Innovation, Trade, and Technology Policies in Asia-Pacific Economies: A Scorecard

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About the Authors

The authors of this report are Dr. Robert D. Atkinson, President, Information Technology and Innovation Foundation (ITIF) in the United States; Stephen J. Ezell, Senior Analyst, ITIF; Scott M. Andes, Research Analyst, ITIF; Luke A. Stewart, Research Analyst, ITIF; Dr. Suk-Gwon Chang, Professor, Business School, Hanyang University in South Korea; and Dr. Atsushi Sunami, Associate Professor, GRIPS Innovation, Science and Technology Policy Project, National Graduate Institute for Policy Studies in Japan. The authors thank John Zoshak, ITIF Analyst, for his contributions. This report was prepared for Asia-Pacific Economic Cooperation on behalf of the APEC Technical Assistance and Training Facility (TATF). APEC TATF is managed by USAID with funding and strategic direction from the U.S. State Department Bureau of East Asian and Pacific Affairs, Office of Economic Policy. For further information, contact Victoria Waite, Chief of Party of APEC TATF at vwaite@nathaninc.com.

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Executive Summary

The global economy—and trade among its members—is evolving rapidly. Many economies are seeking to drive economic growth through innovation, including boosting the use of information and communications technologies among all organizations, helping companies become more productive and innovative, and enabling the creation of new companies producing high-value-added products and services. Driving this shift has been the realization by a growing number of economists that it is innovation—the improvement or creation of products, processes, services, and business or organizational models—more than the accumulation of savings or capital that has become the central driver of economic growth and the key to improving standards of living.

Yet the growing awareness of innovation's key role in national economic well-being and competitiveness has spawned a race for global innovation advantage. As economies seek to realize the highest levels of innovation-based economic growth, they will need to design their policies with regard to trade, technology, competition, intellectual property rights, procurement, and even taxes and education in optimal ways to bolster their innovation capacity. But as innovation becomes the focal point of economic growth, economies will also have to implement their innovation-supporting policies in a manner that does not distort global trade. Accordingly, the rules governing the international trading system will also have to evolve, so that trade in innovative products and services is as unrestricted as trade in manufactured goods. This will require maintaining a focus on removing quantifiable trade barriers, such as tariffs, but complementing that approach by vigilantly removing non-tariff and technical barriers to trade while eschewing the erection of new barriers.

The reality is that trade policy and innovation policy have come together to the point where now they are intimately intertwined: it's impossible to make trade policy without an understanding of innovation policy, and it's likewise impossible to craft innovation policy without an understanding of trade policy. Fundamentally, this is because innovation—both its production and consumption—has become globalized, for three reasons.

First, a non-globalized innovation system is a sub-optimal one. Open markets lead to an increase in the size of the marketplace and allow innovative firms to realize economies of scale, thus enabling them to reinvest earnings into the next generation of innovative products, engendering a virtuous cycle of innovation. This is especially important for industries with relatively high fixed costs but low marginal costs of production (such as semiconductors, software, video games, movies and music, pharmaceuticals, biotechnological products, etc.) since larger markets can be served with overall declining average costs. Second, by exposing domestic firms to globalized competition, trade acts as a strong driver of innovation and productivity growth. Indeed, exposure to international markets has been shown to have a strong positive effect on both enterprises' incentives—and ability—to innovate. Finally, there is a learning effect from innovation. The more that innovative businesses and individuals in all economies are exposed to the new challenges, opportunities, ideas, technologies, and capabilities that exist in foreign markets, the more those innovators can develop innovative solutions in response. The world is rich in problems, yet if

organizations are innovative only in their own markets, their knowledge base and exposure to problem sets is incomplete.

In summary, APEC economies possess a unique opportunity to move beyond facilitating trade in existing products and services to fostering the world's leading regional environment in which both the production—and ensuing trade and usage—of innovative new products and services is maximized, thereby driving economic growth and improving the quality of life for citizens not just in APEC economies, but worldwide. To make this a reality, APEC members will need to foster open economies that allow the free flow of capital, people, ideas, goods, and services across borders in ways that promote competition. However, to realize this vision, member economies will have to not only rethink their approach to trade and investment, but also embrace critical core innovation principles. Indeed, economies are unlikely to achieve sustainably high rates of innovation if their governments have not put in place a broad range of innovation-enabling policies that create the conditions in which organizations throughout an economy—whether private enterprises, government agencies, or non-profit entities—can successfully innovate.

To help them do so, this report provides a structured assessment of policies informing the innovation capacity of the 21 APEC member economies. Moreover, it highlights the most effective policies APEC members have used to build their innovation capacity and describes how APEC members can learn from one another.

The report assesses APEC member economies on their strength in six core policy areas:

1. Open and non-discriminatory trade, market access, foreign direct investment, and standards policies;
2. Science and research and development (R&D) policies that spur innovation;
3. Digital policies that enable robust deployment of information and communications technology (ICT) platforms that support a broad range of digital applications;
4. Intellectual property rights (IPR) protection policies;
5. Robustness of domestic competition and new firm entry;
6. Open and transparent government procurement policies.

In preparing this report, we searched extensively to identify as many indicators relevant to the six core innovation policy areas as possible. The report includes every indicator relevant to an economy's innovation policy that we were able to identify, provided that sufficient data existed for the indicator to provide coverage across all (or almost all) APEC economies. This study assigns weights to the six core innovation policy areas—and then to the sub-indicators which comprise each innovation policy area—based upon an extensive review of the scholarly literature on innovation policy and our own judgment and expertise in the field.

Overall, the six core innovation policy areas receive fairly balanced weights in the study, as Table ES-1 shows. For economies to create an environment in which innovative organizations and innovation in general flourishes, it's vital that they craft innovation- and competition-promoting policies with regard to market access, foreign direct investment, and standards; science and R&D; digital/ICT; and intellectual

property rights, and so economies' scores on each of these four policy areas accounts for 17.5 percent of their overall score. An economy's openness to trade—characterized by open market access, receptivity to foreign direct investment, and participation in collaborative, international standards-setting processes—has become an increasingly important bedrock pillar of its innovation capacity. Likewise, economies' science and R&D policies—such as levels of government and corporate R&D investment and higher-education R&D performance—are crucial to the development, diffusion, and adoption of new technologies that substantially drive innovation. For its part, ICT has become a central driver of innovative new services and business models, productivity improvements, and economic growth for developed and developing economies alike. And economies that fail to provide and enforce intellectual property rights stifle innovation by failing to provide adequate incentives and protections to innovators while discouraging the inflow of foreign technology and investment. Economies' policies that promote domestic competition and entrepreneurship as well as government procurement which fosters innovation are also important, and so economies' scores on each of these two core innovation policy areas account for 15 percent of their overall scores.

The intent of this study is to provide a generalized sense to APEC economies of how well they are doing relative to their peers on these six core innovation policy areas, so that they can identify their strengths, weaknesses, and opportunities for improvement in innovation policy. As this is an overall framing and assessment report, it does not report economies' individualized scores; rather APEC economies are ranked as upper-tier, mid-tier, or lower-tier on each of the six core innovation policy areas, with those ranks calculated based on economies' performance on an array of key sub-indicators relevant to each core policy area. (In total, the study assesses 73 sub-indicators.) The tiered rankings of economy performance in each of the six core innovation policy areas were constructed using equidistant partitions of the set of weighted aggregate scores derived from each economy's normalized sub-indicator scores.[1] Economies' ranks on the six weighted core innovation policy areas are then aggregated to produce an overall ranking reflecting the strength of their innovation policy capacity, as shown in Table ES-2.

Table ES-1: Weights of Core Innovation Policy Areas in Overall Scoring Methodology

Core Innovation Policy Area	Share of Overall Weight
Tariffs, Market Access, Foreign Direct Investment, and Standards	.175
Science and R&D	.175
Digital/Information and Communications Technology	.175
Intellectual Property Rights	.175
Domestic Market Competition	.150
Government Procurement	.150

The study finds Australia, Canada, Chinese Taipei, Hong Kong, Japan, New Zealand, Singapore, and the United States to have the most robust innovation policy capacities in the Asia-Pacific region. Chile, Korea, and Malaysia are in the mid-tier, and Brunei, China, Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam are in the lower-tier. Table ES-3 shows where each APEC economy stands with regard to each of the six core innovation policy areas.

Table ES-2: Rank of APEC Economies on Innovation Policy Capacity (in alphabetical order)

Tier	APEC Economy
Upper-Tier	Australia Canada Chinese Taipei Hong Kong Japan New Zealand Singapore United States

Tier	APEC Economy
Mid-Tier	Chile Korea Malaysia

Tier	APEC Economy
Lower-Tier	Brunei China Indonesia Mexico Papua New Guinea Peru Philippines Russia Thailand Vietnam

Table ES-3. APEC Economies' Rank on Each Core Policy Area (by tiers; in alphabetical order)

	Aggregate	Trade	Science/R&D	ICT	Intellectual Property	Domestic Competition	Government Procurement
Australia	Upper	Upper	Upper	Upper	Upper	Upper	Mid
Brunei	Lower	Mid	Lower	Lower	Mid	Mid	Lower
Canada	Upper	Mid	Upper	Upper	Upper	Upper	Upper
Chile	Mid	Upper	Mid	Mid	Mid	Mid	Mid
China	Lower	Lower	Mid	Mid	Lower	Mid	Lower
Chinese Taipei	Upper	Mid	Upper	Upper	Mid	Upper	Upper
Hong Kong	Upper	Upper	Mid	Upper	Upper	Upper	Upper
Indonesia	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Japan	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Korea	Mid	Lower	Upper	Upper	Upper	Mid	Upper
Malaysia	Mid	Lower	Mid	Mid	Mid	Mid	Lower
Mexico	Lower	Lower	Lower	Lower	Mid	Lower	Lower
New Zealand	Upper	Upper	Mid	Upper	Upper	Upper	Mid
Papua New Guinea	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Peru	Lower	Mid	Lower	Mid	Lower	Lower	Lower
Philippines	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Russia	Lower	Lower	Mid	Lower	Lower	Lower	Lower
Singapore	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Thailand	Lower	Lower	Mid	Lower	Lower	Mid	Lower
United States	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Vietnam	Lower	Lower	Mid	Lower	Lower	Mid	Lower

Trade: As innovation and trade policy have become increasingly intertwined, openness to trade characterized by open market access and receptivity to foreign direct investment (FDI) has become an increasingly important bedrock pillar of an economy's innovation capacity. Free trade benefits all economies by allowing each to specialize in producing the products or services for which it has comparative and/or competitive advantage. This also suggests that economies shouldn't specialize in all technologies; rather, trade enables them to specialize in what they are good at and trade for the rest. A vital component of free trade is economies' openness to both inward and outward foreign direct investment. Research shows that FDI contributes significantly to regional innovation capacity and economic growth, in part through the transfer of technology and managerial know-how. In fact, a study comparing East Asian with Latin American economies found that the larger trade and foreign direct investment flows demonstrated by East Asian economies explained their relatively stronger technological growth than that of the Latin American economies. Another important component of economies' trade policies is their use of voluntary, market-led, and global standards that promote innovation and competition while creating global markets for products and services.

This study assesses eight measures of APEC economies' trade, market access, and foreign direct investment policies, assessing indicators such as their average tariff levels, tariffs on advanced technology products, degree of restrictions on services trade, participation in regional trade agreements, openness to FDI, and use of standards policies. It finds that Australia, Chile, Hong Kong, Japan, New Zealand, Singapore, and the United States exhibit the greatest openness to trade, market access, and foreign direct investment among APEC economies. Brunei, Canada, Chinese Taipei, Indonesia, Papua New Guinea, Peru, and the Philippines are mid-tier economies, while China, Korea, Malaysia, Mexico, Russia, Thailand, and Vietnam are lower-tier economies.

Science and R&D: Science and R&D policies—including those regarding R&D tax incentives, government R&D expenditures, and university ownership of intellectual property—boost economies' innovation potential while enhancing their ability to benefit from technology-based innovation. But science and R&D policies, such as the ability to partake in R&D tax incentives or receive R&D grants, should not discriminate against foreign firms operating domestically, for economies that do so limit their own ability to reap benefits from the sharing of ideas, knowledge, and skills that enhance the entire global innovation system. Moreover, leader economies' science and R&D policies ensure that the terms and conditions of technology transfer, production processes, and proprietary information are voluntary and left to agreement between individual enterprises.

An analysis of five sub-indicators in science and R&D policy finds Australia, Canada, Chinese Taipei, Japan, Korea, Singapore, and the United States to be leaders. They are followed by Chile, China, Hong Kong, Malaysia, New Zealand, Russia, Thailand, and Vietnam in the mid-tier and Brunei, Indonesia, Mexico, Papua New Guinea, Peru, and the Philippines in the lower-tier. This study finds a slight difference in emphasis between the science and R&D policies of developed and developing economies. Science and R&D policies in developed economies often focus on increasing the supply of ideas and knowledge in the economy and incentivizing their commercialization, whereas in less developed economies they often involve helping a nation's organizations (private, public, and non-profit) adopt

newer and better technologies than those that are currently in use. Nevertheless, science and R&D policies in all APEC economies need to embrace elements from both approaches.

Digital Policies: Information and communications technology (ICT) is the global economy's strongest enabler of productivity and innovation. Effective digital policies focus first and foremost on spurring the use of ICT throughout the economy, as the vast majority of benefits from ICT, as much as 80 percent, come from the widespread usage of ICT, while only about 20 percent of the benefits comes from its production. Leading economies recognize that the greatest opportunity to improve their economic growth lies in increasing the productivity of their domestic sectors, particularly through the application of ICT.

This report assesses 34 sub-indicators to evaluate APEC economies' digital policies. Australia, Canada, Chinese Taipei, Hong Kong, Japan, Korea, New Zealand, Singapore, and the United States possess the digital policies which contribute most strongly to their economies' innovation capacity. Chile, China, Malaysia, and Peru represent mid-tier economies, while Brunei, Indonesia, Mexico, Papua New Guinea, the Philippines, Russia, Thailand, and Vietnam are in the lower-tier. Economies with the best digital policies, including policies relating to data privacy, security, and telecommunications, implement them in ways that minimize their trade-distorting and investment-limiting impact while promoting greater global alignment of ICT policies. Leader economies have also embraced membership in the World Trade Organizations (WTO's) Information Technology Agreement, which has substantially eliminated barriers to trade in ICT products.

IPR: Effective protection and enforcement of IPR encourages innovators to invest in research, development, and commercialization of technologies while promoting their dissemination throughout the Asia-Pacific region. But weak intellectual property rights protections reduce the flow of foreign direct investment and technology transfer. Without adequate intellectual property protections, there will be less innovation overall, and this hurts all economies. Moreover, as the World Bank finds, IPR reform tends to deliver positive economic results, regardless of an economy's level of development.

This report assesses five sub-indicators to evaluate economies' IPR protection policies. These indicators show that Australia, Canada, Hong Kong, Japan, Korea, New Zealand, Singapore, and the United States have implemented the strongest intellectual property protections among APEC economies. Brunei, Chile, Chinese Taipei, Malaysia, and Mexico are mid-tier economies with regard to intellectual property rights protections, while China, Indonesia, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam are lower-tier economies that have the most room to strengthen intellectual property protections.

Domestic Competition: Vibrant domestic markets supported by a sound and fair regulatory environment that allows both existing and new firms to compete on a level playing field remain a lynchpin of prosperity. Indeed, one of the strongest drivers of innovation and productivity growth is the existence of competitive marketplaces. This includes removing regulatory restrictions, incumbent protections, cross-border trade restrictions, and labor market restrictions that inhibit competition. Leading APEC economies feature regulatory systems that are transparent and non-discriminatory, provide due process, and include opportunities for meaningful engagement on the part of all stakeholders.

This study assesses eighteen indicators of APEC economies' degree of openness to domestic market competition, organized into three categories: the regulatory environment, the competitive environment,

and the entrepreneurial environment. On these measures, Australia, Canada, Chinese Taipei, Hong Kong, Japan, New Zealand, Singapore, and the United States exemplify the greatest degree of openness to domestic market competition among the APEC economies. Brunei, Chile, China, Korea, Malaysia, Thailand, and Vietnam are mid-tier economies, while Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, and Russia are lower-tier economies in this category.

Government Procurement: Because government procurement accounts for such a large share of most economies, ensuring fair and open government procurement practices has become a vital aspect of realizing liberalized global trade. A core principal of market-based trade is that government purchases should be made on the basis of the best value for government, not on the basis of national preferences. Yet this does not mean that APEC economies should not orient their procurement policies to become strong drivers of innovation. Indeed, government procurement policy is an important and legitimate component of economies' innovation strategies. However, APEC members' government procurement policies should be transparent, non-discriminatory, openly competitive, and performance-based. In particular, APEC members should not make the location of the development or ownership of intellectual property a consideration when awarding government procurement contracts. Further, APEC members should not impose requirements on foreign firms that they must license their intellectual property to a domestic entity either in order to receive permission or access to compete in local markets or to participate in foreign government procurement contracting activity.

An assessment of four key government procurement policy indicators reveals that Canada, Chinese Taipei, Hong Kong, Japan, Korea, Singapore, and the United States have implemented government procurement policies that contribute most strongly to their economies' innovation capacity. Uniformly, leader economies are full members of the WTO's Government Procurement Agreement (GPA). Australia, Chile, and New Zealand are mid-tier economies with respect to government procurement, while Brunei, China, Indonesia, Malaysia, Mexico, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam are lower-tier economies.

Conclusion: The Asia-Pacific region has the capacity to be the world's most innovative. To realize this vision, APEC economies need to implement policies with regard to trade, science and R&D, ICT, intellectual property rights, domestic market competition, and government procurement in ways that maximize their innovation capacity but without distorting global trade. To accomplish this, APEC economies' policies will have to be predicated on transparent, non-discriminatory, market-based principles that embrace both global standards and the free flow of talent, capital, information, products, services, and technologies. Moreover, APEC economies' innovation policies need to accord respect for innovators' intellectual property rights while creating incentives for them to keep innovating in ways that promote improvements in economic growth and quality of life.

1. Introduction

Innovation—the improvement of existing or the creation of entirely new products, processes, services, and business or organizational models—is a central driver of economic growth. And in an increasingly globalized economy, trade policy and innovation policy are intimately entwined. But innovation really doesn't just spring "like manna from heaven" as something which policymakers have no influence over. Rather, economies must put effective innovation policies in place to enable innovative activity to flourish in their societies. This study assesses how effective current innovation policies are in the 21 Asia Pacific Economic Cooperation member economies and explains how APEC economies can make their innovation policies even more effective in the future. The study ranks the 21 APEC economies on their strength in six core innovation policy areas:

1. Open and non-discriminatory market access, foreign direct investment, and standards policies;
2. Science and R&D policies that spur innovation;
3. Digital policies enabling the robust deployment of ICT platforms;
4. Effective intellectual property rights protection policies;
5. Openness to domestic competition and new firm entry;
6. Open and transparent government procurement policies.

In preparing this report, we searched extensively to identify as many indicators relevant to the six core innovation policy areas as possible. The report includes every indicator relevant to an economy's innovation policy that we were able to identify, provided that sufficient data existed for the indicator to provide coverage across all (or almost all) APEC economies. This study assigns weights to the six core innovation policy areas—and then to the sub-indicators which comprise each innovation policy area—based upon an extensive review of the scholarly literature on innovation policy and our own judgment and expertise in the field.

Overall, the six core innovation policy areas receive fairly balanced weights in the study, as Table 1-1 shows. For economies to create an environment in which innovative organizations and innovation in general flourishes, it's vital that they craft innovation- and competition-promoting policies with regard to market access, foreign direct investment, and standards; science and R&D; digital/ICT; and intellectual property rights, and so economies' scores on each of these four policy areas accounts for 17.5 percent of their overall score. An economy's openness to trade—characterized by open market access, receptivity to foreign direct investment, and participation in collaborative, international standards-setting processes—has become an increasingly important bedrock pillar of its innovation capacity. Likewise, economies' science and R&D policies—such as levels of government and corporate R&D investment and higher-education R&D performance—are crucial to the development, diffusion, and adoption of new technologies that substantially drive innovation. For its part, ICT has become a central driver of innovative new services and business models, productivity improvements, and economic growth for

developed and developing economies alike. And economies that fail to provide and enforce intellectual property rights stifle innovation by failing to provide adequate incentives and protections to innovators while discouraging the inflow of foreign technology and investment. Economies' policies that promote domestic competition and entrepreneurship as well as government procurement which fosters innovation are also important, and so economies' scores on each of these two core innovation policy areas account for 15 percent of their overall scores.

The intent of this study is to provide a generalized sense to APEC economies of how well they are doing relative to their peers on these six core innovation policy areas, so that they can identify their strengths, weaknesses, and opportunities for improvement in innovation policy. As this is an overall framing and assessment report, it does not report economies' individualized scores; rather APEC economies are ranked as upper-tier, mid-tier, or lower-tier on each of the six core innovation policy areas, with those ranks calculated based on economies' performance on an array of key sub-indicators relevant to each core policy area. (In total, the study assesses 73 sub-indicators.) The tiered rankings of economy performance in each of the six core innovation policy areas were constructed using equidistant partitions of the set of weighted aggregate scores derived from each economy's normalized sub-indicator scores. Economies' ranks on the six weighted core innovation policy areas are then aggregated to produce an overall ranking reflecting the strength of their innovation policy capacity, as shown in Table 1-2.

