to deepen with the adoption of 4G and mobile broadband.¹⁶ By 2020, approximately half of the population in the Asia Pacific region will have mobile Internet access.¹⁷ By 2025, approximately 700 to 900 million Indians will have access to mobile Internet.¹⁸

Although the current mobile phone market in Asia is underdeveloped, the region is expected to account for a majority of the global subscriber base over the next decades. As of 2014, there were 1.3 billion smartphone subscribers in the region – a figure that is expected to increase to three billion in five years' time. While there is a large gap in terms of smartphone adoption between developed and developing Asian countries, this gap is expected to narrow given the emerging popularity of locally-made smartphones.¹⁹

Rapidly expanding access to the Internet and increasing penetration of mobile phones are fuelling the expansion of electronic commerce (e-commerce) and mobile commerce (m-commerce) in Asia. As a result, online commerce has become a significant driver of economic activity, particularly in economically more developed countries in the region. In 2013, China became the top e-commerce market in the world, with e-commerce transactions in China expected to hit US\$540 billion in 2015.²⁰ In 2014, South Korea's e-commerce sector was valued at approximately US\$37.9 billion²¹ while



m-commerce totalled over US\$12.6 billion and boasted a remarkable 126 per cent growth from the previous year.²² E-commerce sales in Japan totalled US\$104.7 billion in 2013,²³ and up to 89 per cent of Japanese consumers have participated in m-commerce activities.²⁴ Lower penetration rates in South and Southeast Asia reflect lower but by no means insignificant valuations for their respective online commerce markets. E-commerce in India has grown by 34 per cent since 2009 and was valued at US\$16.4 billion in 2014.²⁵ On the other hand, the six largest Southeast Asian e-commerce markets (Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam) totalled US\$7 billion in 2013, and this amount is projected to grow to US\$34.5 billion by 2018.²⁶

IMPLICATIONS FOR ASIA

Key innovation and technological trends in Asia will transform sectors as varied as financial services, consumer electronics, automotive, health care, real estate, manufacturing, infrastructure, and education. They are also likely to affect the global transportation and logistics industry in four key ways.

First, Asia's digital transformation and its budding innovation ecosystem have contributed to the rising popularity of app-based transportation services, both from the demand and supply sides. On the demand side, expanding numbers of tech-savvy consumers with access to the mobile Internet have created the rationale for international transportation network companies such as Uber and Lyft to enter and expand aggressively in Asia. For example, despite controversies and protests against it, Uber is set to invest US\$1 billion in India²⁷ and another US\$1 billion in China in 2015 and to launch its services in 50 more cities in China.²⁸ Aside from offering ride-hailing services, these companies have also started offering last-mile delivery services,

including on-demand cargo delivery services²⁹ and courier services.³⁰ On the supply side, burgeoning innovation ecosystems in Asia have spurred the growth of homegrown rivals in Asia³¹ – many better suited to adapt to local consumer needs.

Second, as Asia's digital transformation enables the rapid expansion of online shopping, it is likely to require a rapid scaling of efficient warehousing and just-in-time distribution and logistics systems, as the attractiveness of e-commerce partially lies in its ability to offer quick deliveries. At the same time, the popularity of online shopping places pressure on governments to build roads, improve transportation infrastructure, and devise a more organized system for identifying specific locations, particularly in remote rural areas. In addition, the increasing demand for the delivery of goods purchased online creates opportunities for international and local companies engaged in courier and last-mile delivery services.

Third, transformations in Asia's innovation and technological scene have created immense opportunities for the application of big data analytics in the transportation sector. The collection and analysis of massive amounts of data can reveal key transportation patterns and help reduce traffic congestion by improving demand management and enhancing the reliability and efficient use of transportation infrastructure.³² The potential of these applications provides promising opportunities for countries such as Japan, Singapore, and India, which aim to become leaders in big data analytics.