Table 1-1: Weights of Core Innovation Policy Areas in Overall Scoring Methodology

Core Innovation Policy Area	Share of Overall Weight
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Digital/Information and Communications Technology	.175
Intellectual Property Rights	.175
Domestic Market Competition	.150
Government Procurement	.150

Table 1-2: Rank of APEC Economies on Innovation Policy Capacity (in alphabetical order)

Tier	APEC Economy
Upper-Tier	Australia
	Canada
	Chinese Taipei
	Hong Kong
	Japan
	New Zealand
	Singapore
	United States

Tier	APEC Economy
Mid-Tier	Chile
	Korea
	Malaysia

Tier	APEC Economy
Lower-Tier	Brunei
	China
	Indonesia
	Mexico
	Papua New Guinea
	Peru
	Philippines
	Russia
	Thailand
	Vietnam

On extensive review of over 70 sub-indicators, this study finds Australia, Canada, Chinese Taipei, Hong Kong, Japan, New Zealand, Singapore, and the United States to lead APEC economies in the strength of their policies to spur innovation capacity. Mid-tier economies include Chile, Korea, and Malaysia. Lower tier economies include Brunei, China, Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam. Notwithstanding the variation in ranks, all APEC economies have at least some particular innovation policies that other APEC economies would be well advised to emulate. Table 1-3 shows how each APEC economy scored on each of the six core innovation policy areas.

Table 1-3: APEC Economies' Rank on Each Core Innovation Policy Area (in alphabetical order)

	Aggregate	Trade	Science/R&D	ICT	Intellectual Property	Domestic Competition	Government Procurement
Australia	Upper	Upper	Upper	Upper	Upper	Upper	Mid
Brunei	Lower	Mid	Lower	Lower	Mid	Mid	Lower
Canada	Upper	Mid	Upper	Upper	Upper	Upper	Upper
Chile	Mid	Upper	Mid	Mid	Mid	Mid	Mid
China	Lower	Lower	Mid	Mid	Lower	Mid	Lower
Chinese Taipei	Upper	Mid	Upper	Upper	Mid	Upper	Upper
Hong Kong	Upper	Upper	Mid	Upper	Upper	Upper	Upper
Indonesia	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Japan	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Korea	Mid	Lower	Upper	Upper	Upper	Mid	Upper
Malaysia	Mid	Lower	Mid	Mid	Mid	Mid	Lower
Mexico	Lower	Lower	Lower	Lower	Mid	Lower	Lower
New Zealand	Upper	Upper	Mid	Upper	Upper	Upper	Mid
Papua New Guinea	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Peru	Lower	Mid	Lower	Mid	Lower	Lower	Lower
Philippines	Lower	Mid	Lower	Lower	Lower	Lower	Lower
Russia	Lower	Lower	Mid	Lower	Lower	Lower	Lower
Singapore	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Thailand	Lower	Lower	Mid	Lower	Lower	Mid	Lower
United States	Upper	Upper	Upper	Upper	Upper	Upper	Upper
Vietnam	Lower	Lower	Mid	Lower	Lower	Mid	Lower

The reason these rankings matter is because innovation is a fundamental driver of economic growth and because economies are unlikely to achieve sustainably high rates of innovation if their governments have not implemented a broad range of innovation-enabling policies that create the conditions in which organizations throughout an economy—whether private enterprises, government agencies, or non-profit entities—can successfully innovate. The following section discusses what innovation is, why it's important, and the optimal paths for economies to grow through the application of innovation. It then discusses what innovation policy is (and isn't), why innovation policy is important, and what constitutes

legitimate and illegitimate innovation policies in spurring economic growth. The individual chapters discuss APEC economies' performance with regard to the six core innovation policy areas.

What is Innovation?

Innovation has become the central driver of national economic well-being and competitiveness—and this is why so many economies are engaged in what might be termed "a race for global innovation advantage." But what is innovation? Most believe that innovation is only technological in nature, resulting in shiny new products like Apple's iPad, Sony's PlayStation, or Samsung's 3-D HDTVs, or in enhanced machines or devices, such as lasers and computer-controlled machine tools. Others believe that innovation pertains only to the R&D activity going on at universities, national laboratories, or corporations.

While that is true, it is much too limiting. While innovation is about shiny new products, R&D, and technology, it is about much more. In fact, the OECD defines innovation expansively as, "the implementation of a new or significantly improved product (that is, a physical good or service), process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations."[1] The key point is that innovation can be both technological and non-technological in nature and that innovation is equally, if not more important, in non-traded sectors as in traded ones. Moreover, the "non-technological" innovations can be at least as important as the technological ones—although innovations are often best when they combine both technological and non-technological elements.

To elaborate, Larry Keeley and his colleagues at Monitor Company, a consultancy, painstakingly researched the nature of innovation activity in U.S. Fortune 500 corporations between 1989 and 1999, classifying innovative activity into four categories: those dealing with the "offering" itself (that is, the key technical features or attributes of the product or service); those pertaining to the "delivery" of the product or service (principally branding and distribution channels); those relating to the firm's internal "processes" (such as use of knowledge or customer relationship management systems); and those relating to the firm's "business model or value chain."[2] What Keeley and his colleagues found was that, though the vast majority of innovation activity in enterprises pertains to the core attributes of a product of service, the overwhelming value arises from innovations focused on the firm's business model or value chain. They found that innovation efforts focused only on the technical features of a product or service could easily be copied or imitated, leading to commoditization pressures, whereas innovations in business models or value chains (think Dell's mass customized build-to-order PC model) were more sustainable and less easily reproducible.[3] In fact, Keeley and his associates found that just 2 percent of innovation projects delivered approximately 90 percent of the value created from U.S. Fortune 500 enterprises' innovation efforts between 1989 and 1999.

As the subsequent section on ICT policies explains, many of those innovative efforts leveraged information and communications technologies to create innovative new business models—many previously fundamentally impossible to execute without ICTs such as the Internet—that have unlocked tremendous value for businesses, customers, and society alike. (In fact, ITIF estimates that the annual

global economic benefits of the commercial Internet equal $2 trillion, more than the global sales of medicine, investment in renewable energy, and government investment in R&D, combined).[4] Indeed, there is a growing inter-linkage between technological innovation and business model innovation, with new technologies enabling new business models (think inexpensive digital storage and faster broadband enabling the online music store iTunes), and in turn new business models being required to enable new technological innovations to fully emerge in the marketplace. Moreover, this trend points to the increasingly important role services play in innovation. With service industries accounting for 68 percent of APEC economies' aggregate GDP, well more than double manufacturing's 29 percent share, economies and enterprises alike need to be at least as focused on innovation in services as in products.[5]

To summarize, innovation comes in a multitude of types, including products, services, production or business processes (for goods or services, respectively), organizational models, business models, and social innovations (innovation directed toward specific societal gains). Within these dimensions, innovation can arise at different points in the innovation process, including conception, research and development, transfer (the shift of the "technology" to the production organization), production and deployment, or marketplace usage. Figure 1-1 charts the dimensions of potential innovation opportunity in the "innovation value chain."

Figure 1-1: The Innovation Value Chain

		Phase of Development				
Type of Innovation		Conception	Research & Development	Transfer	Production/ Deployment	Usage
	Products					
	Services					
	Production process					
	Organizational models					
	Business models					

To be most effective, economies' innovation activity should be found along all matrices of the innovation value chain—in all types of innovation and along all phases of development. But one of the biggest mistakes economies make with their innovation strategies is that they define innovation too narrowly. In reality, many economies (and companies) focus their innovation activity only on products, and even then, only on a sub-set of products tradable on international markets. And, as Figure 1-2 depicts, many economies only focus on obtaining the intellectual property for an innovative product and then developing, manufacturing, and exporting it.

Figure 1-2: Focal Point of Innovation in Export-Led Growth Economies

		Phase of Development				
Type of Innovation		Conception	Research & Development	Transfer	Production/ Deployment	Usage
	Products			*	*	
	Services					
	Production process					
	Organizational models					
	Business models					

Indeed, building their economies around high-productivity, high-value-added, export-based sectors, such as high-tech or capital-intensive manufacturing sectors, appears to be the path that nations such as China, Indonesia, Malaysia, Russia, and others are following, in the footsteps of Japan and the Asian tigers—Chinese Taipei, Hong Kong, Korea, and Singapore—before them. These economies place the vast majority of their innovation focus on supporting the manufacturing and export of internationally tradable products, while generally giving short shrift to their domestic services industries. This is unfortunate for economies, because export-led growth strategies leave broad swaths of opportunity to innovate in services, business models, and organizational models untapped, despite the fact that this is where 80 percent or more of innovation opportunities lie.

Why Is Innovation Important?

In recent years, a growing number of economists have come to see that it is not so much the accumulation of more savings or capital that is the key to improving standards of living; rather, it is innovation that drives economies' long-run economic growth.[6] Indeed, a key factor behind much of the rise in living standards in the post-World War II era has been the rapid advances in technology and innovation.[7]

Ultimately, innovation drives economic growth, employment growth, wage growth, and the very productivity growth that lies at the heart of it all. The U.S. Department of Commerce estimates that technological innovation has been responsible for as much as 75 percent of the growth in the American economy since World War II.[8] Other studies have found that, in developed economies, up to 90 percent of per-capita income growth stems directly from innovation.[9] Innovation also leads to job growth. As the OECD found in a definitive review of studies on productivity and employment, "Technology both eliminates jobs and creates jobs. Generally it destroys lower-wage, lower-productivity jobs, while it creates jobs that are more productive, higher-skilled, and better paid. Historically, the income-generating effects of new technologies have proven more powerful than the labor-displacing effects: technological progress has been accompanied not only by higher output and productivity, but also by higher overall employment."[10] Moreover, technology-using industries have higher-than-average productivity and employment growth than industries that use less technology.[11]

Innovative activity also delivers substantial social returns. Yale economist William Nordhaus estimates that inventors capture just 4 percent of the total social gains from their innovations; the rest spill over to other companies and to society as a whole.[12] And economist Edwin Mansfield finds that the social rate of return from investment in academic research (in terms of its impact on product and process development in U.S. firms) to be at least 40 percent.[13]

Yet innovation drives not just the productivity and employment growth fundamental to long-term prosperity; it also plays a central role in improving citizens' quality of life. Innovation has been and likely will continue to be indispensable in helping societies address difficult challenges, such as developing sustainable sources of food and energy, improving education, combating climate change, meeting the needs of growing and aging populations, raising billions out of poverty, and achieving shared and sustained global prosperity.

Innovation achieves these considerable impacts in large part by enabling the productivity improvements that lie at the core of economic growth; for example, the *use* (as opposed to the *production*) of information technologies was responsible for two-thirds of U.S. total factor productivity growth between 1995 and 2002 and virtually all of the growth in labor productivity.[14] In China, the use of ICT by organizations has been estimated to account for 38 percent of total factor productivity growth.[15]

In fact, a number of economists have identified ICT as an important "general purpose technology" that plays an inordinate role in innovation and productivity.[16] Analysis at the firm level confirms that the use of ICT by organizations enables innovation. Specifically, the probability to innovate increases with the intensity of ICT use, and this holds true for both manufacturing and services firms and for different types of innovation.[17] In effect, ICT is "super capital," having an impact on worker productivity three to five times that of non-ICT capital (e.g., buildings and machines).[18] Thus, the widespread use of ICT is a key driver of the across-the-board productivity improvements that truly drive economic growth.

ICT is a major driver of growth in developed and developing economies alike. ICT use in Canada is associated with higher labor productivity in industries that adopt it.[19] Connolly and Fox analyzed the impacts of ICT capital on TFP growth in ten Australian industries from 1966 to 2002 and found that ICT capital is more productive than other types of capital at the aggregate level in all industries of the Australian economy.[20] Likewise, ICT usage in China has played a critical role in growth, accounting for as much as 21 percent of GDP growth.[21] Developing nations such as Chile, Malaysia, and Thailand have also shown significant ICT-induced productivity growth.[22] For example, in a study of approximately 900 Chilean retail firms in 2008, De Vries found that productivity for the firms with greater ICT use was 1.3 log points higher than the other three groups of retail firms with lower ICT use.[23]

Innovation is Critical for Across-the-Board Productivity Growth

Economies—whether national, state, or regional—have three ways to grow over the medium and longer term: growth in population, shifting to higher productivity industries, or productivity improvements across-the-board.

In the first path, economies can get bigger by increasing their population, and hence number of employed workers. But this is not a sustainable strategy for many nations, particularly given threats to the global ecosystem. Moreover, the "get big" strategy does not improve the incomes or quality of life for individuals; it just leads to economies with more individuals and a larger total GDP.

The second two channels involve boosting productivity. Productivity growth—the increase in the amount of output produced by workers per a given unit of effort—is in fact the most important measure and determinant of economic performance for a nation.[24] For instance, if U.S. productivity were to grow just 1 percent faster for the next forty years than it did during the 1980s, the average American would earn $41,000 more per year than he or she would have otherwise (in real 2006 dollars).[25]

Economies can increase their productivity in two ways, either through the "growth effect" or the "shift effect." In the first, all sectors in an economy, all its firms and industries, become more productive, usually by investing in new technologies or improving the skills of their workers. For example, an economy's retail, banking, transportation, and automobile manufacturing sectors all increase their productivity at the same time. The second method, the "shift effect," is more dynamic and disruptive: low-productivity industries lose out in the marketplace to high-productivity industries as the compositional mix of the economy changes.

Both across-the-board productivity growth (the growth effect) and shifts in the mix of establishments and industries toward more productive ones (the shift effect) will contribute to an increase in an economy's productivity. But which strategy is the best? The answer depends in large part on the size of the economy and in part on the type of sector. The larger the economy, the more important the growth effect is, while the smaller the economy, the more important the shift effect is. Moreover, the more local-serving the sector is, the more important the growth effect is. To understand why, consider an automobile factory in a small city. If its managers install a new computer-aided manufacturing system and raise the plant's productivity (the growth effect), a large share of the benefits will flow to the firm's customers around the nation and even around the world in the form of lower prices. The city will benefit only to the extent that its residents buy cars from that factory or if some of the increases in productivity go to higher wages instead of only to lower prices.[26] In contrast, if the city attracts another auto plant where the wages average $18 per hour to replace a textile firm (with average wages of $12 per hour) that moved overseas to a low-wage economy (the shift effect), most of the benefits will accrue to residents in the form of higher wages for the workers who moved from the textile plant to the car factory (and from more spending at local-serving businesses like restaurants, dry cleaners, furniture stores, etc.). This means that across-the-board productivity growth, rather than a shift to higher-value-added sectors, will be more important for larger areas, including virtually all economies, because their consumers will capture a greater share of the productivity gains. Yet, even for small economies, across-the-board productivity gains are still a vitally important way to become richer, especially through productivity gains in domestic-serving industries.[27]

But to the extent that economies have cared about raising productivity, most have focused on trying to attract higher-wage firms to locate or grow within their borders. Yet, as Michael Porter found in his analysis of traded clusters in sub-state regions, raising the productivity of all clusters has about the same effect on income as shifting to higher-productivity clusters.[28] In other words, a strategy of raising

productivity in existing traded firms is just as effective as attracting or growing higher-productivity industries. Moreover, raising the productivity of non-traded firms (e.g., firms in industries like retail, health care, services, or even government) whose output is consumed almost entirely by the economy's residents can have even larger benefits to the economy. Most of the benefits will go to the area's residents in the form of lower prices for consumers and higher wages for workers. For example, if a city encourages its electric utility to install a smart electric grid system that boosts the utility's productivity, most of the benefits, in the form of lower prices (and higher-quality electric services), will flow to local residents.

Thus, the lion's share of productivity growth in most economies—and especially large- and medium-sized ones such as China, Indonesia, Japan, Korea, and the United States—comes not from changing the sectoral mix to higher-productivity industries, but from all firms and organizations, even low-productivity ones, boosting their productivity. Overall, the evidence shows that it is changes in organizations (e.g. businesses, government, non-profits, etc.) that drive productivity, with around 80 percent of productivity growth coming from organizations improving their own productivity and only about 20 percent coming from more productive organizations replacing less productive ones. In other words, the productivity (and innovativeness) of an economy's organizations (and thus sectors) matters more than its mix of sectors. And since the vast majority of economic benefits from technology, as much as 80 percent, comes from the widespread usage of technology, while only about 20 percent of the benefits of technology comes from its production, economies with export-led growth strategies miss out on the greatest opportunity to improve their economic growth: by increasing the productivity of domestic sectors, particularly through the application and diffusion of general purpose technologies such as ICT.

Designing Effective Innovation Policy

As the race for global innovation advantage has intensified, dozens of economies—including many from the Asia-Pacific region, such as Australia, China, Chinese Taipei, Indonesia, Korea, and Singapore, among others—have created national innovation strategies designed to boost their economies' potential to benefit from innovation. These economies recognize that innovation drives growth and that losing the race for innovation advantage can result in a relatively lower standard of living. They know that success in the competition to develop globally competitive domestic companies and industries while attracting internationally mobile innovation-based economic activities—and, thus, to achieve high and sustainable levels of economic and employment growth—increasingly depends on the strength of their national innovation ecosystems. The economies with the more sophisticated strategies also realize that innovation-based economic activity is not just about moving up the value chain to higher-value-added activities, but also about boosting the productivity of sectors across-the-board and developing new capabilities and functionalities in their economies. All of these economies have come to understand that markets relying on price signals alone will not always be as effective as smart public-private partnerships in spurring higher productivity and greater innovation. They understand that government can—and must—play a constructive role in helping its private sector compete. Therefore, they see the promotion of innovation as a focal point of their economic growth and competitiveness strategies. Ultimately, economies' innovation policies aim to explicitly link science, technology, and innovation with economic and employment

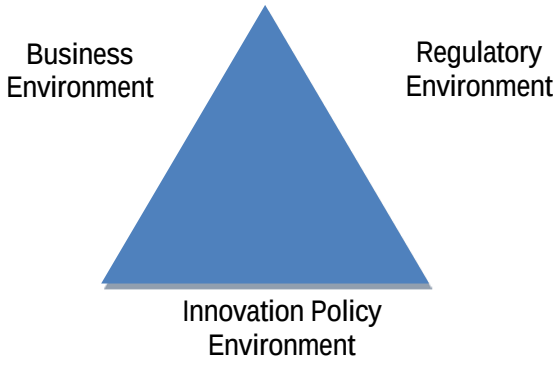
growth, effectively creating a game plan for how they can compete and win in innovation-based economic activity.

But just as innovation is about more than high-tech products, effective innovation policy focuses on more than just science policy or on promoting high-tech product development. Effective innovation policy focuses more on ensuring the diffusion of innovation to all sectors and organizations and on enabling new business model innovations to emerge and to compete. In fact, innovation policy basically involves the same set of policy issues that all economies deal with all the time, but focuses on how economies can address those issues with a view toward maximizing innovation and productivity. For example, economies can operate their procurement practices the same way they always have, or they can reorganize their practices in a manner specifically designed to promote innovation. Likewise, economies can organize their corporate tax system simply to raise revenues, or to raise revenues while also driving innovation. They can set up their science policy just to support science, or organize their investments in scientific research in ways that consider technology commercialization and innovation needs.

The most sophisticated economies have implemented innovation policies that recognize this. Their innovation strategies constitute a coherent approach that seeks to coordinate disparate policies toward scientific research, technology commercialization, ICT investments, education and skills development, tax, trade, intellectual property, government procurement, and regulatory policies in an integrated fashion that drives economic growth by fostering innovation.

Getting innovation policy right requires that economies master three components of the innovation ecosystem—the business environment, the regulatory environment, and the innovation policy environment—which are sometimes called "The Innovation Policy Triangle," as Figure 1-3 illustrates. The six core innovation policy areas that form the basis of this study address all the core elements of the innovation policy triangle, whose elements are specified in greater detail below:

Figure 1-3: The Innovation Policy Triangle



Business Environment: The first leg of the innovation triangle is the business environment, which includes finance, private sector institutions, and business capabilities. A strong business environment has several components:

- Ability of capital to flow to innovative and productive investments easily and efficiently;

- A widespread embrace of entrepreneurship and innovation by individuals;
- Strong ICT adoption, especially among businesses;
- Strong managerial skills; and
- A culture that embraces competition and collaboration, as well as an appropriate level of risk taking.

Regulatory Environment: The second leg is the regulatory environment, which enables the right overall framework for organizations to be innovative. This includes:

- A competitive and open trade system so that domestic firms are spurred to innovate through competition;
- Support for competitive product and labor markets so that new entrants, including new business models, can enter markets;
- A tax system that spurs innovation and enables enterprises to be competitive in global markets;
- Regulatory requirements on businesses that are to the extent possible based on consistent, transparent, and performance-based standards;
- Limited regulations on the digital economy that don't impair widespread digital innovation and adoption;
- A legal process that is transparent and based on the rule of law;
- Government procurement based on performance standards as well as open and fair competition; and
- Protection of intellectual property that enables innovators to achieve returns.