Fourth, the burgeoning innovation ecosystem in Asia sets the stage for the introduction of disruptive technologies such as additive manufacturing or 3D printing, as the digital infrastructure in the region becomes better developed. Although 3D printing is not yet poised to replace traditional manufacturing, it is projected that by 2020 up to 80 per cent of all finished products worldwide will involve some

type of 3D printing. Such increased reliance on 3D printing will transform how companies manage their supply chains. As the demand for shipping and air cargo diminishes, the rationale for maintaining huge inventories becomes weaker, thus reducing requirements for warehousing. At the same time, however, increased use of 3D printing technologies will create demand for the shipping and delivery of 3D printer raw materials.³³ The increased popularity of 3D printing will require manufacturing-heavy economies such as China, India, and a number of Southeast Asian countries to rethink their growth strategies and reconsider how they are integrated into the global supply chain.³⁴

IMPLICATIONS FOR CANADA'S TRANSPORTATION SYSTEM

In order to respond to developments in Asia's innovation and technology sphere, stakeholders within the Canadian transportation system will need to become increasingly flexible to adapt to the fluctuations in demand in goods brought about by new technologies and to realize the potential opportunities for exporting Canadian transportation logistics expertise.

In terms of technology, increased e-commerce usage and the integration of additive manufacturing in Asia-bound goods could have significant implications on Canada's transportation networks.

The precipitous growth of e-commerce usage in Asia could lead to more Canadian products being bought and sold in Asia's online marketplaces. Discussions with the Vancouver Airport Authority reveal that it projects that integrators (i.e., FedEx, Purolator, UPS) will make up a majority of YVR's growth in inbound and outbound air cargo, with annual growth rates of 2 per cent and 2.3 per cent from 2014 to 2035, respectively. Competitive shipping times could make the difference in the

choice of buying Canadian goods versus those from our international competitors, especially with perishable items. Canada's transportation networks must not only be able to connect suppliers, which are often small- and medium-sized enterprises, with distributors and distributors with customers, but also do this quickly and at a reasonable price.

While at present hard to predict, additive manufacturing may also lead to changes in the volume and nature of goods being shipped between Canada and Asia. Within Canada, some groups of major manufacturing industries, such as the aero and auto industries, are more likely to be affected by 3D-printed inputs than others. Although no drastic change is foreseen, this may result in the reduced transportation of some goods, as certain Canadian inputs are replaced in the supply chain with 3D-printed ones. As new technologies such as additive manufacturing become more pervasive, there will be an increasing need for Canadian transportation systems to develop more flexibility to address fluctuating demands for shipping and cargo.

However, the integration of new technologies in transportation systems also allows Canadian transportation organizations and authorities to potentially play an important role not only in developing Asia's transportation systems, but also in building the profile of Canada as a leader in transportation logistics. For example, the increasing salience of big data analytics presents Canada with the opportunity to explore transportation data sharing agreements with Asian leaders. At the same time, a shortage in human resources qualified to conduct big data analytics while possessing knowledge in transportation systems means that Canadian expertise can help fill this talent gap.

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SECURITY

WHAT ARE THE TRENDS?

As we look to the next decade and a half, the Asia Pacific region is likely to face a number of security challenges. Territorial disputes, piracy, terrorism, the trafficking of people and goods, and cyber attacks have the potential to have a particularly crippling impact on the transportation of goods and people between Asia and Canada.

Territorial Disputes

Several territorial/border demarcation disputes remain unresolved in the Asia Pacific, and the majority of them lie along or near shipping routes. These include the divide between North and South Korea and the relations across the Taiwan Strait (see figure on page 55). Not all disputes are equally volatile, but they do deserve consideration when