Innovation Policy Environment: The third leg of the triangle is a robust innovation policy environment. While markets are key to innovation, absent effective innovation policy markets will underperform. A strong innovation policy environment supports the key building blocks of innovation. This includes:

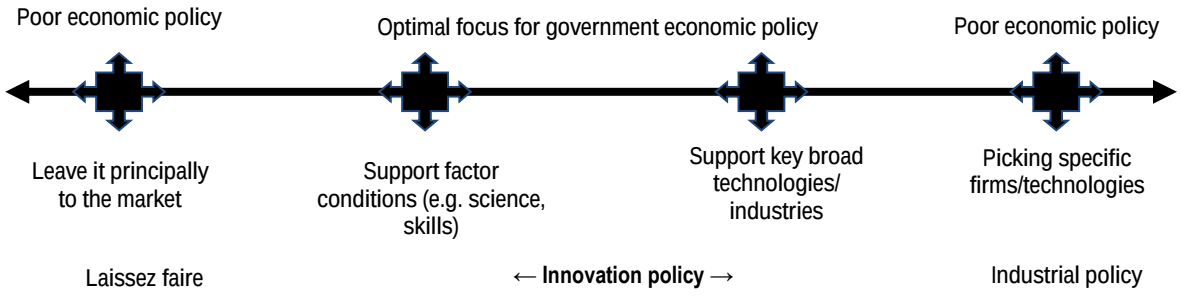
- Support for technology research;
- Support for technology commercialization;
- Support for digital technology infrastructures (e.g., smart grid, broadband, health IT, intelligent transportation systems, e-government, etc.);
- Support for firms, especially small and medium-sized firms, to modernize and boost productivity; and
- Fostering effective education and skills, particularly science, technology, engineering and math skills (STEM), while welcoming high-skill immigrants.

Ultimately, innovation policy is concerned with enhancing the strength of a nation's innovation ecosystem and recognizes that businesses innovate with the help of many other institutions. Innovation policy recognizes that technological progress depends on certain infrastructure investments and on specific innovations that are too risky, too complex, or too interdependent on other breakthroughs for private firms to always risk alone the substantial investments that are needed.[29] Indeed, the private sector

often needs the government's partnership to innovate, and the more collaborative nature of the modern innovation process is reflected by the greater role government agencies, national laboratories, and research universities play in private sector innovation. As ITIF documented in its report *Where Do Innovations Come From? Transformations in the U.S. National Innovation System*, whereas the lion's share of the *R&D 100 Award*-winning U.S. innovations in the 1970s came from corporations acting on their own, most of the *R&D 100 Award*-winning U.S. innovations in the last two decades have come from partnerships involving business and government, including federal labs and federally funded university research. In fact, in 2006, only 11 of the 88 entities that produced award-winning innovations were not beneficiaries of federal funding.[30]

What then is the appropriate role of government in innovation policy? In particular, when does an economy's *innovation policy* cross the line into an *industrial policy* which seeks to intervene in markets to "pick winners" or "national champions" and which in the process distorts the efficient market-based allocation of resources (and sometimes even hinders private firms from developing innovative technologies on their own)? It is useful to envision a continuum of government-market engagement, increasing from left to right in four steps from a "laissez faire, leave it to the market" approach; to "supporting factor conditions for innovation;" to going further by "supporting key broad technologies/industries;" to, at the most extreme, "picking specific technologies/firms," which is what would be tantamount to industrial policy, as Figure 1-4 shows.

Figure 1-4: The Innovation Policy Continuum



To provide a specific example in the context of advanced batteries for electric vehicles, it would be industrial policy if a government picked a particular company to be its national battery champion—say, if the United States picked Duracell—or a particular technology that government planners think is the best—such as lithium-ion. Rather, it's innovation policy if governments seek to support private sector efforts to solve key problems, like batteries and electric charge storage. This means supporting a wide range of firms, including startups, and technologies (such as lithium-ion, lithium-air, zinc-air, all electron, metal-molten salt, and magnesium-ion, etc.), recognizing that while government needs to support the private sector in its efforts to spur battery innovation, neither it nor the private sector can adequately predict which firms and technologies will ultimately win. In short, industrial policy entails a government picking *specific* firms or technologies, whereas innovation policy refers to governments making strategic investments in and supporting key *broad* technologies and/or industries. Governments do play a vital and appropriate role in making investments in strategic and emerging advanced technologies and sectors and helping facilitate the transfer of that technology to the private marketplace with the explicit intent and

purpose of driving economic growth. However, governments should not pick specific companies, or technologies, to be national champions, nor should they exclude local operations of foreign enterprises from eligibility to receive government funding for research grants working on next-generation technologies or otherwise disadvantage foreign enterprises competing in their markets.

In summary, innovation policy recognizes that while the private sector should lead innovation, in an era of globalized innovation and intensely competitive markets, governments can and should play an important enabling role in supporting private-sector innovation efforts. Economist Dani Rodrik paints a helpful picture of the appropriate relationship between government and business with respect to innovation policy by describing an interactive process of strategic cooperation between the public and private sectors which, on the one hand, serves to elicit information on business opportunities and constraints and, on the other hand, generates policy initiatives in response.[31] Ultimately, the true choice is not between government and no government, but about the right type of government involvement in support of innovation. A modern, practical approach recognizes both the need for fundamental support and the hazards of overzealous government intervention.

2. Tariffs, Market Access, Foreign Direct Investment, and Standards

Why Open Market Access and FDI are Important and How They Drive Innovation

Free trade benefits all economies by allowing each economy to specialize in producing the products or services for which it has comparative and/or competitive advantage. As economies specialize in the production of traded goods and services at which they are the most efficient, global economic output is maximized and consumers globally benefit by receiving the highest-value, lowest-cost products and services. In a global market-based innovation economy, free trade is a positive-sum game in which everybody wins. Nevertheless, the degree to which nations embrace free trade varies significantly.

Yet empirical data suggests that free trade benefits developed and developing countries alike. A World Bank study of 77 developing economies over a twenty-year period finds that a developing economy's productivity is larger the more open it is to trade with developed economies and the greater its foreign R&D investment.[1] In a study comparing East Asian economies with Latin America economies, the World Bank finds that the East Asian economies demonstrated larger flows of trade and foreign direct investment, and suggests that this provides a key reason for their relatively stronger technological growth.[2] As much as one-half of U.S. productivity growth derives from foreign technology acquired through trade, licensing, and direct investments (including joint-equity ventures and wholly owned subsidiaries).[3] Moreover, firms that sell in international markets generate more knowledge than counterparts that sell in national markets only.[4] For example, in a study matching patent citation data with trade data, Sjoholm finds that international trade flows encourage knowledge flows.[5]

Trade leads to both static and dynamic gains for economies. Trade can lead to substantial economic benefits through more efficient allocation of resources and deepened specialization, which allows economies to prosper from comparative advantage. These are the so-called "static gains" from trade. "Dynamic gains" come from the increases in competition and the transfer of technology and innovation that trade engenders.

Thus, there is a two-way link between trade and innovation. On the one hand, innovation creates technological advantage, which, together with differences in factor endowments, are the sources of comparative advantage. This in turn drives trade. Indeed, technology gaps have been found to be a key determinant of trade and investment between economies.[6] In other words, economies shouldn't specialize in all technologies; trade enables them to specialize in what they are good at and trade for the rest. Moreover, open markets benefit innovative firms, leading to an increase in the size of the market over which the firm can leverage its innovation (e.g. economies of scale). This is especially important for industries with relatively low marginal costs of production and high fixed costs, (e.g., semiconductors, software, movies and music, etc.) since larger markets can be served with overall declining average costs.

On the other hand, trade and investment also spur innovation through competition effects, technology transfer, and spillover effects (including learning from exporting and learning by investing).

In particular, by exposing domestic firms to international markets and forcing them to compete against sophisticated global competitors, trade is a strong driver of innovation and productivity growth. In fact, data from the OECD Innovation Microdata project shows that exposure to international markets has a strong positive effect on both firms' incentives to innovate or on their ability to innovate.[7] In part, this occurs because international trade and investment allow for a freer flow of technologies across borders, enhancing competitive pressures and opening new markets. Indeed, a number of studies find that firms which are involved in trade and investment are more productive and innovative than purely domestic firms.[8] For example, a study of Canadian exporters by Baldwin and Gu finds them to use technology more intensively and have higher rates of innovation than non-exporters.[9] Likewise, importers are 7.6 percent more likely to adopt new technology than firms that do not import.[10]

Moreover, the global shift from a closed, linear innovation model to an open innovation model, which requires closer coordination between network partners, makes a free trade and investment environment that enables freer interaction with suppliers, competitors, and customers more important than ever before.[11] While restrictive trade and investment policies have been used by some countries as part of efforts to develop domestic industries (so-called import substitution industrialization policies), they may lead economies to be excluded from global value chains, ultimately doing more harm than good to their economies. Indeed, global value chains driven by multinational corporations (MNCs) are a key conduit for technology transfer and innovation; thus, a stable trade and investment environment conducive to MNCs is likely to promote further technology transfer and innovation. Likewise, small-medium sized enterprises that are linked to the global market are more innovative and can make use of global value chains to improve their technology and ability to innovate.

A deeper exploration of the literature shows first that trade is an important conduit for the international transfer of technology and diffusion of innovation, and second that the competition that trade engenders spurs innovation.

First, new technologies are transmitted across economies through different activities including trade in capital goods and intermediate goods and services, inward and outward FDI, movement of individuals, contact with suppliers, licensing agreements, and learning by doing. Imports of capital goods are an important conduit for technology diffusion, as foreign machinery can embody more technology than domestic machinery, especially in the case of developing economies. Indeed, a number of empirical studies support the conclusion that imports play a significant role in international technology transfer. Xu and Chiang find that productivity in advanced economies benefits from foreign technology embodied in imported capital goods.[12] Eaton and Kortum and Bernstein and Mohnen find that R&D spillovers from the United States to Japan are more significant than in the other direction, suggesting that it is trade with the technological leader that matters.[13] Coe et al. find that total factor productivity in developing economies is positively and significantly related to R&D in their industrial economy trade partners and to their imports of machinery and equipment.[14]

Freer trade has a particular impact on firms' productivity. In an analysis of Chilean firm data, Kasahara and Rodrigue find that the use of imported intermediates led to an immediate 2.6 percent positive productivity effect and possibly additional dynamic effects.[15] Keller finds international trade to enable domestic firms to raise their productivity by importing specialized foreign intermediate goods.[16] Likewise, in a study of Indonesian plant level data, Amiti and Konings find that a 10 percentage point fall in tariffs leads to a 3 percent productivity gain on average and an 11 percent productivity gain for importing firms.[17]

Second, trade spurs productivity and innovation through competition. Increased competition through imports has a disciplining effect on domestic industries. Tariffs and nontariff barriers such as preferential standards can shield domestic industries from competition and lead to an increase in mark-ups. Studies examining changes in mark-ups when countries liberalize trade find a negative relationship between trade openness and mark-ups for imperfectly competitive markets, suggesting that pressure from competing imports lead to a decrease in rents.[18]

Further, enhanced competition increases firms' incentives to improve performance through boosting productivity and innovating. Competition-restraining regulations slow the rate at which positive productivity shocks diffuse across borders and new technologies are incorporated into the production process. For example, Cameron finds that Japanese industries that are more open to international trade catch up faster to their U.S. counterparts.[19] And an analysis of U.S. companies by Huh and Scherer finds that there are considerable differences in the R&D spending reactions of U.S. companies in response to changes in high-technology imports. Huh and Scherer find that, on average, R&D-to-sales ratios were reduced in the short run as imports rose, but increased over the long run. However, insulation from import competition through trade barriers generally made companies less likely to boost R&D (e.g. innovative) activity.[20] Thus, the evidence seems clear: openness to trade spurs innovation and drives productivity growth, whether by enhancing competition, promoting the diffusion of technology, or by giving the most innovative firms access to larger economies of scale.

But the effect of competition from trade is a bit like the "Goldilocks phenomena." Too little competition is not good as it doesn't provide the competitive spur. Companies protected from global trade can become lazy and complacent. But too much competition, when it arises from or is supported by unfair trade practices initiated by foreign economies, is just as bad, as it reduces the ability of innovators in the receiving economies to be successful. The sweet spot where trade maximizes the benefits to innovation occurs only when it is conducted generally according to markets. When nations unfairly subsidize technology exports (e.g., through discriminatory taxes or other means); take intellectual property without paying; adopt narrow technology standards to disadvantage foreign technologies; or force technology transfer as a condition of market access, this creates excess unfair and destructive competition and global innovation suffers. This occurs for many reasons. Globally interoperable markets can become smaller, reducing scale economies. Financial returns to innovation diminish with intellectual property theft and with having to compete against unfairly subsidized and protected competitors.[21] And forced technology transfer reduces the positive agglomeration effects in existing innovation clusters. For all these reasons, it's critical that APEC economies embrace open but rules-based trade.

Trade and Investment Liberalization in the Asia-Pacific Region

The evidence shows that both industrialized and developing APEC economies have made progress in reducing trade barriers, although, as the *APEC Outlooks and Outcomes 2010-2011* report (and this report) observe, more work remains to be done.[22] Nevertheless, since APEC was established in 1989, average applied tariff rates among its member economies have declined from 17 percent to 6 percent.[23] As tariffs and trade barriers have fallen, the volume of trade and investment in the region has flourished. From 1994 to 2009, APEC's trade in goods with the world increased at an annualized rate of 7.1 percent, reaching $11.4 trillion in 2009. The nominal value of trade in services also increased at an annualized rate of 7 percent, reaching $2.4 trillion in 2009. From 1994 to 2008, inflows of FDI into the APEC region increased by 13 percent per year and outflows grew by 12.7 percent. The economic dynamism of the region is apparent, as APEC economies now represent approximately 54 percent of world GDP and 44 percent of world trade.[24] The following section assesses APEC economies' continued progress toward trade and foreign direct investment liberalization.

Assessing the State of Market Access and FDI Liberalization Among APEC Economies

To assess APEC member economies' openness to international trade and investment, this section analyzes a total of eight indicators divided into three categories: open market access, foreign direct investment, and standards. In assessing economy ranks, 60 percent of the weight is allocated to measures of open market access, particularly to tariff barriers and their complexity, degree of services trade liberalization, and participation in regional free trade agreements. Twenty percent is allocated to economies' openness toward foreign direct investment and 20 percent is allocated based on an analysis of economies' standards policies. Table 2-1 shows the indicators used and their relative weights. Economies' scores on the market access, foreign direct investment, and standards indicators account for 17.5 percent of their overall score.

Table 2-1: Market Access and Foreign Direct Investment Indicators

Section Weight	Indicator	Data Type	Source	Indicator Weight
60%	MARKET ACCESS			
	MFN Applied Tariff Rate	% Rate	APEC	.150
	Tariff rate, most favored nation, simple mean, manufactured products	% Rate	International Trade Centre (ITC)	.075
	Tariff rate, advanced technology products (lithium ion batteries)	% Rate	WTO	.050
	Share of Duty-Free Imports	%	ITC	.075
	GATS Commitments Restrictiveness Index	Index	World Bank	.100
	Participation in Regional Trade Agreements Notified to WTO	#	ITC	.150
20%	Openness to foreign direct investment	Rating	Review of Economies' Policies	.200
20%	Standards Policy	Rating	Review of Economies' Policies	.200

On assessment of these eight indicators, Australia, Chile, Hong Kong, Japan, New Zealand, Singapore, and the United States lead in openness to trade, market access, and foreign direct investment among APEC economies, as Table 2-2 shows. Brunei, Canada, Chinese Taipei, Indonesia, Papua New Guinea, Peru, and the Philippines constitute mid-tier economies. China, Korea, Malaysia, Mexico, Russia, Thailand, and Vietnam constitute the lower-tier economies in this category.

Table 2-2. Rank of APEC Economies on Trade, Market Access, and FDI Policies (in alphabetical order)

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Australia	Mid-Tier	Brunei	Lower-Tier	China
	Chile		Canada		Korea
	Hong Kong		Chinese Taipei		Malaysia
	Japan		Indonesia		Mexico
	New Zealand		Papua New Guinea		Russia
	Singapore		Peru		Thailand
	United States		Philippines		Vietnam

Market Access

Tariffs

High tariffs distort innovation in a number of ways. First, they often disadvantage more innovative, productive, and efficient foreign competitors, while protecting domestic enterprises that are often less innovative, productive, and efficient. Further, in the interest of trying to favor domestic products on which the tariffs are applied, high tariffs damage other industries in the economy that are consumers of those goods. For example, high tariffs applied on foreign ICT products in the interest of supporting domestic ICT producers have the effect of both raising the cost of ICT goods for other industries in an economy and inhibiting the ability of those sectors to procure best-of-breed information and communications technologies. Hence, placing high tariffs on products can damage industries that use those products as an input to production. Ultimately then, high tariffs distort global markets for innovative products and services and, by disadvantaging the economic interests of the most efficient and innovative enterprises, leave the world with less innovation than would otherwise be the case. Raising the cost of key technology inputs to production reduces, rather than spurs, innovation.

While developed and developing APEC economies alike have made progress towards eliminating tariffs, by a wide margin Singapore and Hong Kong lead the way among APEC economies. In fact, each has a most-favored nation (MFN) applied tariff (simple average of all products) rate of 0 percent, reflecting a world-leading commitment to removing barriers to free trade.[25] Just after Singapore and Hong Kong, New Zealand and Brunei impose the lowest tariffs, at 2.1 and 2.5 percent, respectively (Table 2-3).

The average MFN applied tariff of APEC economies in 2009 was 6.17 percent, with Vietnam, Mexico, and Korea having the highest rates at 10.9, 11.5, and 12.1 percent, respectively. Likewise, China's 9.6 percent applied MFN tariff rate remains high. Chile, Chinese Taipei, and the Philippines all stand at about the APEC average, with Chile administering a uniform six percent rate across all sectors.

Table 2-3: MFN Applied Tariff Rates[26]

APEC Economy	MFN Applied Tariff (%)
Singapore	0
Hong Kong	0
New Zealand	2.1
Brunei	2.5
United States	3.5
Australia	3.5
Canada	4.5
Japan	4.9
Papua New Guinea	5.0
Peru	5.5
Chile	6.0
Chinese Taipei	6.1
Philippines	6.3
Indonesia	6.8
Malaysia	8.4
China	9.6
Thailand	9.9
Russia	10.5
Vietnam	10.9
Mexico	11.5
Korea	12.1
APEC Average	**6.2**

Among the five industrialized APEC economies—Australia, Canada, Japan, New Zealand, and the United States—Japan and Canada have the highest average applied tariff rates, at 4.9 and 4.5 percent, respectively. Open access to Australia's market remains impeded by tariffs of close to four percent, which apply to a significant share, as much as 45 percent, of imports.[27] The United States' MFN applied tariff averages 3.5 percent (unchanged since 2006), while New Zealand records the lowest tariff rate among the industrialized APEC economies at 2.1 percent.

Positively, from 2006 to 2009, APEC-wide tariff rates declined almost one percentage point, while several APEC economies made significant progress in decreasing their average tariff rates. Peru halved its average tariff rate from 10.2 to 5.5 percent; Vietnam significantly liberalized its trade in goods and services, reducing its average rate by more than one-third, from 16.8 to 10.9 percent; and Mexico reduced its average rate by 2.5 percentage points. However, several APEC economies made no progress from

2006 to 2009, with Korea's average tariff rate stuck at 12.1 percent; and the Philippines, though laudably with an average tariff rate half of Korea's levels, holding steady at 6.3 percent.

With MFN applied tariffs set at zero percent, Hong Kong and Singapore unsurprisingly lead the APEC economies with the share of trade that is imported free of tariff duties, at 100 percent. Mexico, Canada, and Chile round out the top five with 86.2, 86.0, and 80.1 percent of imports entering those economies duty-free (Table 2-4). The United States ranked eighth among APEC economies, with 76.3 percent of imports entering duty-free. China, Thailand, and Russia, at 46.0, 35.7, and 31.2 percent, respectively, allow the lowest share of foreign imports to enter their economies on a duty-free basis. APEC-wide, 68.8 percent of imports entered economies duty-free in 2009, a substantial increase from the 42.6 percent that entered duty free in 1996.[28]

Table 2-4: Share of Imports Entering Duty-free[29]

APEC Economy	Share of Duty-free Imports (%)
Hong Kong	100.0
Singapore	100.0
Mexico	86.2
Canada	86.0
Chile	80.1
Japan	77.2
Malaysia	76.6
United States	76.3
Peru	73.2
New Zealand	67.6
Indonesia	61.0
Australia	56.7
Vietnam	51.3
Philippines	49.6
Korea	48.5
China	46.0
Thailand	35.7
Russia	31.2
Brunei	N/A
Chinese, Taipei	N/A
Papua New Guinea	N/A
APEC Average	**68.8**

Tariffs on manufactured products entering APEC economies, at 5.31 percent on average, are slightly lower than the average for all products, likely reflecting the movement of many component parts (such as for consumer electronics products) through Asian value chains (and the higher tariffs applied on agricultural products by several APEC economies). Again, Hong Kong and Singapore lead the way, with zero percent tariffs on manufactured products, followed by New Zealand, Japan, Canada, Brunei, and Papua New Guinea with tariffs on manufactured products at or under 3 percent, while China, Vietnam, and Mexico have the highest tariffs on manufactured products, with rates all in excess of 9 percent (Table 2-5). China imposes tariffs of 9.08 percent on manufactured products despite the fact that it accrued a global trade surplus of $297 billion in 2009.[30]

Table 2-5: Tariffs on Manufactured Products[31]

APEC Economy	Tariff Rate, MFN, Simple Mean, Manufactured Products (%)
Hong Kong	0
Singapore	0
New Zealand	2.38
Japan	2.51
Canada	2.83
Brunei	2.98
Papua New Guinea	3.00
Australia	3.25
United States	3.82
Peru	5.51
Philippines	5.82
Chile	5.98
Indonesia	6.85
Korea	7.37
Malaysia	8.06
Thailand	8.40
Russia	8.73
China	9.08
Vietnam	9.55
Mexico	10.16
Chinese Taipei	N/A
APEC Average	**5.31**

Unfortunately, steep tariffs persist among a number of APEC economies across a range of advanced technology products, including for information and communications technology products (as discussed in the digital polices section) and for renewable energy products. As an indicative example, several APEC economies place stiff tariffs on high-technology products, such as in green and renewable energy technologies. For example, on lithium-ion cells and batteries, Vietnam, Brunei, Russia, and China place maximum tariffs of 26 percent, 20 percent, 15 percent, and 14 percent, respectively, as Table 2-6 illustrates, even though the greater use and development of such batteries can be a critical component in addressing global warming.