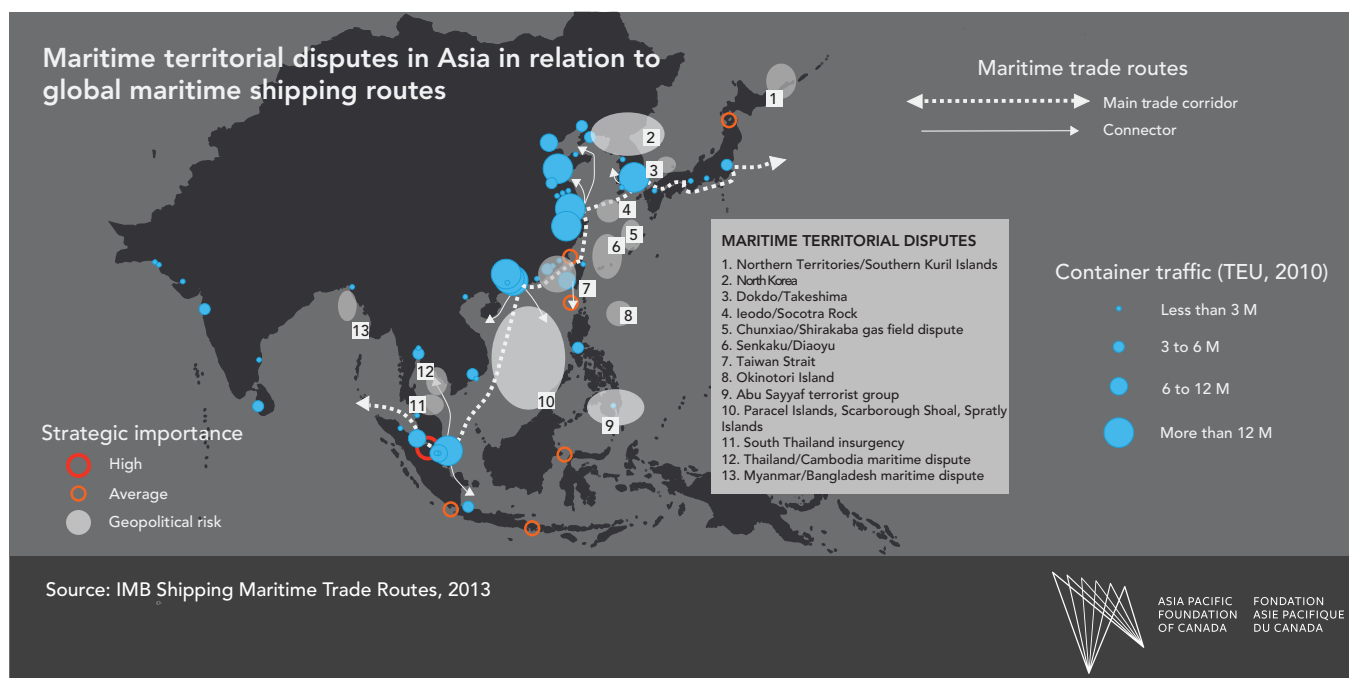
planning to maintain a secure transportation supply chain. The risks involved in the territorial conflicts include a destabilization of the sea lines of communication and challenges to the status quo, especially with regard to maritime law and freedom of navigation. The challenges thus far have mostly arisen in the South China Sea, with reclamation of land being the biggest driver of conflict. This has served to create some destabilization in the region and has led to fears of an arms race, although China is the only country capable of challenging the naval dominance of the U.S. If tensions increase, pressure may mount on Canada to play a part. This pressure will raise complex issues regarding the ability of Canada's naval forces to maintain the status quo and protect shipping.

Piracy

Maritime piracy continues to be a major threat to transportation sector security. Piracy is on the rise in Asia, with the International Maritime Bureau (IMB) reporting that a coastal oil tanker is hijacked every two weeks in Southeast Asian waters. Many of the reported incidences are of small-scale piracy and not on the same level of violence seen in attacks off the East African coast in years past. However, of the 134 reported attacks through the first six months of 2015, 92 were in East or Southeast Asia, and 15 were in the Indian sub-continent.¹ With the number of attacks reported in the first half of 2015, incidences of piracy are on an upward trend (see figure on page 60). Insurers tend to view these attacks negatively, while security analysts consider the consequences of piracy and armed robbery as negligible.

Terrorism

Maritime terrorism is an ongoing contingent risk for the seaborne trade in Southeast Asia, although with a much lower incidence than in the Middle East. While the possibility of terrorist attacks should remain part of any security analysis, the reality of terrorism in Asia is that terrorist groups are increasingly more splintered and less powerful. Abu Sayyaf in the Philippines is perhaps the most powerful terrorist organization in Asia, along with Jemaah Islamiyah in Indonesia. However, neither of these groups has been responsible for any maritime terrorism in the past 10 years, and both groups have been reduced to low-impact activities such as kidnapping. The last incident (also the most serious terrorist attack at sea to date) occurred in 2004, when a bomb exploded on Superferry 14 off the coast of Manila, causing it to sink and killing 116 people. While the number of terrorist attacks



Trends in incidences of piracy, 2007–2014

Location	2007	2008	2009	2010	2011	2012	2013	2014	Total
Cambodia/Vietnam	5	11	9	12	8	4	9	7	65
Indonesia	43	28	15	40	46	81	106	100	459
Strait of Malacca	7	2	2	2	1	2	1	1	18
Malaysia	9	10	16	18	16	12	9	1	91
Philippines	6	7	1	5	5	3	3	6	36
Singapore Strait	3	6	9	3	11	6	9	8	55
Thailand	2	0	1	2	0	0	0	2	7
Myanmar	0	1	1	0	1	0	0	0	3
South China Sea	3	0	13	31	13	2	4	1	67
China	0	0	1	1	2	1	0	0	5
Bangladesh	15	12	18	23	10	11	12	21	122
India	11	10	12	5	6	8	14	13	79
Total	104	87	98	142	119	130	167	160	1007

Source: Bateman, Sam. “The Future Maritime Security Environment in Asia: A Risk Assessment Approach” *Contemporary Southeast Asia*, Vol. 37, No. 1 (2015), pp. 49–84

remains low at present, the return of soldiers from the current fighting in the Middle East (2015) creates the possibility of an upward trend in terrorist violence against shipping or energy infrastructure.

Trafficking

There are four main categories for trafficking in Asia: 1) human trafficking and smuggling of migrants; 2) illicit drugs (heroin and methamphetamine); 3) resources (wildlife, wood products) and pollution crime (e-waste, ozone-depleting substances); and 4) products (counterfeit goods, fraudulent medicines). The sea remains the primary mode of transportation for the illegal movement of goods. Combating the movement of illicit goods and smuggling requires the resources of all nations involved, as well as robust international cooperation. However, the overall effect of human trafficking and smuggling on maritime shipping is negligible. A 2015 report from the United Nations indicates that most illegal transportation of people stays within Asia. As Asia undergoes deeper regional integration, for example through the ASEAN Economic Community 2015

and the Greater Mekong Subregion Transport Master Plan, border controls are being eased and transportation corridors expanded to facilitate an increase in cross-border movements of different kinds. While this offers benefits for trade and economic development in the region, without adequate safeguards in place to regulate movements, the process may provide criminal groups with new opportunities.

Cyber Security

The shipping and transportation industries have become increasingly reliant on information technology (IT) for loading and unloading containers, safe navigation, communications, cargo tracking, and radar and identification systems. Security researchers have identified serious holes in three key technologies used for navigation: global positioning system (GPS), marine Automatic Identification System (AIS),² and the Electronic Chart Display and Information System (ECDIS).³ In addition, with port and vessel network systems implementing new technology, stakeholders are

moving away from traditional standalone systems, and maritime industrial control systems are becoming more integrated. While new systems help streamline and increase the flow of trade, the number of vulnerabilities in network systems is also increasing.

While only a few severe cyber attacks have been identified in the maritime shipping sector, this is likely to be an underrepresentation of the actual number of attacks for a variety of reasons: disclosure of attacks can reveal possible attack vectors, as well as how companies attempt to mitigate those threats; private companies currently have little incentive to disclose known breaches; and many cyber attacks simply go unnoticed. However, the IMB has called for vigilance and said that cyber criminals are increasingly targeting carriers, terminals, ports, and transportation operators.

IMPLICATIONS FOR ASIA

The five security challenges described above are likely to have uneven regional and local implications. In the event of a military flare-up in the Asia Pacific region – most likely around one of the above-mentioned territorial disputes – key ports or transportation links could become unstable and disrupt safe passage, timely shipping, and/or traffic volume. China's actions in the South China Sea may have the biggest impact on shipping, as they challenge the notions of free transit as outlined by the United Nations Convention on the Law of the Sea. Delays in shipping increase overall costs for goods and services providers, shipping companies, insurers, and ultimately consumers.

While there have been a number of piracy attacks in Asia in recent years, measures taken by regional countries against piracy and sea robbery, both at sea and onshore, have been relatively effective. Indeed, the number of attacks has decreased in both scale

and severity compared to the peak years of piracy in Southeast Asia a decade ago, when the Strait of Malacca was designated as a “war risk” for marine insurers by Lloyd's Market Association.

Terrorism and trafficking represent the lowest level of risk to shipping and the transportation of goods in Asia. While trafficking does create opportunities for corruption among regional customs officials, the consequences of trafficking and smuggling at sea in terms of lost revenues or thwarting trade are negligible. However, in the longer term, there are possibilities that ongoing poverty, lack of economic opportunity, and the effects of climate change could lead to illegal people movement becoming more serious.

Terrorism has the possibility to create regional instability, but cooperation and communication among governments can mitigate that risk to some extent. An immediate concern is that an attack or threat of attack on port architecture could lead to a major regional waterway being closed. This would of course lead to delays along the supply chain.