Table 2-6: Tariffs on Lithium-ion Cells and Batteries[32]

APEC Economy	Tariffs on Lithium-ion Cells and Batteries (%)
Australia	0
Hong Kong	0
Japan	0
Malaysia	0
Mexico	0
New Zealand	0
Papua New Guinea	0
Singapore	0
Chinese Taipei	2.5
United States	2.7
Philippines	3.0
Canada	3.5
Chile	6.0
Korea	8.0
Peru	9.0
Indonesia	10.0
Thailand	10.0
China	14.0
Russia	15.0
Brunei	20.0
Vietnam	26.0
APEC Average	**6.2**

Services Trade Liberalization

Services trade liberalization is an important area for attention given that services innovation represents a growing share of global innovation. This is because (compared to the manufacturing and agricultural sectors) services have come to account for the largest share of GDP and employment in most economies, developed and developing alike. As noted, on average in the APEC economies, services now account for twice as large a share of GDP than manufacturing industries. Further, the composition of FDI has also been shifting toward the service sector, with services now accounting for 59 percent of FDI inflows worldwide, up from 50 percent in 1990 and 25 percent in the 1970s. [33]

As services account for an increasing share of economies' GDP and economic growth, it's vital that economies focus on supporting innovation in services as much as in manufactured goods. One particular reason to be concerned about the level of innovation in an economy's services sectors is that if the economy's services industries are not innovative and productive, they can imperil the long-term competitiveness of the economy's manufacturing industries that produce traded goods for the economy. This is because service industries boost other industries' competitiveness. Logistics, financial, consulting, engineering, and software-design industries serve as intermediate inputs to manufacturing industries and play critical roles in boosting their competitiveness.[34] As a specific example, market research, technological research and development, human resource management, business consulting, and financial services play major roles in producing and selling automobiles in countries such as Korea (in fact, the intermediate demand rate of Korea's service sector is approximately 40 percent). But as Kim Jung-Woo of South Korea's Samsung Economic Research Institute (SERI) has observed, the comparatively low rates of productivity in Korea's service industries may undermine the productivity of the nation's entire economy.[35]

Thus, economies that impose restrictions on trade in services (in the interest of protecting certain specific services industries) do a disservice to enterprises throughout their economy by making it more expensive and difficult to access best-of-breed services that may be available from foreign services providers. Moreover, economies that preclude or limit trade in services miss out on the dynamic innovation-promoting effects that trade engenders by promoting competition amongst enterprises. Economies that shield their domestic services sectors from foreign competition will only experience lower rates of innovation in their services sectors, and thus lower rates of productivity and economic growth across the economy as a whole.

Moreover, it's important that economies not over-regulate services industries in ways that compromise the free flow of trade in services between economies. That is, while it may be justifiable for regulators to maintain oversight over firms that own or operate part of the economy's transportation or communications infrastructure, regulators should provide space for innovators to freely experiment in the application/services layer. For example, if social networking Websites such as Facebook in the United States, Mixi in Japan, or Cyworld in South Korea had had to ask regulators to allow them to offer their services, it's unlikely they would ever have gotten off the ground, as regulators would have had little understanding of what services these enterprises were planning to offer, or what 'box" to fit the service in.

Table 2-7: GATS Commitments Restrictiveness Index, 2007[36]

APEC Economy	GATS Commitments Restrictiveness Index (High Score Best)
United States	65.2
Australia	59.0
New Zealand	52.2
Canada	51.1
Japan	48.8
Korea	41.2
China	36.2
Mexico	35.9
Vietnam	30.2
Hong Kong	25.5
Malaysia	25.4
Peru	24.6
Singapore	22.7
Thailand	19.7
Philippines	14.1
Papua New Guinea	12.2
Indonesia	9.52
Chile	9.51
Brunei	4.35
Russia	N/A
Chinese Taipei	N/A
APEC Average	**30.9**

Unfortunately, services sector restrictions remain with regard to several sectors in APEC economies, particularly in financial services, telecommunication services, transportation services, and audiovisual services.[37] Table 2-7 shows APEC economies' scores on the GATS (General Agreement on Trade in Services) Commitments Restrictiveness Index, which measures the extent of GATS commitments for all 155 services sub-sectors as classified by the GATS. Economies are scored from zero (unbound or no commitments) to 100 (completely liberalized). The United States leads APEC economies with a score of 65.2, followed by Australia, New Zealand, Canada, and Japan. Brunei, Chile, and Indonesia have the least open services sectors out of the APEC economies, according to this set of 2007 World Bank data. APEC economies' average score of 30.9 places it slightly ahead of the world average of 25.4. But with the APEC average at less than half the score of the APEC economies with the most liberalized services sectors, there is clearly more work to be done in liberalizing services trade among APEC members.

Participation in Free Trade Agreements

By comprehensively removing barriers to trade between or among economies, bilateral and multilateral free trade agreements promote the expedited, efficient, and freer flow of products and services amongst the economies participating in such free trade agreements. Thus, free trade agreements unlock the innovation-promoting effects from trade outlined at the beginning of this chapter, notably by giving innovative enterprises access to larger economies of scale and by fostering greater levels of competition which encourages enterprises to compete by innovating and improving their products and services.

Recent years have seen a significant increase in APEC economies' participation in regional and bilateral free trade agreements. As Table 2-8 shows, Chile and Singapore lead the way, with each economy having notified the WTO of their participation in 19 regional trade agreements.

Table 2-8: Regional Trade Agreements Notified to the WTO[38]

APEC Economy	Regional Trade Agreements Notified to the WTO
Chile	19
Singapore	19
Mexico	15
Japan	11
Thailand	11
United States	11
China	9
Korea	9
Malaysia	9
Peru	9
Philippines	9
Australia	8
Brunei	8
Indonesia	8
New Zealand	8
Vietnam	8
Russia	7
Canada	6
Papua New Guinea	4
Chinese Taipei	4
Hong Kong	2
APEC Average	**9**

Chile and Singapore are followed by Mexico with 15, and Thailand, Japan, and the United States with 11 free-trade agreements notified to the WTO. Chile, Korea, and Mexico are the only APEC economies that have entered into free trade agreements with the European Union.[39] Canada and Australia trail other industrialized APEC economies (and the APEC average) with participation in only six and eight regional trade agreements, respectively. The average number of regional trade agreements APEC economies participate in is nine. Chinese Taipei and Papua New Guinea with four, and Hong Kong with two, participate in the fewest regional trade agreements.

Yet APEC economy participation in regional free trade agreements has increased markedly over the past decade. For example, whereas before 2005 China had only entered into 3 regional trade partnerships, it has since entered into free trade arrangements with Chile, New Zealand, Pakistan, Peru, and Singapore and has notified the WTO that future agreements are forthcoming with Australia, Costa Rica, Norway, and Switzerland. Beyond bilateral agreements, APEC economies are continuing to aggressively explore deeper trade integration through a variety of multilateral forums. In 2006, Australia, Brunei, New Zealand, and Singapore created the Trans-Pacific Partnership, to which Chile, Malaysia, Peru, Vietnam, and the United States are now negotiating to accede. Meanwhile, APEC economies continue to take concrete steps toward the creation of a Free Trade Area of the Asia-Pacific (FTAAP).[40]

Foreign Direct Investment

A vital component of market access is economies' openness to both inward and outward foreign direct investment. Competitive domestic markets let foreign firms compete in their markets and encourage foreign direct investment.[41] Research shows that FDI can contribute significantly to regional innovation capacity and economic growth, in part through the transfer of technology and managerial know-how.[42] For example, Dahlman suggests that higher rates of FDI can explain the relatively higher technological growth rates in East Asian economies.[43] Coe, Helpman, and Hoffmeister find that a developing economy's productivity growth is larger the greater its foreign R&D investment.[44] This is in part because multinationals can better attain both economies of scale and scope that enable them to be more productive than domestic-only firms, particularly in small- and mid-sized economies. Eaton and Kortum estimate that one-half of the productivity growth in OECD economies is derived from trade, licensing, and FDI.[45] In other words, FDI builds international linkages and knowledge networks that augment innovation both domestically and around the globe. Foreign R&D investment has also been shown to spur local companies in the receiving economy to increase their own share of R&D, leading to regional clusters of innovation-based economic activity. Therefore, it is essential that economies not only open their borders to inward foreign direct investment, but that they allow domestic firms to invest overseas as well.

There are two ways in which economies can stifle FDI. The first, foreign equity restrictions, entail direct controls on foreign ownership. For example, the Philippines limits foreign ownership of many firms to 40 percent.[46] The second way is through domestic laws and regulation that make it difficult for foreign-controlled businesses to operate. An economy may allow the inward flow of capital across its borders, but if that capital is underutilized or inefficient once it arrives, then the economy will not reap the benefits bestowed by FDI. For example, Papua New Guinea has few restrictions on investment flows, but, lacking a cohesive business regulatory framework, it is difficult for foreign firms to start and operate domestic

enterprises.[47] In order to rank highly on this indicator, APEC economies must be open to both foreign equity ownership and have a regulatory framework that allows foreigners to establish and operate businesses with ease.

Table 2-9 ranks APEC economies with regard to their openness to both inward and FDI. Economies' FDI regimes are evaluated across four categories according to the methodology of the global Investing Across Borders project of the World Bank Group. The first category, Investing Across Sectors, corresponds to FDI equity restrictions. The latter three categories correspond to the ease with which foreign nationals can establish and operate businesses. Australia, Canada, Hong Kong, New Zealand, Singapore, and the United States score highly across the board. Chile, Peru, and Russia score highly in foreign equity ownership, yet perform less well when it comes to their business environments. Conversely, Korea and Japan have healthy business environments, yet suffer from numerous restrictions on foreign ownership. Economies that restrict foreign ownership and provide a poor regulatory environment for foreign enterprises include China, Indonesia, Malaysia, Mexico, the Philippines, Thailand, and Vietnam.

Table 2-9: Openness to Inward and Outward Foreign Direct Investment[48]
(in alphabetical order)

APEC Economy	Investing Across Sectors (100=Best; 0=Worst)	Starting a Foreign Business (100=Best; 0=Worst)	Accessing Industrial Land (100=Best; 0=Worst)	Arbitrating Commercial Disputes (100=Best; 0=Worst)
Australia	96.2	93.1	70.3	81.7
Brunei	86.7	52.4	51.8	N/A
Canada	81.4	93.6	78.2	89.5
Chile	100.0	68.7	78.3	77.5
China	64.9	47.6	68.4	77.1
Chinese Taipei	74.7	70.7	82.8	70.1
Hong Kong	100.0	89.2	63.8	89.9
Indonesia	71.9	56.1	70.8	72.8
Japan	84.8	77.1	77.4	79.7
Korea	86.7	72.9	85.5	82.3
Malaysia	67.5	69.8	55.4	81.1
Mexico	63.8	69.3	71.6	72.2
New Zealand	100.0	95.0	94.0	82.3
Papua New Guinea	N/A	55.5	N/A	47.2
Peru	99.1	70.0	77.6	81.1
Philippines	60.1	49.9	69.0	72.0
Russia	91.2	72.0	71.9	74.8
Singapore	88.6	88.8	81.5	90.1
Thailand	52.1	70.7	66.4	69.2
United States	95.2	81.9	84.4	80.7
Vietnam	68.8	56.8	68.1	68.0
APEC Average	**81.7**	**71.5**	**73.4**	**77.0**

Standards Policies

The development of voluntary, transparent, and market-led global standards for products and technologies benefits producers and consumers alike, augmenting innovation throughout the global trading system. Internationally compatible standards enable businesses to leverage technologies and manufacture products efficiently at economies of scale by reducing the cost that would otherwise be involved in producing specific variations of products to meet different jurisdictions' standards. Consumers benefit from technology standards every time they are able to use the same USB port across multiple computing or consumer electronics products, to use their cell phone in different economies, or to communicate using data and audio standards.[49] Standards have become increasingly important because they directly affect up to 80 percent of world trade, and because they are ubiquitous in ICT products and services.[50] In essence, standards form a bridge between markets and technologies, and whoever controls that bridge can greatly influence global trade.[51]

Due to this power, standards can be used as a tool to block or limit foreign companies' access to domestic markets, especially in ICT industries.[52] Economies that develop discriminatory national standards typically have two goals. First, they hope to give local companies a competitive advantage by keeping foreign competitors out of the market. Second, they seek to avoid having to pay royalties on foreign intellectual property. For example, economies may enact mandatory standards ("technical regulations") that are incompatible with global standards, thus preventing foreign competitors from entering their markets or forcing them to adopt the domestic standard and then pay royalties to the domestic IP owner.[53] Another tactic is to ostensibly embrace global standards, but then to mandate strict conformity assessment procedures that create product entry delays, required the disclosure of sensitive IP, and/or greatly increase the cost of doing business for foreign companies only. By imposing these unfair standards-related measures, governments ultimately harm local consumers and businesses. These costs can be significant. The OECD estimates that complying with economy-specific technical standards can add as much as 10 percent to the cost of an imported product.[54] And that's the point: discriminatory standards raise the cost of capital goods, which leads in an economy to less competitive industries and less innovation.

APEC economies' standards policies are evaluated (Table 2-10) based on four criteria:

1. In general, companies' adherence to standards should be voluntary, not mandatory.
2. In general, standard setting should be market-led; in the vast majority of cases, governments should not dominate or direct the process.
3. Standards should be transparent and open to all interested parties at a reasonable cost.
4. Standards should, where possible, conform to global standards.[55] Additionally, conformity assessment procedures should not present unnecessary obstacles to trade.

In the context of the WTO, APEC economies' standards policies are guided by their adherence to the Agreement on Technical Barriers to Trade (TBT), which, *inter alia*, seeks to ensure that standards and technical regulations are not discriminatory, are based on relevant international standards, and do not create unnecessary obstacles to trade.[56] As such, APEC economies' adherence to the four criteria is assessed based on information present in WTO Trade Policy Reviews. Russia is not a WTO member, and thus is not included in the analysis. Additionally, no Policy Review has yet been published for Vietnam,

and thus Vietnam is also excluded from the analysis. The emphasis of the analysis is on technical standards relating to ICT and high-technology manufacturing; other standards—for example, those of sanitary and phytosanitary standards—are given less weight.

Table 2-10: Embrace of Voluntary, Market-Led, and Transparent Global Standards*[57]
(in alphabetical order)

Tier	APEC Economy
Upper-Tier	Australia
	Brunei
	Canada
	Chile
	Chinese Taipei
	Indonesia
	Hong Kong
	Japan
	New Zealand
	Papua New Guinea
	Peru
	Philippines
	Singapore
	United States

Tier	APEC Economy
Mid-Tier	Korea
	Malaysia
	Mexico
	Thailand

Tier	APEC Economy
Lower-Tier	China

*Not rated: Russia, Vietnam

Some APEC economies are leaders in standards policy. For example, in the Philippines, most standards are voluntary, with technical regulations enacted almost exclusively for health and safety purposes. In the Philippines, standards are set based on a market consensus—that is, by technical committees consisting of academics, trade and industry associations, consumer groups, members of professional groups, research institutions, government agencies, and testing institutions.[58] The equivalence between domestic standards and global standards has improved dramatically in recent years: from just 47 percent in 1998 to an estimated equivalence of over 80 percent in 2010.[59]

The United States also sets a strong example for other economies in its standards policies. According to the WTO, "The National Technology Transfer and Advancement Act of 1995 directs federal government agencies to adopt 'voluntary consensus standards' in lieu of government-developed standards as a means to carry out policy objectives, except when doing so would be inconsistent with the law or otherwise impractical."[60] From an innovation perspective, this is ideal: the market guides government standards-setting, and compliance is voluntary. Moreover, global standards are the rule in the United States because under the Trade Agreements Act of 1979, federal agencies are required to take into consideration international standards when developing standards, and base the standards on international standards when appropriate. Conformity assessments are not burdensome in the United States, where the most common assessment is the producer's self-declaration of conformity.[61]

Chile also maintains a healthy standards policy. In Chile, standards are drafted on the basis of the principles of non-discrimination and transparency and, whenever possible, international standards.[62] Although Chile does have a number of mandatory technical regulations, according to the WTO, the

majority of technical regulations are based on international standards. For example, in the electricity sector, all the technical regulations applied are based on international standards and, according to the Chilean authorities, have "no significant impact on trade."[63] The Chilean regime demonstrates that, while not ideal, mandatory standards may not affect trade and thus harm the global innovation system so long as they conform to global norms. Indeed, mandatory standards may in fact be beneficial is some cases—for example, the domestic players in a market may require coordination in order to conform to a global standard. The key here is that these technical regulations are frequently reviewed to ensure their relevance. In Chile, government agencies regularly review technical regulations and conformity assessment procedures, repealing those that have become obsolete.[64] Additionally, Chile is exemplary in the transparency of its standards: not only does Chile require transparency in the development process, but it also maintains a catalogue of standards, technical regulations, and conformity procedures that is accessible online.[65]

The mid-tier economies lag behind the upper-tier economies in one or more of the four criteria. Despite having relatively high international equivalence in its standards, Korea is characterized by its complex conformity assessment procedures (although these have improved in recent years) and its extremely high number of mandatory national standards—15 percent, the highest of the APEC economies studied. For example, the Korean government has supported the development of mandated domestic radio frequency identification (RFID) standards, without international participation or consensus.[66] Korea also uses its standards to favor domestic industries in government procurement. According to the WTO, Korea's New Excellent Product (NEP) certification is granted to products manufactured with technologies that were first developed in Korea or with technologies improved from existing technologies. NEP-certified products receive government support for expansion of sales channels and for new product development. Furthermore, NEP products receive an additional point in Korean government procurement.[67]

Like Korea, Mexico also falls behind due to mandatory standards and burdensome conformity assessment procedures. For example, with the exception of certain products, the import of goods subject to Mexican technical regulations that are verifiable at the border must be accompanied by a corresponding technical regulation certificate. In order to obtain this certificate, the importer must send samples to a laboratory accredited by the competent Mexican authority. In fact, for importers in countries that lack a Free Trade Agreement with Mexico, importers must obtain a separate certificate for each product they wish to import.[68]

China lags far behind other APEC economies in developing a pro-innovation standards policy. According to the WTO, in 2007, around 14.5 percent of national standards, 15 percent of professional standards, and 19 percent of local standards were mandatory.[69] And, voluntary standards can become mandatory if they are referenced in mandatory conformity assessment procedures. In 2007, only 46.5 percent of national standards were equivalent to international standards, although China is making efforts to increase its international alignment.[70] Despite these efforts, China is still behind many APEC economies in adopting global standards, particular in the ICT industry. For example, China has developed its own standards in wireless networking, mobile television, wireless storage, computer security, terrestrial television, digital satellite television, Internet protocol television, video codecs, and digital rights management.[71] Even when China adopts global standards, China's rigid conformity assessment procedures can hinder foreign

firms' participation in the Chinese market. In particular, China's compulsory product certification system has been described in the TBT Committee as burdensome and an impediment to trade, according to WTO documents.[72] In transparency, China does not have a history of allowing foreign participation in its standards-setting process, although in 2009 China did announce that foreign-owned companies established in China would be allowed to participate as voting members in standards-setting committees.[73]

Conclusion

The link between greater trade flows fostering greater innovation is clear. Innovations are the source of comparative advantage that drives trade. And a globalized innovation system is a more optimal one, as open markets lead to an increase in the size of the marketplace and allow innovative firms to realize greater economies of scale. At the same time, by exposing domestic firms to globalized competition, trade acts as a strong driver of innovation and productivity growth in economies.

Therefore, open and non-discriminatory trade and investment policies which ensure competition and promote the development and diffusion of innovations across borders are vital for maximizing productivity, economic growth, and social welfare across all APEC economies. In a global, market-based economy, free trade and liberalized foreign direct investment is a positive sum-game in which all parties win. APEC economies have made substantial progress in liberalizing trade and investment since the organization's inception in 1989, particularly with regard to reducing tariff barriers. But more needs to be done, particularly on products and services that are key to driving innovation, such as ICT products.

Therefore, APEC members need to continue to implement open and non-discriminatory trade and investment policies that reduce tariffs, remove non-tariff and technical barriers to trade, and ensure the free flow of capital, people, ideas, goods, and services across borders in ways that promote competition. Further, they need to promote investment by minimizing restrictions on both inward and outward foreign direct investment. And they need to adopt the use of voluntary, market-led, and global standards that promote innovation and competition while creating global markets for products and services.

3. Science and R&D Policies

An economy's science and R&D policies (sometimes referred to as its technology policies) are crucial determinants of its economic vitality. For more developed economies with higher labor costs and greater skills, this often means implementing science and R&D policies that increase the supply of ideas and knowledge in an economy and then incentivizing their commercialization. For less developed economies, it often means implementing science and R&D policies that enable a nation's organizations to adopt newer and better technologies than are currently in use. (Although both these approaches are necessary for developed and developing economies alike.) Underlying these policies is the fact that, without them, the level of innovation in an economy is almost always suboptimal from a societal perspective. Indeed, the significant spillover benefits of innovation mean that, even under "perfect" market conditions, the private sector will underinvest in the factors that produce innovation, including R&D. Furthermore, organizations often fail to even adequately adopt existing innovations, in part because of "learning failures," but also because spillover effects apply as well to companies' investments in new capital equipment (e.g. companies underinvest because they can't capture all the benefits of their investments).[1]

There are two additional problems that can arise when relying on market forces alone to dictate innovation investment. The first is that firms will particularly underinvest in basic and early-stage applied research where the positive spillovers are greatest. This is where universities and other research organizations come in: these organizations tend to conduct more of the basic research that the private sector can then draw upon for product and process innovations. The second problem is the so-called "valley of death." The path through the "valley" from early-stage research to commercialization is often long and plagued with setbacks and uncertainty along the way. As such, firms will often shy away from traversing it, instead relying upon less innovative paths to short-term profits.

In order to alleviate these problems, governments need to step in and support private sector investment through, among other policies, public funding of R&D, tax policies that support R&D and new capital investment, and programs and policies that encourage innovation networks and help organizations adopt best practice technologies. While these policies might focus solely on increasing the output of domestic innovation and modernizing existing industries, perhaps more important in the globalized economy is that they also promote international linkages—or, in other words, not just regional, but also global innovation networks. The sharing of ideas, knowledge, and skills across borders benefits not only the domestic economy but also the world economy as a whole. It is a win-win arrangement; the size of the "innovation pie" increases for all. Indeed, Coe and Helpman found that the own-country rate of return from R&D conducted in the G7 countries was 123 percent, but that the *worldwide* rate of return from R&D investment conducted in the G7 countries was 155 percent.[2] In this vein, science and R&D policies should be open to the participation of foreign-controlled firms that operate domestically. For example, R&D tax incentives should not discriminate against foreign firms.[3] Nor should public research funds be allocated solely to domestically controlled companies. Unfettered participation in the global economy is the key to harnessing the network effects that compound the returns on an individual economy's innovation and new capital investments.

Nevertheless, an ad-hoc approach to the implementation of these policies can limit their effectiveness. University research may be fruitless if the resulting intellectual property (IP) languishes and is never spun out into the private sector. Industry clusters may underperform if they are nothing more than regional collections of isolated firms that do not collaborate in an innovation ecosystem. And policies may be targeting the wrong innovation challenges, especially if economies try to become world innovation leaders without the requisite moving up the learning and value chain. Hence, economies should develop and continually refine national innovation and competitiveness strategies such that policies are relevant and take advantage of their potential synergies. Indeed, recognizing that neither traditional science support agencies nor large, inflexible economic ministries can adequately coordinate innovation policies, over twenty economies worldwide have either created or expanded national innovation foundations over the last decade. While nearly all APEC economies have some form of science-support or innovation-promotion agency (or multiple agencies), the most effective ones, such as those of Australia, Chinese Taipei, Japan, Korea, and Singapore have broad authority to shape and coordinate their economy's innovation policies.

This chapter uses five indicators to assess APEC economies' science and R&D policies, as shown in Table 3-1. The indicators include economies' R&D and high-technology tax incentives; government R&D expenditures; higher-education R&D performance; university intellectual property ownership policies; and industry cluster development activities. Government's expenditures on R&D receive the highest weighting, 35 percent, followed by the generosity of R&D tax incentives at 25 percent and higher-education R&D performance at 20 percent. Measures of university IP ownership and industry cluster development each account for 10 percent of economies' scores on this core innovation policy area. Economies' scores on science and R&D policies account for 17.5 percent of the weight used in determining APEC economies' aggregate rank.

Table 3-1: Science and R&D Policy Indicators

Indicator	Data Type	Source	Indicator Weight
R&D Tax Incentives	Rating	Various	.25
Government R&D Expenditure	% of GDP	UNESCO	.35
Higher Education R&D Performance	% of GDP	UNESCO	.20
University IP Ownership	Rating	Various	.10
Industry Cluster Development	Rating	World Economic Forum	.10

Based on these measures, as Table 3-2 shows, Australia, Canada, Chinese Taipei, Japan, Korea, Singapore, and the United States lead with regard to their science and R&D policies. Chile, China, Hong Kong, Malaysia, New Zealand, Russia, Thailand, and Vietnam are mid-tier economies, while Brunei, Indonesia, Mexico, Papua New Guinea, Peru, and the Philippines are in the lower-tier.

Table 3-2: Rank of APEC Economies on Science and R&D Policy
(in alphabetical order)

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Australia	Mid-Tier	Chile	Lower-Tier	Brunei
	Canada		China		Indonesia
	Chinese Taipei		Hong Kong		Mexico
	Japan		Malaysia		Papua New Guinea
	Korea		New Zealand		Peru
	Singapore		Russia		Philippines
	United States		Thailand		
			Vietnam		

R&D and High-Technology Tax Incentives

The first sub-indicator ranks economies on the strength of their R&D and high-technology tax incentives. These incentives primarily include tax credits, tax holidays and reductions, and tax deductions (including "super deductions"). R&D and high-technology tax incentives can be effective tools with which to increase private investment in innovation. Not only do they help firms overcome the "valley of death" problem, whereby firms shy away from investment in innovation due to its inherent uncertainties, but tax incentives also aid in bringing innovation investment up to its socially optimal level. A plethora of studies have found that the economy-wide social rate of return from corporate R&D and innovation activities is at least twice the returns that a company itself receives.[4] For example, Tewksbury, Crandall, and Crane examine the rate of return from twenty prominent innovations and find a median private rate of return of 27 percent but a median social rate of return of a whopping 99 percent, almost four times higher.[5]

Almost all scholarly studies conducted since the early 1990s find R&D tax incentives to be both effective and efficient. A study of the pre-2011 regime of Australian R&D tax incentives finds that it produced about one dollar of R&D for every dollar of tax expenditure.[6] The Canadian tax credit, according to three separate studies, generates between 98 cents and $1.38 in additional R&D for every dollar of credit.[7] Several studies have evaluated the effect of tax incentives for research across a number of nations. In examining R&D tax incentives in 17 OECD nations, Guellec and van Pottelsberghe find that incentives effectively stimulate business R&D.[8] Falk finds that every dollar of R&D tax expenditure stimulates at least 90 cents in additional business R&D.[9] Another cross-national study by Wolff and Reinthaler concludes that R&D tax subsidies stimulate at least one dollar of R&D for every dollar of tax expenditure.[10]

In the APEC economies, R&D and high-technology tax incentives take three primary forms: (1) tax credits; (2) tax deductions; and (3) tax holidays and reductions. R&D tax credits are of two sorts. Volume credits are a flat credit that is generally independent of a firm's history of R&D expenditure over time (although volume credits may reward firms for high R&D intensity). Incremental credits, on the other hand, reward firms for increasing R&D expenditure or R&D intensity over time. Incremental credits tend to have a greater stimulative effect than volume credits.[11] In some cases, as with Japan and the United States, tax incentive regimes employ both volume and incremental credits.[12] For example, in the United

States, the Alternative Simplified Credit (ASC) provides a credit of 14 percent of eligible R&D expenses but only on expenses greater than 50 percent of base period expenses.

Tax deductions, the second form, include three common types. Standard deductions allow firms to deduct up to 100 percent of their R&D expenditure from their taxable income. Super deductions allow deductions greater than 100 percent—that is, for a 200 percent super deduction, a dollar in R&D expenditure would allow a two dollar deduction—and are similar to tax credits in effect. Accelerated depreciation allows firms to reduce the value of a fixed asset involved in R&D at a higher rate during the early years of the asset's lifespan, yielding a larger deduction over the lifespan of the asset relative to normal depreciation rates.

The third form of incentive includes tax reductions and tax holidays. Often, these are granted selectively. For example, China reduces the corporate tax rate from 25 percent to 15 percent for firms deemed "High and New Technology Enterprises" and other R&D-intensive firms.[13] Thailand grants a 100 percent tax holiday for eight years for firms engaged in "promoted" R&D activities.[14] Tax reductions and holidays are typically the most generous of the R&D tax incentives, particularly when combined with other incentives such as R&D deductions, although they typically apply to a narrower base of taxpayers. (Tax credits, deductions, and other R&D tax incentives can also be granted on a selective basis.) Although this selectivity has the potential to be a cause for concern—for example, if economies are picking specific firms or technologies for support—this is generally not the case with the APEC economies, in which selective policies tend to instead support broad technologies and industries.

Each of these tax incentive forms can qualify as a best practice in innovation policy (see Table 3-3), as long as they conform to the following criteria:

1. R&D tax incentives should be relatively generous. Generosity is impacted not only by the rate of reduction in tax liability, but also by myriad other factors including refundability, the lack of ceilings or caps, and the degree to which reductions in tax liability can be carried forward ("carryforward") or back ("carryback") across tax years.
2. Tax incentives should be permanent and certain to reduce uncertainty and to promote long-term innovation projects. They should not require reauthorization after a set period of time.
3. Tax incentives should not discriminate against foreign firms operating domestically. Economies that discriminate against foreign-controlled firms operating in their economy do not reap the benefits from the sharing of ideas, knowledge, and skills that enhances the global innovation system as a whole.[15]
4. The definition of eligible R&D should be relatively broad, and include both process and product innovations.[16] Eligible R&D should also include software development.
5. Eligibility should be open to all sectors, or open to broad key sectors or technologies selected in the context of a national innovation strategy.[17]

Table 3-3: Rank of R&D Tax Incentives (in alphabetical order)[18]

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Australia Brunei China Chinese Taipei Japan Malaysia Singapore Korea Thailand Vietnam	Mid-Tier	Canada Chile Hong Kong Papua New Guinea Philippines United States Russia	Lower-Tier	Indonesia Mexico New Zealand Peru

APEC economies with R&D tax credits are Australia, Canada, Chile, Chinese Taipei and Hong Kong with volume credits, and Japan, Korea, and the United States with combination volume and incremental credits. Australia, Chinese Taipei, Japan, and Korea each have upper-tier R&D credits. In July 2011, Australia revamped its R&D tax incentive system, switching their regime from super deductions to volume credits. Australia now provides one of the most generous R&D tax credits in the world, with large enterprises able to claim a 40 percent refundable credit and small and medium enterprises able to claim a 45 percent credit.[19] Australia's definition of eligible R&D is commendable, covering both product and process innovations and including software development.[20] Korea also has an impressively generous credit, with firms able to choose between the larger of a 20-25 percent volume credit or a 40-50 percent incremental credit on R&D expenditure exceeding the firm's average expenditure over the prior four years. Furthermore, Korea offers a 30 percent additional R&D credit for firms eligible for "New Growth Engine Industry" or "Original Source Technology" programs, as well as a 10 percent R&D equipment expenditure credit.[21] Chinese Taipei offers a generous credit at 15 percent of R&D expenditure (with a ceiling) combined with an accelerated depreciation allowance. Japan's credit is also generous, yet only barely qualifies as a best practice, because its incentive value is diminished by its non-refundability, a ceiling on its value, and only a single-year carryforward.

The economies with mid-tier tax credits are Canada, Chile, Hong Kong, and the United States. Canada offers a generous R&D tax credit, with large enterprises eligible for a 20 percent non-refundable credit and SMEs eligible for a 35 percent refundable credit. However, Canada is ranked in the mid-tier because only Canadian-controlled firms are eligible for the 35 percent credit; foreign-controlled firms are eligible only for a 20 percent credit.[22] Chile's credit is also generous, at 35 percent, but covers only expenditures on approved contracts with registered research centers; it does not cover R&D conducted internally by firms.[23] Hong Kong provides the equivalent of an R&D tax credit through its R&D Cash Rebate Scheme, in which selected projects or firms that partner with designated research institutions receive a cash rebate equivalent to 10 percent of its R&D expenditure, although the rate is not sufficiently generous to bring Hong Kong into the upper tier.[24] Firms in the United States qualify for a non-refundable credit of 20 percent of eligible R&D expenditure exceeding a complicated base amount, or they can take the non-refundable ASC of 14 percent exceeding 50 percent of the average of the three prior years' expenditure. However, according to the professional services firm Deloitte, "The cumulative effect of limited

deductions for the ASC and base calculation rules is that the maximum value of the ASC is less than 9.1 percent of current qualified R&D expenditure." And, notably, the U.S. credit is not permanent; it must be reauthorized every two years.[25]

Although many APEC economies offer R&D tax deductions of some sort, including accelerated depreciation on R&D equipment, Singapore, Papua New Guinea, and Russia offer super deductions, which in effect offer R&D incentives similar to a credit. In the upper tier, Singapore's policy involves a tiered set of super deductions, ranging from 200 percent to 350 percent. While there is a ceiling on the value of the deduction, Singapore offers unlimited carryfoward, as well as carryback in some circumstances.[26] Moreover, Singapore's super deduction comes in addition to a host of other R&D tax incentives.[27] In the mid-tier, Papua New Guinea provides a 150 percent super deduction, and Russia grants a 150 percent super deduction—but for only certain R&D expenses—on top of a VAT exemption.[28]

Tax holidays and reductions are common in the developing Southeast Asian economies and are often targeted to select technologies and industries. China grants a reduced 15 percent corporate tax rate (from 25 percent) to firms deemed "High and New Technology Enterprises" that operate in several broad technological areas and to firms that are otherwise R&D intensive. China also offers a 150 percent R&D super deduction and either immediate expensing or accelerated depreciation for qualified R&D equipment, in addition to several other R&D and high-technology incentives.[29] Malaysia grants a five-year corporate tax holiday for "Pioneer" companies—which are R&D companies, high tech companies, software development companies, and manufacturing companies capable of producing world-class products. Additionally, Malaysia provides a 200 percent super deduction for qualifying companies.[30] Likewise, Thailand grants an eight-year tax holiday for companies engaged in "promoted" R&D activities, and biotechnology companies located in a research park are entitled to a 50 percent reduction for five years after the tax holiday expires. Thailand also offers a 200 percent super deduction and accelerated depreciation on R&D equipment.[31] Vietnam provides a four-year tax holiday for new, R&D-intensive companies and then a 60 percent tax reduction for up to 15 years from the company's startup date, on top of other tax incentives.[32] Brunei grants a tax holiday for a multitude of "Pioneer Industries"—which include many R&D intensive industries—for up to eight years and up to eleven years if the business is located in a research park.[33] The Philippines grants a reduced 10 percent corporate tax rate (from 35 percent) for multinational enterprises deemed "Regional Operating Headquarters" and providing "qualifying services," yet the limited taxpayer base of the reduction (multinational firms only) gives the Philippines only an average rating.[34]

The lower-tier economies either provide no incentives or only limited incentives for private R&D. Indonesia only provides a standard 100 percent deduction for R&D expenditure.[35] New Zealand recently eliminated its R&D tax credit and now provides only research grants.[36] Mexico went so far as to eliminate even its grants along with its tax incentives in its 2010 tax reform legislation, although the grants were extended through 2011 by the legislature.[37] Peru does not provide incentives for R&D, although the newly-elected President Ollanta Humala has proposed establishing government grants and coordination for "priority" R&D areas.[38]

Government R&D Expenditure

Due to the private sector's tendency to underinvest in innovation, public R&D funding is needed to bring the rates of economic growth, job creation, and improvement in living standards up to their potential. Furthermore, governments tend to be less averse than the private sector to investments in high-risk, early-stage research that is far from commercialization, thus publicly funded R&D helps alleviate the private sector's underinvestment due to the "valley of death" problem. While much of this early-stage research does not lead to commercial results in the short term, it is more apt to produce the breakthrough innovations that generate large benefits for the domestic economy and the world in the long run.

Table 3-4: Government Expenditure on R&D as a Share of GDP, 2007[39]

APEC Economy	Government R&D Expenditure Share of GDP, 2007 (%)
Singapore	0.83
Australia	0.81
Korea	0.80
Chinese Taipei	0.77
United States	0.75
Russia	0.70
Canada	0.63
Japan	0.54
New Zealand	0.50
Hong Kong	0.36
China	0.34
Chile	0.30
Mexico	0.19
Vietnam	0.13
Thailand	0.08
Indonesia	0.04
Brunei	0.03
Malaysia	0.03
Philippines	0.03
Papua New Guinea	N/A
Peru	N/A
APEC Average	**0.41**

For example, one of the most potentially important future technologies is nanotechnology. Although nanotechnology may very well be to the twenty-first century what steel was to the early twentieth century, commercialization of this new technology is limited. As a result, governments fund the majority of nanotechnology research. And public R&D is efficient: estimates of the return on investment from publicly funded R&D range from 20 percent to 67 percent.[40] Moreover, multiple studies have found that public R&D serves as a complement, rather than a substitute, for private R&D, with information flow between public researchers and industry augmenting the value of industrial R&D.[41]

Consistent with its commitment to policies that support technological innovation, Singapore leads the APEC economies in government R&D expenditure, devoting nearly 1 percent of its GDP to complement private sector R&D investment, as shown in Table 3-4. Australia, Korea, Chinese Taipei, and the United States are close behind, while Russia and Canada allocate about two-thirds of 1 percent of their GDP to public R&D.[42] Each of these economies provides a level of government funding for R&D that is consistent with that required to support a robust innovation ecosystem.

Japan, New Zealand, Hong Kong, China, and Chile devote from about one-third to one-half of 1 percent of GDP to public R&D. Although this level of R&D spending is not insignificant, it is insufficient to support the R&D needs of each domestic economy and the needs of the world economy at large. Following these economies are those that must drastically increase their public R&D support. Only then will they reap the full benefits of not only their own domestic innovations, but also the compounding effect brought about by their contribution to a global innovation ecosystem.

Higher Education R&D Performance

The previous section reported that government expenditure on R&D is more likely than private expenditure to support early-stage research that is far from commercialization. One reason why this is true is that, in many economies, a significant share of public research funding is performed at universities and other institutions of higher education, which undertake the basic and early-stage research projects without the disincentives that might prevail in the private sector. That said, government is not the only source of university research funds; a significant share of university research budgets can come from the private sector as well as the institutions' own revenues (which will be discussed further in the following section on university IP ownership). Hence, it is important to measure the performance of R&D in the higher education sector in order to attain an accurate snapshot of an economy's innovation ecosystem.

In the quantity of R&D performed in the higher education sector, shown in Table 3-5, Canada has taken a substantial lead. One reason for this is that successive Canadian governments have made innovation-based competitiveness a national priority and have recognized the health of research universities as a valuable core asset. (As a result, in only five years, the number of Canadian universities listed in a popular world top-200 ranking has increased from seven to ten.)[43] Further behind, but still impressive nonetheless, are Australia and Singapore, respectively. These economies' higher education institutions perform the equivalent of half a percentage point of GDP on R&D. Following behind are Japan, Hong Kong, New Zealand, the United States, Korea, and Chinese Taipei, with higher education R&D performance approximately equal to one third to just below one-half of GDP. Even further behind is

China: although not nearly high enough to qualify as a "best practice," China has at least made large gains in its higher education performance of R&D, nearly doubling its share of GDP from ten years prior.

Table 3-5: Higher Education R&D performance as Share of GDP, 2007[44]

APEC Economy	R&D Performance in the Higher Education Sector (%)
Canada	0.67
Australia	0.54
Singapore	0.50
Japan	0.43
Hong Kong	0.37
New Zealand	0.35
United States	0.35
Korea	0.34
Chinese Taipei	0.31
Chile	0.21
China	0.12
Mexico	0.10
Thailand	0.09
Russia	0.07
Malaysia	0.06
Peru	0.06
Vietnam	0.03
Philippines	0.02
Brunei	0.00
Indonesia	0.00
Papua New Guinea	N/A
APEC Average	**0.23**

University Intellectual Property Ownership

Government funding of higher education research is important, but it is of little use to the domestic and the global innovation ecosystem if the resulting IP languishes in government coffers without ever being brought into development and commercialized. In other words, the success of the university system in performing early-stage research relies upon the effective transfer of knowledge from the university to the private sector so that it can be developed into marketable innovations. In the United States, the main provision of the Bayh-Dole Act of 1980 sought to promote the commercialization of university research

by vesting the IP rights of government-funded research with the institution, instead of relying upon the disparate policies of the funding government agencies. U.S. institutions now earn royalties through the licensing of their research, and this provides a strong incentive for universities and other institutions to pursue opportunities for commercialization.[45] For example, many universities have established Technology Transfer Offices (TTOs) to identify potentially commercially applicable IP that can then be sold or licensed to the private sector.