The potential consequences of a cyber breach are numerous and far reaching. Criminals could disable or take control of parts of the supply chain including port operations, a ship's safe navigation, communication, cargo tracking, and radar and identifications systems. Further, if control systems are slow to update security patches, they become increasingly vulnerable to security breaches. Due to a ripple effect in the economy, one cyber breach could have immense implications. Canada can support developing nations in Asia by developing capacity building programs to enhance cyber security.

IMPLICATIONS FOR CANADA'S TRANSPORTATION SYSTEM

Of the threats described above, international territorial disputes and trafficking of people are likely to have the least direct impact on Canada's transportation system. Disputes may disrupt transportation routes briefly, but shipping will be rerouted to avoid these disputes. While Canada does have its share of trafficked people entering the country, the numbers are reduced due to the distances involved. The incidents of illegal migration by sea from Asia have been clustered in one year (2010) and overall numbers are minuscule compared to illegal migration in Australia and Europe. Regardless, Canada's best strategy in approaching this issue is to continue to work with its allies and international partners in Asia to create standardized customs procedures and training of customs officials. There is no piracy off either coast of Canada.

Of greater importance is the impact of possible terrorism either domestically or in the U.S., and cyber attacks. A terrorist attack would have serious implications on the cross-border flow of goods and people, and requires clear and consistent communication with the relevant agencies in the United States to mitigate the issue. Cyber attacks on the industrial transportation sector have only recently come to the attention of policymakers and stakeholders in the transportation sector. As a result, both public and private organizations are still catching up in this area.

While maritime shipping accounts for approximately 90 per cent of global trade, road continues to be the dominant mode for transporting goods within North America. Another terrorist attack against the U.S. could increase wait times in Canadian ports if the U.S. further tightens security checks on shipments and containers before entering U.S. waters or if the U.S. requests that goods be offloaded in Canada before shipping via land or air to the U.S.

For example, after 9/11, the emphasis on physical security has meant increased costs for crossing the Canada-U.S. border by land. Delays at the border and other border compliance costs add to the fixed costs per shipment incurred by trucking firms. These fixed costs include facilities costs, insurance costs, and terminal costs associated with loading and unloading.⁴ Increased security measures in the wake of another terrorist attack would mean that Canada would need to work closely with U.S. authorities to plan for rerouting of transportation to and through Canada or vice versa. In short, physical security issues could decrease access to particular areas or ports while increasing traffic through others, and increase risk along shipping lanes.

As technologies evolve and become more complex, so too do the challenges of detecting and protecting against cyber attacks. The increasingly interconnected nature of Canada's transportation system via networked devices poses a significant risk to maintaining a secure environment. The three critical components of shipboard navigational systems – GPS, AIS, and ECDIS – and the industrial control systems onshore are targets of increasing vulnerability in the case of the shipboard navigational systems and increasing significance in the case of the industrial control systems. Cyber security is a global domain that requires a high degree of cooperation with Canada's allies and partners, as well as communication among multiple non-government stakeholders.

Given the dominance of container shipping for trade, cyber attacks could prove disastrous for the Canadian economy. Examples of attacks that shut down or altered systems include the case of the South Korean oil rig that was shut down for 19 days in 2010 (at an estimated cost of US\$700,000 per day), and the successful 2011 cyber attack on

Iranian shipping line IRISL, which damaged all the shipping company's data related to rates, loading, cargo numbers, dates, and places so that no one knew where containers were, whether they had been loaded or not, or which boxes were onboard the ships or onshore. In the event of criminals breaching a port's GPS tracking system, as happened at a port in the U.S. in 2014, the operation of cranes for loading and moving containers becomes a manual process, which is considerably more time consuming and leaves the port open to criminal practices such as fraud and smuggling. An IMB report from 2014 on cyber security breaches stated that in instances discovered to date, there has been an apparent focus on specific individual containers in attempts to track the units through the supply chain to the destination port. Such systematic tracking is coupled with compromising the terminal's IT systems to gain access to, or generate release codes for, specific containers.⁵ This is exactly what happened at the Port of Antwerp from 2011 to 2013.⁶

Canada is underprepared to mitigate cyber security breaches in its shipping industry. The "Marine Transportation" chapter of the *Transportation in Canada 2011 – Comprehensive Review* mentions the word "security" 99 times. The term "cyber" appears not once. The *Marine Transportation Security Act*, which is current to July 9, 2015, has no mention of cyber security. Of the 19 reports submitted to the Review by transportation organizations, not one mentions the word cyber. There are no cyber security standards for port facilities in Canada. Canada's *Cyber Security Strategy* is the government's plan for meeting the cyber threat, yet has only vague assertions for taking steps to strengthen Canada's cyber resiliency for critical infrastructure. Canadian National and Canadian Pacific Railway both use Siemens control systems of the same variety that operated Iran's nuclear facilities, which were taken down by the Stuxnet virus in 2010. Vulnerability to cyber attack and subsequent damage to the Canadian economy may increase with increased

integration of industrial control systems and other networked infrastructure.