Table 3-6 rates economies on whether universities (and other research institutions) are awarded ownership rights to the IP that results from government-funded research. Upper-tier economies have clear and explicit rules that grant ownership of IP arising from publicly-funded research to the performing institution—universities in particular. Moreover, their universities have, in turn, established a system of effective TTOs or other IP management organizations to facilitate the commercialization of their research. China began establishing its Bayh-Dole-like system in 1994, culminating in the revised Science and Technology Progress Law of 2007.[46] Japan established a Bayh-Dole-like policy with the Industrial Revitalizing Law of 1999; Chinese Taipei in 1999 with the Science and Technology Basic Law; Korea in 2000 with the Technology Transfer Promotion Law; Indonesia in 2000 with the Application of Technology Law; Russia with the 2003 revision of the Patent Law; and, most recently, the Philippines in 2009 with the Technology Transfer Act.[47] Singapore's policy is not the result of a specific law; rather, it has long been standard practice, having evolved from existing civil and contract laws.[48] In 2004, Malaysia established a policy in which the ownership of IP derived from government-funded research is split three ways between the government, the institution, and the inventor.[49]

Table 3-6: Rank of University Intellectual Property Ownership Policies (in alphabetical order)[50]

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	China	Mid-Tier	Australia	Lower-Tier	Mexico
	Chinese Taipei		Brunei		Papua New Guinea
	Indonesia		Canada		Peru
	Japan		Chile		Thailand
	Malaysia		Hong Kong		Vietnam
	Philippines		New Zealand		
	Russia				
	Singapore				
	Korea				
	United States				

APEC economies in the mid-tier either do not have a formal or explicit university IP ownership policy. Instead, IP ownership is guided by individual university policies, contract details, or merely historical precedent, leading to some degree of uncertainty and thus weakening the commercialization incentive. For example, like most common law jurisdictions, Canada, Australia and New Zealand have no laws specifying the universities' IP rights, and thus IP ownership is generally decided based on individual university policies. This can impede research commercialization, as faculty members and university staff lack a common understanding of IP policy and universities must devote more resources to establishing commercialization procedures. Furthermore, it complicates the commercialization arising from research

performed at multiple institutions.[51] Offsetting this problem somewhat is the fact that most universities in these nations have established TTOs. Chile has no established Bayh-Dole-like policy and instead its universities abide by the IP policies of the funding agencies, although ownership is typically vested with the university, and the economy has several TTOs and IP management organizations.[52]

The lower-tier economies have no explicit Bayh-Dole-like policy and also have poor technology transfer institutions in general. In Mexico, IP ownership is based on university policy and is generally awarded to the institution, but its TTOs and IP management organizations are few and ineffective.[53] In contrast, Thailand is beginning to develop a more effective technology transfer system and is currently in the early stages of building a Bayh-Dole-like policy; however, at this time its commercialization process remains rather ad-hoc and limited.[54] Intellectual property rights remain weak in Vietnam, inhibiting the implementation of a Bayh-Dole-like system for IP ownership.[55] Likewise, Papua New Guinea's Intellectual Property Office describes the concept of IP as still "very foreign" and "unheard of" in the economy.[56] Although stronger than that of Papua New Guinea, according to the UNCTAD, Peru has "limited capacities for managing intellectual property" and an "absence of intellectual property policies in research institutions and universities."[57]

Industry Cluster Development

Evidence suggests that industries that are geographically concentrated experience higher productivity, employment, and wage growth, as well as higher levels of patenting.[58] Industry clustering enables firms to take advantage of common resources, such as a workforce trained in particular skills, technical institutes, or a common supplier base, in order to facilitate better labor-market matching and the sharing of knowledge. This process is particularly relevant to industries that rely more on the creation or use of new knowledge, as clustering appears to spur knowledge transfers.[59] Just as each additional broadband user makes the Internet more valuable to existing users, each firm in a cluster makes the cluster more valuable to other firms. As such, because the benefits of geographic clustering spill over beyond the boundaries of the firm, market forces produce less geographic clustering than is socially optimal. In addition, the firms in a cluster usually have common needs (for example, worker training or infrastructure) that they cannot meet on their own. Clustered firms therefore usually require external coordination—for example, from a national innovation foundation—to meet these needs.

The classic example of industry clustering is California's Silicon Valley, where a large agglomeration of high-tech firms, research universities such as Stanford, technical colleges to train high-tech workers, venture capitalists, and other supporting institutions create the world's most vibrant technology region.[60] In China, some refer to the technology park Zhong Guan Cun in Beijing as "China's Silicon Valley" as it draws talent from several nearby colleges and research universities.[61] Japan has established over seventeen industrial cluster projects in the biomedical, ICT, manufacturing, semiconductor, and environmental fields.[62] Chinese Taipei has several well-developed clusters, such as the Taipei Neihu Technology Park, which has over 3,000 resident firms.[63] And Singapore has allocated numerous zones for industry cluster development and now boasts clusters for the biomedical, petrochemical, food, and maritime industries, among others.[64] Table 3-7 shows APEC economies' ratings on industry cluster development.

Table 3-7: Industry Cluster Development Rating[65]

APEC Economy	State of Cluster Development (1 = nonexistent; 7 = widespread in many fields)
Japan	5.4
Chinese Taipei	5.4
Singapore	5.2
United States	5.1
Hong Kong	5.1
Canada	5.0
Vietnam	4.9
Malaysia	4.8
China	4.7
Indonesia	4.5
Korea	4.4
Thailand	4.1
Australia	4.1
Chile	4.1
Mexico	3.8
Philippines	3.7
New Zealand	3.7
Brunei	3.4
Peru	3.4
Russia	3.2
Papua New Guinea	N/A
APEC Average	**4.4**

However, the key to successful clusters is not simply enabling the co-location of similar firms and slapping a label on it ("e.g., High Tech Valley"). As Saxenian and others have shown, it is the active participation of firms and other organizations in a dynamic, regional learning system.66 For example, research shows that informal communications between cluster participants leads to more innovation.67 Thus, for APEC economies seeking to support dynamic clusters, simply putting together real estate deals is not enough. In order to develop a high-functioning regional innovation ecosystem, they must work to ensure that the active cooperation and learning occurs as well.

4. Digital and Information and Communications Technology Policy

Why Digital Policy is Important and How It Drives Innovation

As APEC economies continue to recover from the global financial crisis and resulting economic slowdown, information and communications technologies can play a vital role in supporting economic recovery, both because they drive productivity growth and because they enable the creation of new products and services.

Academic literature and industry analyses provide empirical evidence that the use of ICT directly drives economic growth.[1] An empirical study by Colecchia and Schreyer found that, throughout the 1980s and 1990s in Australia, Canada, Finland, France, Germany, Italy, Japan, the United Kingdom, and the United States, ICT contributed between 0.2 and 0.5 percentage points per year to economic growth.[2] During the second half of the 1990s, this contribution rose to 0.3 to 0.9 percentage points per year. Also, in a study of 27 developed and 66 developing economies, Clarke and Wallsten found that a 1 percentage point increase in the number of Internet users is correlated with a boost in exports of 4.3 percentage points.[3] According to a recent World Bank econometrics analysis of 120 economies, for every 10 percentage point increase in the penetration of broadband services, there is an increase in economic growth of 1.3 percentage points. Furthermore, this growth effect from broadband Internet is significant and stronger in developing economies than in developed economies.[4]

The impact of ICT on APEC economies is apparent. In the United States, the share of total factor productivity growth contributed by ICT-using sectors increased from 0.42 per year in 1995-2000 to 0.54 percentage points per year in 2000-2006.[5] In a study of ICT impacts in Australia, Connolly and Fox found that ICT capital is more productive than other types of capital. ICT capital's effect on TFP growth was particularly prominent in wholesale and retail trade, construction, agriculture, finance and insurance, and accommodation, cafes, and restaurants.[6] IT-intensive firms in New Zealand saw a substantial increase in labor productivity in the early 2000s. For example, the annual output growth rate due to labor productivity growth for communication services in 1988-2003 was 12.54 percent.[7] This was approximately nine times higher than the mean of 1.47 for all industries over the same period.

Colecchia and Schreyer noted another interesting point which has implications for trade. They observed that ICT diffusion and ICT usage play key roles and depend on the right framework conditions, not necessarily on the existence of a large ICT-producing sector. As to the role of the ICT-producing industry, there is no immediate reason why an economy with a small ICT-producing industry or without any at all should not benefit from the growth impulses of the use of ICT as a capital input.[8] This implies that any economy, even one with a weak ICT-producing industry, can pursue ICT-enabled economic growth with the help of open IT trade policies such as the WTO's Information Technology Agreement (ITA).

What are the mechanisms of ICT's contribution to economic growth? There are two different perspectives on the role of ICT. The first one is the output perspective, where the primary concern is the role of ICT-producing industries in the economy and the outputs consumed in the market. ICT as an output provides users with the opportunities to realize a higher level of achievement, personal capability development, and quality of life. At the economy level, it also helps construct an expansive knowledge capital base. The second, presumably more important, view is the input perspective that ICT serves as a source of capital services, delivering inputs to the production process.[9] The use of ICT as an input increases productivity, realized in part through the learning curve effect and in part through network externalities, and improves the sustainability of the economy in the long run.

As analyzed by Bresnahan, the mechanism of ICT's contribution to various socio-economic performances involves quite complicated innovation processes at all levels, including the individual, firm, market, industry, and national economy level.[10] Some features of that mechanism need to be noted. The first is the co-invention of business applications driven by the use of ICT. Typically, inventions in applications lag a few years behind ICT inventions. This injects a dynamic feedback loop in which ICT advance leads to unpredictable applications invention, which in turn raises the return to improvements in ICT whose rate and direction can only be understood after the application invention is complete.[11] This feature, combined with the role ICT plays as a general purpose technology (GPT), contributes to shift forward the innovation and productivity possibility frontier of an economy.

The second feature is the dynamic externalities among ICT adopters. The first type comes from falling co-invention costs. Early users' experience lowers later users' costs of co-invention, which increases social returns from ICT investments. The second type is the well-known positive network effect. With this effect, the incentive to adopt an ICT or an ICT application increases as the number of total adopters increase. This leads to increases in social returns from ICT investments as well.[12]

The third feature is related to the diffusion process of ICT adoption. The first type is the diffusion of ICT adoptions along the vertical value chains. The second type is the diffusion of ICT adoptions from specific application areas to general application areas. The first type frequently occurs in e-business applications such as customer relationship management (CRM), supply chain management, and e-procurement systems, while the second type can be seen in convergence applications like m-Banking, e-Commerce, telematics, TPS (Triple Play Service), smart grid, smart work, and smart office.[13]

The last feature is the complementarity property. Bresnahan specified four different kinds of complementarities, which are complementarity over time, complementarity between different ICT systems, convergence of formerly separate kinds of ICT, and finally complementarity over all.[14] All complementarities arise from the feedback system between two interacting objects. Complementarity over time occurs when inventions in applications increase the size of the market for ICT, improving the return to ICT invention, which is subject to considerable increasing returns. The other complementarities are closely related with the convergence ICTs and the convergence applications.

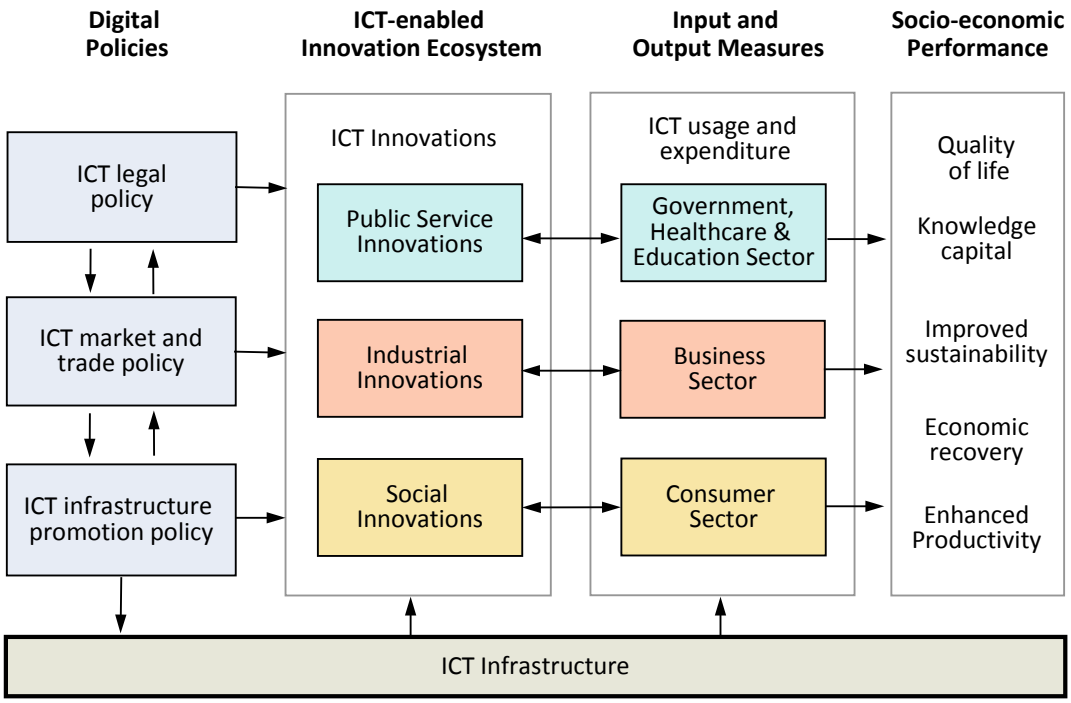
Dedrick's review of the empirical evidence supports this mechanism of ICT's contribution. At both the firm and the economy level, greater investment in ICT is associated with greater productivity growth. At the firm level, the review concludes that the wide range of performance of ICT investments among

different organizations can be explained by complementary investments in organizational capital such as decentralized decision making systems, job training, and business process redesign. ICT is not simply a tool for automating existing processes, but is more importantly an enabler of organizational changes that can lead to additional productivity gains.[15]

Regarding the contribution of ICTs, one needs to pay additional attention to the long-term effect, which is more or less related with intangibles. Corrado, Hulten, and Sichel stated that the fraction of output growth per hour attributable to the old "bricks and mortar" forms of capital investment is very small, accounting for less than 8 percent of total growth. While it is inappropriate to automatically attribute the other 92 percent to "knowledge capital" or "the knowledge economy," it is equally inappropriate to ignore the association between innovation, human capital, and knowledge acquisition, on the one hand, and investments in intangibles, ICT capital, labor quality change, and multifactor productivity on the other.[16] In other words, it is not just the amount of capital that matters, it is the type of capital and the extent to which it is effectively used.[17]

To summarize, ICT is the global economy's strongest enabler of productivity and innovation related to technology, product, market, industry, and society. In this context, digital policy covers all the government-initiated institutional activities which seek to utilize the power of ICT to stimulate and spur innovations in all architectural levels of a national economic system. It should be noted that digital policy acts as a facilitator and an accelerator for the whole innovation process at the national economy level, constituting perhaps the most important part of the overall national innovation system. Figure 4-1 depicts how digital policies stimulate so-called market-based innovation and productivity processes in the market and the society, which leads to better socio-economic performances at the economy level.

Figure 4-1. Digital policies and ICT-enabled national innovation system



Digital policy is an integral of several functional policy components, related with infrastructure, industry promotion, market competition, and the political and legal environment. These policy components altogether govern the key pillars of the ICT ecosystem. They include infrastructure investment, applications and content, markets and competition, policies and regulation, government budgets, and even skills and education for ICT.[18] These pillars, interacting with each other in a national ICT ecosystem, characterize the nature of ICT innovations, which can occur at multiple points within the ICT ecosystem. It is important to again reiterate, however, that ICT policy is not so much concerned with the development of the ICT industry per-se but with the widespread use of ICT throughout all aspects of an economy.

Three categories of ICT-enabled innovations are typical. The first category is social innovations generated by individual ICT users and diverse user communities connected via e-mail, Web, and SNS applications such as café, blog, mini homepage, and Twitter. The second category is industrial innovation, which corresponds to the diverse roles of ICT as an input to organizational and industrial production systems. Fast and decentralized decision-making, business process reengineering, organizational change, global value chain reconfiguration such as outsourcing and off-shoring, and finally strategic use of ICTs are the contents of these innovations. Typical, and essential, areas of application include eco-sustainability, transportation, financial services, wholesale and distribution, telecom, and services. The last category is the public service innovation initiated by public service sector agents such as governments, schools, universities, and medical and healthcare organizations. The most typical applications include e-government, digital libraries, e-learning, e-healthcare, telemedicine, ITS (intelligent transportation systems), smart transport, and smart energy grids.

These innovation activities increase ICT usage and expenditure in the consumer sector, business sector, and government, healthcare, and education sectors, which altogether leads to a significant improvement in targeted socio-economic performances such as enhanced productivity, economic recovery, improved sustainability, knowledge capital, and quality of life.

The following section assesses APEC economies' adoption of effective digital policies toward a sustainable digital and knowledge economy, ranking APEC economies as upper- mid-, or lower-tier.

Assessing APEC Economies' Digital Policies

To assess APEC economies' digital policies and their policy performances in a global digital ecosystem, 34 sub-indicators are grouped into nine core digital policy indicators which fit the ICT-enabled national innovation system structure depicted in Figure 4-1.[19] Table 4-1 displays the nine core digital policy indicators and what sub-indicators they are composed of, with different weights. Of the nine core indicators, the first three—infrastructure access, infrastructure affordability, and ICT policy governance—measure the competitiveness of ICT infrastructure and policy, while the next three—international openness to ICT, ICT market competition level, and ICT trade—specify economies' openness toward international ICT markets and competition. One core digital policy indicator focuses on an economy's legal environment surrounding ICT. The last three measure the sector-specific usage levels of ICT by the public service, business, and consumer sectors. Twenty-five percent of the weight is placed on the competitiveness of ICT infrastructure and policy; 35 percent is weighted on international openness to ICT

markets and 5 percent on market competition levels; 10 percent is weighted on the legal environment surrounding ICT; and the remaining 25 percent is allocated to the sector-specific usage indicators. Economies' scores on digital policy indicators account for 17.5 percent of their aggregate score.

Table 4-1: Digital Policy Indicators

Section	Section Weight	Indicator	Data Type	Source	Indicator Weight
Competitiveness of ICT Infrastructure and Policy	10%	**Infrastructure Access**			
		Broadband Penetration	Subscribers—100 inhabitants	Stats APEC[20]	0.050
		Mobile Network Coverage Rate	% Rate	WEF/NRI (2009) 3.02	0.025
		Internet Access in Schools	Rating	WEF/NRI (2009) 7.06	0.025
	5%	**Infrastructure Affordability**			
		Price basket for residential fixed line	US$/month	World Bank/IFC IC4D	0.017
		Price basket for mobile call	US$/month	World Bank/IFC IC4D	0.017
		Price basket for Internet	US$/month	World Bank/IFC IC4D	0.017
	10%	**ICT Policy Governance**			
		National Broadband Plan	Y/N	Economy Analysis	0.050
		Separate Regulatory Body	Y/N	ITU database	0.020
		Government Prioritization of ICT	Rating	WEF/NRI (2009) 6.01	0.020
		Importance of ICT to Government Vision of the Future	Rating	WEF/NRI (2009) 6.03	0.010
International Openness to ICT and Market Competition	35%	**International Openness to ICT**			
		Tariffs on ICT products	% Rate	WTO Database	0.075
		WTO/ITA	Y/N	Economy Analysis	0.075
		Foreign participation/ownership in telecom sector	% Rate	APEC Investing Across Borders Report	0.050
		Long Distance Termination Charges	US$	US FCC	0.050
		Open Interconnection Agreement	Multiple Y/N	ITU Database	0.050
		Unregulated VoIP	Multiple Y/N	ITU Database	0.050
	5%	**ICT Market Competition Level**			
		International long-distance market competition	C/PC/M*	World Bank/IFC IC4D	0.0125
		Mobile telephone market competition	C/PC/M	World Bank/IFC IC4D	0.0125
		Internet service market competition	C/PC/M	World Bank/IFC IC4D	0.0125
		Fixed line telephone market competition	PB/MX/PV**	World Bank/IFC IC4D	0.0125

Section	Section Weight	Indicator	Data Type	Source	Indicator Weight
LEGAL	10%	**LEGAL ENVIRONMENT**			
		IP, Transparency, Privacy, and Cybercrime	Rating	EIU	0.033
		Laws relating to ICT	Rating	WEF/NRI (2011) 2.02	0.033
		Spam legislation	Y/N	ITU Database	0.033
USAGE	15%	**PUBLIC SECTOR USAGE**			
		Government success in ICT promotion	Rating	WEF/NRI (2011) 9.01	0.030
		ICT use and government efficiency	Rating	WEF/NRI (2011) 9.02	0.030
		Online Service Index	Index	UN e-Government Survey	0.030
		e-Participation Index	Index	WEF/NRI (2011) 9.04	0.030
		Public Service Sector Expenditure	US$/US$GDP	WITSA Global ICT Spending	0.030
	7%	**BUSINESS USAGE**			
		Business Usage	Rating	WEF/NRI (2011) 8.03, 8.07, 8.08	0.040
		Business Sector Expenditure	US$/US$GDP	WITSA Global ICT Spending	0.030
	3%	**INDIVIDUAL USAGE**			
		Individual Usage	Subscribers/100 inhabitants, and Rating	WEF/NRI (2011) 7.05, 7.01, 7.07	0.030

** C: Competition, PC: Partial Competition, M: Monopoly*

*** PB: Public, MX: Mixed, PV: Private*

Table 4-2: Rank of APEC Economies on Digital Policy Indicator (in alphabetical order)

Tier	APEC Economy
Upper-Tier	Australia Canada Chinese Taipei Hong Kong Japan Korea New Zealand Singapore United States

Tier	APEC Economy
Mid-Tier	Chile China Malaysia Peru

Tier	APEC Economy
Lower-Tier	Brunei Indonesia Mexico Papua New Guinea Philippines Russia Thailand Vietnam

Evaluating APEC economies' overall performances on digital policies, Australia, Canada, Chinese Taipei, Hong Kong, Japan, Korea, New Zealand, Singapore, and the United States are in the upper-tier; Chile, China, Malaysia, and Peru are mid-tier economies; and Brunei, Indonesia, Mexico, Papua New Guinea, the Philippines, Russia, Thailand, and Vietnam are in the lower-tier, as shown in Table 4-2.

Competitiveness of ICT Infrastructure and Policy

Recent research by Katz indicates that the impact of broadband on the economy is clear, but only becomes significantly so under certain conditions.[21] These include:

- Higher adoption rate of the technology amplifies the impact.
- The impact is stronger in sectors with high transaction costs or high labor intensity.
- In less developed regions, broadband enables the adoption of more efficient business processes.
- The impact of broadband on small and medium enterprises takes longer to materialize.
- The impact is higher when promotion of the technology is combined with stimulus of innovative businesses that are tied to new applications.

This underlines the importance of implementing public policies not only in the areas of telecommunications regulation, but also in education, economic development and planning, science and technology, and others, reflecting the key features of market-based public policies.[22] The effectiveness of market-based public policies in the area of ICT infrastructure can be evaluated in view of access, affordability, and policy governance. These three pillars, when put together in a well-coordinated manner, contribute to the global competitiveness of ICT infrastructure and policy for an economy.

Access and Affordability

Access usually refers to the quality, coverage, and penetration of the target service of our interest. In our case, access measures broadband penetration, mobile network coverage, and Internet access in schools. Table 4-3 shows the actual values of the access indicators for APEC economies.

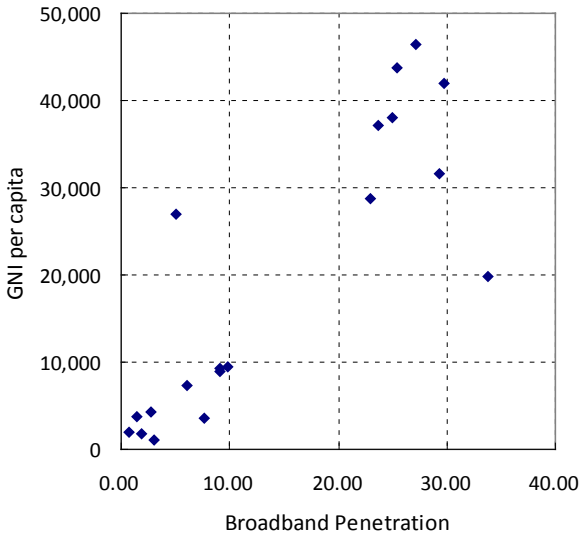
Table 4-3: Infrastructure Access

APEC Economy	Broadband Penetration (Subscriptions per 100 inhabitants)	Mobile Network Coverage (%)	Internet Access in Schools (7=Best; 1=Worst)
Korea	33.8	99.9	6.04
Canada	29.7	99.0	5.95
Hong Kong	29.3	100.0	6.10
United States	27.1	99.6	5.89
Australia	25.4	99.0	5.46
Singapore	23.7	100.0	6.21
Japan	24.9	99.9	4.87

APEC Economy	Broadband Penetration (Subscriptions per 100 inhabitants)	Mobile Network Coverage (%)	Internet Access in Schools (7=Best; 1=Worst)
New Zealand	23.0	97.0	5.75
Chinese Taipei	21.6	100.0	6.11
Chile	9.8	100.0	4.70
Russia	9.2	95.0	4.12
China	7.7	99.5	5.72
Mexico	9.1	99.9	3.46
Malaysia	6.1	95.0	4.96
Brunei	5.0	N/A	4.92
Peru	2.8	95.6	3.94
Vietnam	3.0	70.0	4.53
Philippines	1.9	99.0	3.71
Indonesia	0.7	90.0	4.51
Thailand	1.5	37.8	4.65
Papua New Guinea	N/A	N/A	N/A
APEC Average	**14.8**	**93.5**	**5.08**

Broadband penetration is seemingly dependent on the income level, showing a significant difference between the high-income group and the other middle- and lower-income group. Figure 4-2 shows an empirical evidence of this observation. The high-income group average is 26.5 broadband subscribers per 100 inhabitants, while the middle- and lower-income group average is 5.2. However, broadband penetration is not necessarily a function of income levels. Korea showed the best broadband penetration of 33.8 subscribers per 100 inhabitants despite having the lowest GNI per capita, $19,830, among the high-income economies. Among this high-income group, Canada and Hong Kong demonstrated quite remarkable broadband penetration rates, 29.7 and 29.3, as well. In contrast to these economies, Brunei showed a poor broadband penetration rate of 5.0 subscribers per 100 inhabitants despite its high income level of GNI per capita, $27,050.

Figure 4-2: GNI per capita and Broadband Penetration in APEC Economies



As already discussed in the introduction section, broadband penetration is quite closely related with the growth of a national economy. In this sense, it could be used as a growth engine, especially for developing economies. As for Internet penetration (though not necessarily of broadband Internet), Russia showed the most remarkable growth, from 0.3 to 62.1 subscribers per 100 inhabitants during the period 2000-2009. Malaysia, China, Chile, and Mexico followed with growths from 7.1 to 20.4, from 0.7 to 11.4, from 3.8 to 9.8, and from 1.2 to 9.6, respectively, during the same period. The broadband focus, in terms of broadband as a percentage of total Internet subscriptions, is particularly high in Chile (99.7 percent) and Mexico (96.2 percent) and to a somewhat lesser extent in Indonesia (57.5 percent), Peru (47.1 percent), and China (44.2 percent).[23]

The other access components provide some supplementary views on ICT trends and requirements. By Sundberg's study, the mobile market is reaching saturation levels; on average, there were 116 subscriptions per 100 inhabitants at the end of 2010 and a marginal growth of 1.6 percent from 2009-2010. At the same time, the developing world is increasing its share of mobile subscriptions and reached an estimated 68 percent of global total mobile subscriptions at the end of 2010.[24] This is also the case for APEC economies, and the mobile network coverage data shown in Table 4-3 partially supports this trend. Policymakers in Mexico, Peru, and the Philippines should focus on increasing Internet access in schools.

Table 4-4: Infrastructure Affordability

APEC Economy	Overall Affordability (Rating 1~10)	Residential Fixed-line Tariff (US$/month)	Mobile Cellular Prepaid Tariff (US$/month)	Fixed Broadband Internet Access Tariff (US$/month)
Canada	10	18.3	17.7	24.8
Hong Kong	10	7.1	0.8	12.8
Korea	10	5.2	12.2	25.3
Singapore	10	7.7	3.9	16.7

APEC Economy	Overall Affordability (Rating 1~10)	Residential Fixed-line Tariff (US$/month)	Mobile Cellular Prepaid Tariff (US$/month)	Fixed Broadband Internet Access Tariff (US$/month)
United States	10	12.8	15.3	20.0
Australia	9	26.0	34.9	26.0
Japan	9	22.8	44.3	37.4
New Zealand	9	33.1	27.9	28.5
China	8	2.3	3.7	17.6
Malaysia	8	4.8	4.9	19.0
Chile	7	23.6	10.2	48.1
Mexico	7	17.3	8.6	16.2
Russia	7	5.4	5.8	13.3
Thailand	7	8.3	2.4	18.8
Indonesia	5	5.6	2.8	20.8
Philippines	5	15.9	6.2	21.5
Peru	4	14.3	8.9	36.5
Vietnam	4	2.1	3.2	15.4
Papua New Guinea	3	4.0	17.8	141.8
Brunei	N/A	N/A	N/A	N/A
Chinese Taipei	N/A	N/A	N/A	N/A
APEC Average	**7.5**	**12.4**	**12.2**	**29.5**

Affordability reflects the cost of ICT services, which is affected by the level of competition in a market, its maturity, user uptake, and prices. Three markets of residential fixed-line, mobile cellular prepaid, and fixed broadband Internet access service were evaluated to measure the overall affordability of ICT infrastructure, as Table 4-4 shows. In the evaluation, the income effect was excluded by calculating the price basket in percent of monthly GNI per capita.[25]

Based on Sundberg's analysis on the 2009 ITU ICT Price Basket, citizens in developed economies spend relatively less of their income (1.5 percent) on ICT services compared to citizens in developing economies (17.5 percent), which means ICT services tend to be more affordable in developed economies and less affordable in developing economies.[26] The income effect is definitely clear, but still the impact of other factors like market competition is not negligible. In Mexico, after competition in fixed broadband services began in 2006, the price of a fixed broadband monthly subscription dropped by almost 60 percent between 2008 and 2009, from $40.19 to $18.47, representing, at the end of 2009, 2 percent of the average GDP per capita. Over that same period, the number of fixed broadband subscriptions increased by 29 percent to reach 9.7 million.[27]

Policy Governance

Leadership in infrastructure policy is not solely a result of good broadband policy, but of a collaborative set of diverse public policies, including articulating a national broadband plan, governance of the regulatory body, government's leadership, and regulatory certainty. Table 4-5 shows the ICT policy governance of APEC economies in terms of the availability of a national broadband plan, separate regulatory body, and government's prioritization and vision on ICT.

Table 4-5: ICT Policy Governance and Vision

APEC Economy	National Broadband Plan (Y=1/N=0)	Separate Regulatory Body (Y=1/N=0	Government's Prioritization on ICT (7=Best; 1=Worst)	Importance of ICT to Government's Vision (7=Best; 1=Worst)
Singapore	1	1	6.38	6.16
Chinese Taipei	N/A	N/A	6.03	5.39
Malaysia	1	1	5.76	5.13
New Zealand	1	1	5.71	4.96
Korea	1	1	5.56	4.95
United States	1	1	5.54	4.79
Australia	1	1	5.28	4.98
Canada	1	1	5.35	4.71
Japan	1	1	5.18	4.48
Chile	1	1	4.96	4.64
Brunei	N/A	1	5.31	4.62
Thailand	1	1	4.50	3.98
Peru	1	1	4.05	3.45
Philippines	1	1	4.06	3.36
Indonesia	N/A	1	4.66	4.09
China	1	0	5.58	5.06
Hong Kong	0	1	5.39	5.12
Russia	N/A	0	4.51	3.50
Mexico	0	1	3.97	3.74
Vietnam	0	0	5.54	4.72
Papua New Guinea	N/A	1	N/A	N/A
APEC Average			**5.2**	**4.6**

Among the policy governance measures, the most important are articulating and implementing a national broadband plan concomitant with making the requisite investments to R&D in ICT, network upgrades, and universal service. Many APEC economies have been implementing or preparing national broadband

plans, with different scopes and policy targets. Table 4-6 summarizes typical broadband targets for some APEC economies.[28]

Table 4-6: Broadband Targets of APEC Economies

APEC Economy	Commitment
Australia	By 2021, the target coverage of national broadband network is: 100% of premises, 93% of homes, schools, and businesses at up to 100Mbps over fiber & remainder at up to 12 Mbps over next generation wireless and satellite.
Chile	By 2011, to provide Internet access to 3 million rural households. By 2014, 100% of school and 70% households to have broadband. By 2018, 100% of households.
China	By 2014, to raise broadband accessibility to 45% of the population.
Japan	By 2015, fiber optic highways will be completed enabling every household to enjoy a broadband service.
Korea	By 2010, to provide broadband multi-media services to 12 million households and 23 million wireless subscribers. By 2012, to raise average speeds to 10 Mbps with a maximum of 1 Gbps.
Malaysia	By 2010, 50% household penetration with higher speeds of more than 10 Mbps. (As of Q4 2009, household broadband subscription rate is 31.7%).
Mexico	By 2012, 22% broadband penetration.
New Zealand	By 2019, ultra-fast broadband to 75% of New Zealanders. By 2015, 80% of rural households to have speeds of at least 5 Mbps, with the remainder to achieve speeds of at least 1 Mbps.
Russia	By 2010, to have 15 lines per 100 population. By 2015, to have 35 lines per 100 population.
Singapore	Coverage of the fiber-based Next Generation Nationwide Broadband Network (Next Gen NBN) is targeted to reach 95% nationwide by mid-2012. Universal service obligations for the Next Gen NBN take effect from January, 2013. The Next Gen NBN will deliver downlink access speeds of 100 Mbps, scalable to 1Gbps or more. Similarly, it will provide for uplink access speeds from 50 Mbps per end-user connection.
United States	By 2010, at least 100 million homes should have affordable access to actual download speeds of at least 100 Mbps and actual upload speeds of at least 50 Mbps. By 2020, every household should have access to real download speeds of 4 Mbps and upload speeds of 1 Mbps.

In order to achieve these targets, most APEC economies recognize the necessity of policy coordination between the national broadband plan and the other related policy areas such as universal service, competition and regulation, research and development, and national informatization plan. Even with higher broadband access rates, for example, high broadband adoption gaps remain in many economies, including a 20 percent gap in Australia and a 31 percent gap in the United States.[29] But even in the United States, universal broadband access is still not available. The United States' National Broadband Plan dealt with this issue in a most comprehensive manner by specifying detailed measures for ensuring universal access to broadband network services. These include the creation of the CAF (Connect America Fund), the MF (Mobility Fund), and inter-carrier compensation reform in a tax-efficient manner.

Regarding competition and regulation, Australia and New Zealand have reconsidered their legal and regulatory frameworks as part of their national broadband network projects. The Australian Parliament has recently passed the Telecommunications Legislation Amendment (Competition and Consumer Safeguards) Act to make significant detailed changes. In New Zealand, a number of measures have been introduced by the government and by the Commerce Commission to support the deployment of fiber to the premises, including the continuing use of operational separation.[30] This is also the case in the United States, which adopted competition guidelines to collect, analyze, benchmark, and publish detailed, market-by-market information on broadband pricing and competition and also developed disclosure requirements for broadband service providers.[31]

Ultra-broadband plans, for wired or wireless, represent more futuristic plans, which have some strategic implications on national R&D as well. Korea' BcN, Giga-Internet, IP-USN (Ubiquitous Sensor Network), and recent Ultra-broadband Smart Network idea reflect this recent trend in national broadband plans.[32] Japan's NWGN (New Generation Network) and Singapore's NGNBN (Next Generation Nationwide Broadband Network) also belong to this category. Japan's NWGN is an emergent research target which shall resolve problems on the existing networks and will be introduced by around 2020.[33] Singapore's Next Generation Nationwide Broadband Network targets fiber to the home and business premises (FTTH and FTTB), enabling down- and up-link bandwidth of 1 Gbps, with nationwide coverage of 95 percent expected by mid-2012. The plan was designed to have layered structure to achieve open access, having three tiers of market players: passive infrastructure operator, active infrastructure operator, and retail service providers. The market principle is non-discriminatory access and pricing.[34]

Recently, the Korean government established a comprehensive set of national broadband plans in the framework of its national informatization plan.[35] It includes upgraded versions of Korea's IT-839, BcN, Giga-Internet, IP-USN, and e-Government strategies. Two new plans were added: one is the R&D plan for future Internet or future network, and the other is the National Development Strategy for a Smart Society. The former was announced by the Korea Communications Commission (KCC) in July 2011, while the latter, prepared by the Presidential Council on Informatization Strategies, is now under open review. It contains a high-level government vision on the future smart society, along with some practical strategic targets related to universal healthcare, secure living environments, smart work platforms, open platforms for SMEs, a new IT culture, international cooperation through ICT, open platforms for content creation, smart learning, government as a platform (GAS), nationwide implementation of cloud services, and the design of a future ultra-broadband smart network.[36]

Even with these aggressive national broadband plans, the challenges APEC economies face in coming years remain complex.[37] One of the most important challenges relates to spectrum reform. In most APEC economies there has been exponential growth in both the number of mobile cellular subscriptions and the availability of mobile broadband services. The ongoing deployment of higher speed 4G mobile broadband networks such as WIMAX, HSPA+, and LTE systems will certainly contribute to greater levels of mobile broadband services as well as mobile content and applications delivered over smart phones.[38] Some economies have taken or are planning to take measures to free up more spectrum for wireless broadband. For example, regulatory measures taken in the United States and Korea such as spectrum repurposing and

the licensing of 4G LTE services will also contribute to accelerating the growth of mobile broadband penetration.

We recommend that lower-tier economies participate in discussion forums for continuous assessing and monitoring of the cutting-edge innovative regulatory tools and best practices that leader economies have explored in the hope of surmounting the challenges. In this regard, the latest institutional and regulatory trends indicated by Sundberg are worth noting for all regulators and policymakers in APEC economies.[39] They include:

- Reforming the ICT sector in an economy-specific framework of change management.
- Establishing a separate telecom/ICT regulator. Among 21 APEC economies investigated, China, Hong Kong, Russia, and Vietnam have no separate entity for ICT regulation and policy.[40]
- Extending telecom/ICT policy beyond the traditional core areas to include broadcasting content, Internet content, and cybersecurity, and green IT policies for climate change.
- Setting clear dispute resolution mechanisms in a regulatory framework.
- Aggressively reforming the spectrum allocation process more toward market-based allocation.

International Openness to ICT Market and Competition

Recently, market-based (that is to say, market demand-led) innovation approaches attracted much attention from industry after the U.S. government announced a strategy for American innovation which recommends promoting market-based innovations.[41] However, in academia, much research effort has already been paid to the pros and cons of demand-led innovations as compared to technology-based innovations. (This is the classic technology-push vs. customer-pull conundrum). Market-based innovations often use simpler new technology and sometimes can be new ideas about business operations. They are designed for new or emerging markets and offer benefits that new customer segments value. They sometimes disrupt the existing customer-preference structure by introducing new benefit dimensions.[42]

Market policy is a core component of a market-based national innovation system. Given that digital content and ICT services markets are already integrated into a single global market, local or national markets need to be equipped with diverse visible and invisible resources, a large pool of suppliers and buyers (not necessarily local), and also strategic partners all over the world collaborating within a value chain. In this sense, international openness to ICT in terms of visible or invisible barriers, tariffs, and trade communities like WTO/ITA is becoming more and more important as a market policy tool. These market environments, along with the size of ICT trade and the ICT market structure, determine the global market competitiveness for an economy. Three core policy indicators are measured and discussed in relation to international openness to ICT markets and competition. They are international openness to ICT, market competition levels, and ICT trade.

International Openness to ICT

The performance of market-based innovation is quite closely related with international openness to ICT, especially in a global ICT and ICT application market. If some core technologies and ICT resources are constrained or barred from flowing freely over national borders, the input package for the production system cannot be optimized, degrading the overall performance of the national innovation and production system. Two categories of goods should be differentiated. One is the tangible ICT products, while the other is the intangible ICT services and digital products like digital content and software. In this context, tariffs on tangible ICT products are discussed first and invisible barriers in the form of ownership, price, and interconnection regulations are dealt with next.

A number of APEC economies continue to place high tariffs on information and communications technology products. For instance, despite the fact that China has agreed to enter the WTO's Information Technology Agreement (ITA), it places 30 percent tariffs on magnetic tape-type video recording or reproducing apparatus and 24.5 percent on monitors.[43] Brunei imposes duties of 20 percent on printed circuit boards and machines and apparatus for the manufacture of flat panel displays. Malaysia imposes duties of 25 percent on all monitors not incorporating television reception apparatus. Vietnam places maximum ad valorem duties of 27 percent on video recording or reproducing apparatus, 14 percent on television cameras, digital cameras, and video recorders, and 13 percent on monitors. Chile imposes maximum ad valorem duties of 6 percent and Peru 9 percent across a wide range of ICT products.[44]

Table 4-7 shows APEC economy tariffs on a basket of imported ICT products—including tariffs on printed circuit boards; mobile telephones; monitors (excluding television apparatus); printers, copiers, and fax machines; and television cameras, digital cameras, and video camera recorders—as well as an average ICT tariff calculated as the average tariff on those five categories of ICT products. Hong Kong, Japan, Papua New Guinea, and Singapore impose no tariffs on this basket of ICT products, while New Zealand, Australia, and the United States impose nominal tariffs of less than 1 percent. APEC economies imposed an average tariff of 3.5 percent on this basket of ICT products. Chile, Vietnam, China, Brunei, and Russia place the highest tariffs on this basket of ICT products.