A 2013 Brookings Report asserts that the consequences of a cyber attack that disrupted port activity would be similar in effect to the 2012 labour strikes that shut down Los Angeles-Long Beach ports. Those strikes resulted in an economic impact of US\$1 billion per day in lost wages, lost business revenue, and the value of cargo that had to be diverted to other ports.⁷ Another report done by the National Association of Manufacturers analyzed the cost of a West Coast port shutdown at US\$1.9 billion per day for the first five days of the shutdown, and upward of US\$2.5 billion per day if the shutdown extended to 20 days.⁸ In the event of a major cyber breach, the zero-inventory just-in-time delivery system that sustains the flow of Canadian commerce would grind to a halt in a matter of days; shelves at grocery stores and gas tanks at service stations could run empty.

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CONCLUDING RECOMMENDATIONS

As our analysis suggests, looking toward 2030, the Asia Pacific region will be an engine of global growth and dynamism. This report has identified a series of major trends that are shaping the future trajectory of the region and are likely to affect not only Canada's trade and investment relationship, but more importantly, given the mandate of the *Canada Transportation Act* Review, will give rise to demands on Canada's national transportation system. Although this is outside the scope of original work agreed on with the *Canada Transportation Act* Review Secretariat, APF Canada would like to offer the Review a few key recommendations that emerged from our analysis. They are meant as a supplement to the rich recommendations provided by stakeholders to the Review, a number of which were shared with APF Canada. We have focused on issues that we think are germane to an analysis of future trends in the Asia Pacific region, and have organized our recommendations according to several core elements of the Review's mandate. Some of the proposed measures fall within Transport Canada's immediate jurisdiction, while others may require other departments and agencies to play the lead role.

Adjusting current transportation legislative and policy frameworks to support our trade competitiveness in Asia, a region of growing importance to our nation's economic health

Supporting Canada's trade competitiveness in Asia requires engagement with stakeholders from across transportation entities and future planning of both policies that boost our trade flows and strategies that anticipate changes required for our transportation systems. We recommend:

- The Federal Government should consider convening a national transportation forum every two to three years. This forum would provide a platform for all levels of government and key private sector players to address emerging issues affecting Canada's national transportation, and to assist with nationwide coordination and collaboration. A regular forum where stakeholders could easily identify intersecting interests and work together to solve shared problems could help everyone's bottom line.

- Transport Canada should lead the development of a national transportation strategy that can be reviewed and updated every five years. Such an exercise, which transport ministries and departments in a number of other countries have undertaken, is a useful tool for defining and implementing government priorities, aligning the actions of various stakeholders, and ensuring that legislative and policy frameworks are updated and are interoperable. Existing processes like the *Transportation Act* Review or the Council of the Federation Review of Transportation, while extremely valuable in providing key input into a strategy, are not substitutes for an institutionalized, comprehensive, federally led planning process.
- Innovation, Science and Economic Development Canada in collaboration with Canada Border Service Agency, Transport Canada, and other relevant federal and provincial departments and agencies should conduct a cost-benefit study of the feasibility of establishing free trade zones in key Canadian ports. While this is outside Transport Canada's immediate jurisdiction, it was an idea raised by some of the stakeholders we consulted. If the Trans-Pacific Partnership and/or a number of other multilateral free trade agreements come into force, the benefit-to-cost ratio with regards to the collection of customs duties is further diminished – possibly to the point where it makes sense for Canada to consider either creating a number of well designed free trade zones or eliminating import tariffs completely.

Further developing Asia Pacific gateways and corridors

Further gateway and corridor developments must be made to transform Canada into a true gateway economy, one that does not simply deal with throughput, but also includes the services to support the activities related to the flows of goods and people. The benefits of such a policy would be far reaching and would extend to all provinces and territories. We recommend:

- The Federal Government should develop a new Canada-Asia gateway strategy that expands beyond the Asia-Pacific Gateway and Corridor Initiative to include transportation networks from coast to coast to coast so as to reflect a true gateway economy. Canada is geographically and culturally well-placed to serve as a true gateway economy due to its strengths in logistics and our long history welcoming Asian business. Based on recent trends, we can reasonably expect a strong increase in cargo originating from Asia, and as a nation we need to anticipate this growth in order to boost Canada's competitiveness.

- The Federal Government should appoint a Gateway Minister who would lead a separate department dedicated to identifying key challenges, expanding the scope of the gateway, and directly engaging with relevant private sector entities. A dedicated department can focus on the users and suppliers of the North American supply chain and target specific needs through the gateway. Furthermore, this will enable better project coordination between private stakeholders and various governmental bodies such as Transport Canada, Global Affairs Canada, the Canadian Border Services Agency, and the Canadian Air Transport Security Authority.

Optimizing the quality and use of transportation infrastructure capacity through, for example, improved alignment of transportation policies and regulations and/or the use of innovative financing mechanisms

- Transport Canada should lead and house a common, publicly available resource for shipping statistics. Such a resource would be of value to Canada's ports, railroads, trucking industries, and provinces so that they may better understand and facilitate the shipment of goods in Canada. It is our understanding that until 2011, Statistics Canada collected data on the volume (in TEUs) of containerized cargo flowing through Canada's ports; however, that in recent years data collection has been circumscribed or even stopped. A number of stakeholders we interviewed stressed the need and value of this data being collected and publicly shared, along with information about the commodity being carried and the country, province, city, or port of origin and destination.

Accommodating and leveraging the increasing flow of travellers between Asia and Canada

The number of travellers between Asia and Canada is expected to increase in the coming decades, partly due to the growing size of the middle class in Asia and partly due to increased immigration between Asia and Canada. In order to fulfill the needs of this increased traffic, we recommend:

- Transport Canada should work with Global Affairs Canada to negotiate more liberalized air transportation and service agreements, preferably open skies agreements with key Asia Pacific markets, especially with ASEAN (with whom we have very few agreements).

- Transport Canada should work with the Canadian Border Services Agency and Immigration, Refugees and Citizenship Canada to increase the scope of the Transit Without Visa Program, which currently includes Indonesia, Thailand, Taiwan, and the Philippines, as well as some Chinese cities.

Making the relevant Canadian transportation and logistics workforce more Asia competent

- Transport Canada should create a co-op program for undergraduate students to get hands-on experience with the Asia-Pacific Gateway and Corridor Initiative. If these students can complete their co-op placements before they graduate, they will still be able to take additional coursework to help fill any competency gaps related to Asia (language skills, knowledge of Asian markets, etc.).
- Transport Canada should collaborate with academic programs, such as the Operations and Logistics Division of the Sauder School of Business (University of British Columbia), to develop business cases and other types of learning modules based on current or possible future situations and challenges Transport Canada faces in its Asia-related operations. The process of developing these materials will also help to build the relevant expertise of Canadian faculty members.

Addressing emerging environmental and security threats to ensure Canada's safe and sustainable transportation

- Transport Canada should lead the development of a nation-wide transportation disaster preparedness strategy that addresses, among other risks, natural disasters and the melting of permafrost. This would include working with transportation hubs and nodes to ensure they have up-to-date emergency plans and, if necessary, memoranda of understanding in place to divert cargo regionally and nationally in the event of a disaster. For example, planning for diversion from the West Coast to the Atlantic would ensure goods stay in Canada instead of being diverted through the U.S. and would prevent long sitting times.
- Transport Canada should work with key stakeholders to ensure that environment and community impact assessments of transportation infrastructure expansion and upgrades take into account not only current conditions, but also incorporate future projections of environmental changes likely to occur due to climate change.

- Transport Canada, in coordination with national and international partners as well as domestic stakeholders, should take immediate action to improve and enhance the cyber security of critical infrastructure in the transportation sector. Priority actions include:
 - o Developing risk-assessment protocols that include cyber-related threats, vulnerabilities, and related consequences;
 - o Using the results of the risk assessment to ensure that other transportation-related security planning integrates cyber-related risk into an overall framework;
 - o Developing cyber-security protocols to address inherent vulnerabilities in three critical navigation technologies (GPS, AIS, and ECDIS);
 - o Updating best practices for industrial control system cyber security to reflect current knowledge of threat assessment; and
 - o Mandating standardized IT accreditation and reporting procedures for incidents of cyber crime.



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