Table 4-7: Tariffs on a Basket of Imported ICT Products (%)[45]

APEC Economy	Average	Printed Circuit Boards	Mobile Telephones	Monitors	Printers, Copiers, and Fax Machines	Television/ Digital Cameras, & Video Recorders
Hong Kong	0.0	0.0	0.0	0.0	0.0	0.0
Japan	0.0	0.0	0.0	0.0	0.0	0.0
Papua New Guinea	0.0	0.0	0.0	0.0	0.0	0.0
Singapore	0.0	0.0	0.0	0.0	0.0	0.0
New Zealand	0.3	0.0	0.0	0.0	1.7	0.0
Australia	0.7	0.0	0.0	0.0	0.0	3.3
United States	0.8	0.0	0.0	2.1	0.0	1.7
Canada	1.0	0.0	0.0	5.0	0.0	0.0

APEC Economy	Average	Printed Circuit Boards	Mobile Telephones	Monitors	Printers, Copiers, and Fax Machines	Television/ Digital Cameras, & Video Recorders
Peru	1.8	0.0	0.0	9.0	0.0	0.0
Chinese Taipei	2.4	0.0	0.0	8.8	0.0	3.3
Korea	2.8	0.0	0.0	8.0	1.8	4.0
Mexico	2.8	0.0	0.0	14.0	0.0	0.0
Indonesia	4.2	0.0	0.0	15.0	0.0	6.0
Philippines	4.3	0.0	0.0	15.0	0.4	2.3
Malaysia	5.0	0.0	0.0	25.0	0.0	0.0
Thailand	5.7	0.0	0.0	20.0	6.0	2.3
Chile	6.0	6.0	6.0	6.0	6.0	6.0
Vietnam	7.1	0.0	6.0	13.0	2.5	14.0
China	7.2	0.0	0.0	24.5	6.0	5.7
Brunei	9.0	20.0	5.0	5.0	10.0	5.0
Russia	12.5	15.0	N/A	10.0	N/A	N/A
APEC Average	**3.5**	**2.0**	**0.9**	**8.6**	**1.7**	**2.7**

Such high tariffs on advanced technology products only serve to damage these economies, causing other sectors to suffer. For example, for every $1 of tariffs India imposed on imported ICT products, it suffered an economic loss of $1.30 due to spillover effects.[46] As Kaushik and Singh found with regard to their study of ICT adoption in India, high tariffs did not create a competitive domestic [hardware] industry, but they did limit adoption of ICT in India by keeping prices high.[47] Argentina encountered a similar experience when it imposed tariffs on assembled computers, though not on computer parts, with the goal of creating a domestic computer assembly industry. The result was actually to create an inefficient computer industry, where up to one-third of computers sold in Argentina are hand-assembled in small shops. Such policies have only served to raise the price of computing technology in Argentina, hurting all sectors of its economy. Thus, tariffs are particularly pernicious when applied to ICTs, hurting the nations that impose them by raising the cost of ICT goods and services, thus causing businesses (and individuals) to invest less in ICT and thus lowering their productivity. The economic price to such economies can be steep. For instance, Mann finds that the globalization of ICT hardware resulted in ICT prices some 10 to 30 percent lower than they would have been based on domestic production and domestic technological advances alone in the United States in the 1990s, which could have made U.S. GDP some $250 billion higher over the 1995 to 2000 period than it would have been had there been no globalization of IT hardware.[48]

As for the invisible barriers on ICT, four measures are of interest for our analysis. The first is related to the market accessibility of the telecom sector, which can be measured by examining the maximum foreign participation or ownership allowed in a country's telecom sector. The second and the third are associated

with bilateral agreements in interconnection between two economies. High long distance termination charges play the same role in international settlement markets as high tariffs do in ICT commodity markets. Meanwhile, interconnection agreements can be regulated to drive toward open interconnections. The highest openness is achieved when the agreement itself is made public, price made public, and a Reference Interconnection Offer (RIP) required. In Table 4-8, the number 3 is assigned when all three conditions are met, while lower numbers indicate that conditions are only partially met or never met. The last measure, unregulated VoIP, specifies the scope of services for which VoIP is allowed. Since VoIP is in nature a global service, a larger scope corresponds to a higher openness. Five categories of services, PC-to-PC, PC-to-phone, phone-to-phone, VoIP over private network, and voice-over-broadband were investigated as to whether VoIP is allowed or not. The greater the scope of VoIP allowed, the larger the indicator for measuring the unregulated VoIP. Economies' score on the Unregulated VoIP indicator counts how many of those five types of VoIP services a country allows (implying a maximum score of 5 and least score of 0).

Table 4-8: Open Access Policy for Telecom Market

APEC Economy	Foreign Equity Ownership Index, Telecommunications[49]	Long Distance Termination Charges (US$)	Open Interconnection Agreement (Multiple Y/N)	Unregulated VoIP (Multiple Y/N)
Singapore	100.0	0.01	3	5
Canada	46.7	0.01	3	5
Chile	100.0	0.06	2	5
Japan	88.3	0.07	3	4
Korea	49.0	0.04	2	5
United States	100.0	0.01	3	5
Peru	100.0	0.02	3	N/A
Australia	63.2	0.03	1	2
Malaysia	39.5	0.03	3	3
New Zealand	100.0	0.06	N/A	3
China	49.0	0.02	2	1
Mexico	74.5	0.04	0	2
Brunei	49.0	0.03	N/A	1
Thailand	49.0	0.02	3	0
Vietnam	50.0	0.05	2	1
Hong Kong	100.0	0.01	2	5
Indonesia	57.0	0.05	1	0
Philippines	40.0	0.12	1	N/A
Russia	100.0	0.04	N/A	N/A

APEC Economy	Foreign Equity Ownership Index, Telecommunications[49]	Long Distance Termination Charges (US$)	Open Interconnection Agreement (Multiple Y/N)	Unregulated VoIP (Multiple Y/N)
Chinese Taipei	58.8	0.05	N/A	N/A
Papua New Guinea	N/A	N/A	N/A	N/A
APEC Average	**71.6**	**.038**	**-**	**-**

According to Table 4-8, the telecom sector is fully opened to foreign participation or ownership in Chile, Hong Kong, New Zealand, Peru, Russia, Singapore, and the United States. Japan also allows a relatively high level of foreign ownership in the telecom sector, registering a 88.3 percent score in APEC's *Investing Across Borders* report. APEC economies' average score in the reports' Foreign Equity Ownership Index for the telecommunications sector is 71.6. Mexico, scoring a 74.5 on the telecommunications Foreign Equity Ownership Index, is the only other APEC economy to score above the APEC average.

In view of the other intangible regulatory barriers, still the upper-tier and mid-tier groups in overall performance in digital policies show a higher openness to international interconnection of ICT services. Among the mid-tier and lower-tier economies, Chile, Malaysia, and Peru seem to have a generally open policy toward ICT service markets, while the others still show resistance to openness to varying degrees.

Market Competition Level

The most common types of telecom reform include privatizing the national telecommunications providers and liberalizing the markets. In terms of these two types of telecom reform, most of the APEC economies have made substantial progress since the late 1990s. As can be seen in Table 4-9, the main fixed-line telephone operator was at least partially or fully privatized in 16 economies out of 19 economies investigated. A national telephone operator persists only in Brunei, Papua New Guinea, and Thailand. Regarding market liberalization, it seems that considerable efforts have been made to foster competition since even before 2000. In most APEC economies, the market structure as of 2009 can be seen as similar to the early 2000s. The only exceptions can be found in Malaysia and Thailand, but still with only minor structural changes. In Thailand, the international long distance market transformed from monopoly to competition during this period. In Malaysia, international long distance service and mobile telephone services transformed from partial competition to full competition. As briefly noted, market liberalization is a direct policy tool to foster competition, which in turn contributes to better affordability and wider penetration of ICT services. But relating market structure to ICT affordability directly, we see that market competition level serves as a necessary condition for good ICT service affordability. In other words, market competition alone cannot guarantee affordability of ICT services.

Regarding the impact of telecom reform on technology adoption, Howard and Mazaheri found that privatizing only has a few limited demonstrative effects while liberalizing the market, when combined with implementing an independent telecom regulator, forms the most constructive policies for encouraging technology adoption.[50] The implication on the global ICT market is clear. Market

liberalization and market openness policy will foster global market competition in ICTs and will increase the efficiency of the market, stimulating the diffusion of innovations throughout the world via strategic alliances or mergers and acquisitions (M&As) among international players. This of course will contribute to better affordability of various ICT services across national borders.

Table 4-9: Market Competition Level

APEC Economy	International Long-distance Market*	Mobile Telephone Market*	Internet Service Market*	Main Fixed-line Telephone Operator**
Canada	C	C	C	PV
Chile	C	C	C	PV
Japan	C	C	C	PV
Korea	C	C	C	PV
Mexico	C	C	C	PV
New Zealand	C	C	C	PV
Peru	C	C	C	PV
Philippines	C	C	C	PV
United States	C	C	C	PV
Australia	C	C	C	MX
Malaysia	C	C	C	MX
Singapore	C	C	C	PV
Vietnam	C	C	C	MX
Indonesia	PC	C	C	MX
Thailand	C	C	C	PB
Russia	PC	C	N/A	MX
China	PC	PC	C	MX
Brunei	PC	M	PC	PB
Papua New Guinea	M	M	PC	PB
Hong Kong	C	C	C	PV
Chinese Taipei	N/A	N/A	N/A	N/A

* C: Competition, PC: Partial competition, M: Monopoly
** PB: Public, MX: Mixed, PV: Private

Legal Environment

For economies, legal policy—even narrowly restricted to ICT-related areas—has diverse challenges, issues, and requirements regarding human rights and responsibilities as a member of the digital knowledge economy. Three sub-measures are considered, as Table 4-10 shows: EIU's legal environment,

WEF's political and regulatory framework, and the existence of spam legislation. EIU's measure focuses on comprehensiveness, transparency, and enforcement of IP legislation, data privacy, anti-spam, and cybercrime laws,[51] while WEF measures the effectiveness and efficiency of ICT-related legal systems.[52]

Table 4-10: Legal Environment Relating to ICT

APEC Economy	IP, Transparency, Privacy and Cyber-Crime (100=Best;1=Worst)	Laws Relating to ICT (7=Worst;1=Best)	Spam Legislation (Y=1/N=0)
United States	92.0	5.39	1
Australia	90.5	5.48	1
New Zealand	80.0	5.53	N/A
Japan	79.0	4.75	1
Singapore	81.5	5.91	1
Canada	82.0	5.49	0
Chinese Taipei	73.5	5.32	N/A
Korea	67.0	5.10	1
Hong Kong	80.0	5.54	1
Chile	69.0	4.96	1
Malaysia	54.0	5.08	N/A
China	59.5	4.38	1
Peru	48.5	3.79	1
Mexico	58.0	3.90	0
Philippines	50.5	3.55	N/A
Russia	42.0	3.48	N/A
Brunei	N/A	3.98	0
Thailand	43.5	3.85	N/A
Vietnam	47.0	3.97	0
Indonesia	47.0	3.91	0
Papua New Guinea	N/A	N/A	N/A
APEC Average	**65.5**	**4.7**	**-**

From the assessment of APEC economies in view of these three legal environment measures, we find that Australia, Japan, New Zealand, Singapore, and the United States are leaders; Canada, Chile, Chinese Taipei, Hong Kong, Korea, and Malaysia are mid-tier; and Brunei, China, Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam are in the lower-tier. Since the first two sub-indicators use survey data, the evaluation on these two measures is basically perceptional, with small discrepancies between economies, especially for the second measure. For the first measure, however, the

difference between economies is clear. In view of IP, Transparency, Privacy and Cybercrime, the United States and Australia show an excellent record. The second-tier economies appeared to be Canada, Japan, Hong Kong, New Zealand, and Singapore. The third-tier economies are Chile, Chinese Taipei, and Korea.

Privacy and trust in electronic communications is another essential area in legal policy. Spam legislation must be a component of privacy and trust policy. The arrangements that seek to protect individuals' privacy vary considerably across economies, yet the best economies employ a holistic approach to ensuring individual's digital privacy. In many, legal arrangements often interact with self-regulatory and co-regulatory schemes. Individual rights might be enforced by a government Data Protection Authority, by the individual, or by industry self-regulatory and co-regulatory arrangements.[53]

From the case studies on Europe, Japan, Korea, India, Malaysia, and the United States, a number of policy recommendations were derived, which surely provide insight into mechanisms that seem to be effective for the APEC economies as well:[54]

- The economies that enact comprehensive data protection laws (as is Europe and in Japan) can potentially achieve more consistent and coherent privacy protection.
- Co-regulatory and self-regulatory arrangements are recommended. Particularly instructive is the use of the Children's Online Privacy Protection Act in the United States, where the FTC can designate industry association guidelines as providing safe harbor to firms that collect personal data.
- Penalties for taking insufficient care with personal data must be sufficient to motivate proper behavior.
- Notification to authorities or to impacted individuals whenever personal information is inappropriately disclosed to third parties is required by law.

Usage

As outlined in Figure 4-1, usage must be a concrete measure for evaluating the performance of digital policies. If an economy outperforms on this measure, the implication is that the economy has a better position, better potential, and better opportunities to accomplish the goals of enhanced productivity, economic recovery, improved sustainability, excellent knowledge capital, and better quality of life. This is the way digital policies contribute to the national economy and the well-being of APEC's citizens. Thus, usage is one of the most direct and powerful measures that help assess the performance of digital policies for an economy. Usage by three demand sectors—public sector, business, and individual—were investigated in view of adoption and expenditure.

Public Sector Usage

The usage measures for the public sector reflect survey data on governments' success in ICT promotion; ICT use; a government online service index and e-participation index; and also a quantitative measure of the public service spending per GDP, where public service includes government service, healthcare, and education. The assessment result is summarized in Table 4-11.

Table 4-11: Public Sector Usage and Expenditure

APEC Economy	Gov't Success in ICT Promotion (7=Best;1=Worst)	ICT Use and Government Efficiency (7=Best;1=Worst)	Online Service Index (1=Best;0=Worst)	e-Participation Index (1=Best;0=Worst)	Public Service Sector Expenditure, share of GDP (%)
United States	5.19	5.08	0.3184	0.76	1.57%
Korea	5.25	5.73	0.3400	1.00	0.75%
Canada	4.99	5.28	0.3001	0.73	1.02%
Australia	4.89	4.95	0.2601	0.91	0.72%
Malaysia	5.30	5.37	0.2148	0.66	1.02%
Singapore	6.22	6.15	0.2331	0.69	0.49%
Hong Kong	5.16	5.54	N/A	N/A	0.96%
Chinese Taipei	5.79	5.74	N/A	N/A	0.85%
Japan	4.48	4.28	0.2288	0.76	0.71%
New Zealand	4.41	5.18	0.2170	0.77	0.55%
Chile	4.46	5.49	0.2072	0.34	0.38%
China	5.27	5.03	0.1252	0.37	0.47%
Mexico	3.83	4.19	0.1500	0.37	0.30%
Philippines	3.79	3.56	0.1338	0.19	0.66%
Brunei	5.00	4.62	0.0961	0.17	N/A
Thailand	4.59	4.52	0.1133	0.09	0.51%
Peru	3.69	4.29	0.1392	0.17	0.35%
Russia	3.76	3.70	0.1123	0.13	0.40%
Vietnam	4.47	4.64	0.1036	0.09	0.25%
Indonesia	4.34	4.23	0.0831	0.13	0.26%
Papua New Guinea	N/A	N/A	0.0248	0.01	N/A
APEC Average	**4.74**	**4.89**	**.18**	**.44**	**0.64%**

As Table 4-11 shows, Singapore performs best in view of the first two WEF NRI measures, while Korea shows an outstanding performance in both the UN's online service index and e-Participation Index. In view of the public sector expenditure per GDP, which measures a share of ICT spending in government, healthcare, and education sectors as compared to GDP, the United States outperforms all APEC economies. This reflects the global competitiveness of public service sectors in the United States in terms of the GDP contribution to the national economy, the size of the budget in government services, and the ICT investment relative to the amount of public services.

ICT usage in the public service sector is closely related to national e-government initiatives. Many leading economies recognize ICT as a useful tool that can enable public agencies to change from routine-

based, command-and-control organizations that are inwardly focused on administration to knowledge-based, networked, learning organizations that are externally focused on service. The Korean government's KONEPS (e-procurement), UNI-PASS (online customs service), Home Tax Service, and e-People are good examples of creative e-government services.[55] This shift requires changes not only in front-end transactions and delivery of services to clients but also in integration and reengineering of back-end and core business processes in and across government agencies.[56] According to the UN's e-Government survey 2010, Korea, the United States, Canada, Australia, Singapore, New Zealand, and Japan are listed among the world top-20 economies in e-government development. The evaluations on the other APEC economies are: Chile (34), Mexico (56), Peru (63), Malaysia (32), China (72), Brunei (68), Thailand (76), the Philippines (78), Vietnam (90), and Indonesia (109).

According to Hanna et al. (2010), developing e-government is a process, not a product or a blueprint. It is a continuous process of policy development, investment planning, innovation, learning, and change management. The challenge is to build effective governance and institutional frameworks for ICT-enabled public sector modernization and make the new competencies part of the economy's human and institutional resources.[57] In this sense, regardless of the UN's e-government ranking, many APEC economies have implemented promising efforts to establish strong e-government institutions. Australia, Canada, Chile, China, Japan, Hong Kong, Korea, Mexico, Russia, Singapore, Thailand, the United States, and Vietnam have formed steering/inter-ministerial committees. Also, two or more facilitators of e-government implementation among ministries of ICT, ICT agencies, CIO councils, or PPP/quasi-public ICT agencies were taken by Australia, Canada, Korea, Mexico, Singapore and one facilitator was taken by economies such as Chile, China, Japan, Thailand, the United States, and Vietnam.[58]

Business Usage

Business sector usage reflects firm-level use of Internet and IT-enabled innovations in business. The use of Internet includes Internet access, broadband use, Web presence and Internet commerce. Likewise, ICT-enabled innovations include development of new services and products, establishment of new operational processes and organizational changes. They were measured using the first three indicators shown in Table 4-12. Meanwhile, business sector expenditure measures industry spending per GDP. The industry sectors investigated are construction, energy and utilities, financial services, hospitality, manufacturing, natural resources, retail trade, services, telecom, transportation, and wholesale and distribution. With respect to the first three usage measures, Chinese Taipei, United States, Canada, Singapore, and Korea form the top-tier group, while Hong Kong, Australia, Malaysia, New Zealand, Japan, and Chile constitute the second-tier group. In terms of business sector expenditure per GDP, Hong Kong and Malaysia demonstrated the highest levels, 0.053 and 0.052, respectively, compared to the APEC average of 0.033.

The progress in business use of ICT is quite demonstrative in developed economies. Australian businesses, for instance, took $143 billion worth of Internet orders in 2009-2010, up 15 percent on the previous year, according to figures released in June, 2011 by the Australian Bureau of Statistics.[59] Nearly all (94 percent) of Australia's large businesses had a Web presence and broadband dominated as the Internet access method (97 percent), with little variation between industries. Regarding ICT-enabled innovation, development or introduction of new or significantly improved goods, services, processes, or methods was reported by 44 percent of Australian businesses in 2009-2010. Large businesses were more

than twice as likely to undertake innovation as smaller businesses (74 percent compared to 36 percent). Wholesale trade was the most innovative, with almost 60 percent of businesses in the industry reporting some form of innovation.[60]

Table 4-12: Business Usage and Expenditure

APEC Economy	Extent of Business Internet Use (7=Best;1=Worst)	ICT Impact on New Services and Products (7=Best;1=Worst)	ICT Impact on New Organizational Models (7=Best;1=Worst)	Business Sector Expenditure, share of GDP (%)
Hong Kong	6.03	5.41	5.19	5.34%
Singapore	5.96	5.83	5.52	4.88%
Malaysia	5.45	5.35	5.25	5.21%
Korea	6.30	5.88	5.12	4.76%
United States	6.18	5.67	5.64	3.94%
China	5.14	5.08	4.70	4.69%
Canada	6.16	5.69	5.48	3.73%
Chinese Taipei	6.05	5.98	5.50	2.95%
Japan	6.05	5.26	4.56	3.48%
New Zealand	6.00	5.11	4.82	3.12%
Australia	5.89	5.21	5.07	2.71%
Vietnam	5.29	4.91	3.94	3.06%
Chile	5.47	5.25	4.80	2.51%
Thailand	5.07	4.80	4.51	2.60%
Brunei	5.00	4.27	4.15	N/A
Philippines	4.52	4.32	3.99	2.21%
Mexico	4.72	4.45	4.05	2.06%
Russia	4.81	4.03	3.79	2.07%
Peru	4.49	4.77	4.40	1.57%
Indonesia	4.97	4.55	4.41	1.33%
Papua New Guinea	N/A	N/A	N/A	N/A
APEC Average	**5.48**	**5.1**	**4.7**	**3.30%**

Individual Usage

The usage measures for the individual sector include Internet users per 100 inhabitants, mobile cellular subscriptions, and use of virtual social networks (SNS). The first two are hard data, while the use of SNS is survey data. The last usage measure, somewhat different in nature from the other measures, is

consumer spending per GDP. Table 4-13 shows individual usage and expenditure of ICT for 21 APEC economies. Surprisingly enough, the low-income group does not necessarily show low levels of usage and expenditures. The individual usage was found remarkable in Malaysia, Vietnam, and Thailand, as compared to those of Brunei, Korea, New Zealand, Chinese Taipei, Hong Kong, and Singapore.

Higher prices for ICT products and lower affordability may explain high expenditures per GDP in Malaysia, Vietnam, and Thailand. However, it seems to be more conceivable that large mobile cellular subscriptions rates along with relatively small numbers of Internet users per 100 inhabitants for these economies explain this.

Table 4-13: Individual Usage and Expenditure

APEC Economy	Internet Users per 100 Inhabitants[61]	Mobile Cellular Subscriptions per 100 Inhabitants	Use of Virtual Social Networks (7=Worst;1=Best)
Malaysia	57.61	110.60	5.76
Brunei	79.78	106.66	5.45
Korea	81.60	99.20	5.64
New Zealand	84.38	110.16	6.02
Vietnam	27.25	100.56	4.58
Chinese Taipei	69.83	116.70	5.90
Hong Kong	61.24	173.84	6.11
Singapore[62]	77.23	140.43	6.03
Thailand	25.80	122.57	5.00
Japan	76.80	90.37	5.20
Australia	74.00	113.75	6.14
Canada	78.11	68.75	6.24
United States	76.24	94.83	6.11
Chile	33.98	96.94	5.83
Philippines	6.47	80.98	5.50
Russia	42.38	163.62	4.44
Mexico	25.95	76.20	4.81
Peru	27.72	84.69	4.96
China	28.53	55.51	4.97
Indonesia	8.70	69.25	5.72
Papua New Guinea	1.86	13.37	N/A
APEC Average	**49.78**	**99.5**	**5.52**

Associated with individual usage of ICT, SNS has attracted much attention from industry and government during the last five years. Given the wide diffusion of SNS services in developed and developing economies as well, however, it's social and economic impact is not well-known yet, even in developed economies. It is not so long ago that the policy institutes like the OECD and the European Union began to study the use and impact of SNS services.[63] Their major concern is that the protection of user rights and regulation of abuse should remain a priority. However, considering that SNS is opening new opportunities as it continuously evolves, retaining a balance between liberalizing and regulating SNS services still remains a challenge that policymakers in APEC economies need to meet in coming years.

Conclusion

As regional economies increasingly depend on each other in a globally networked ecosystem, and access to high-quality ICTs and ICT applications becomes more pervasive worldwide, economies with strong aspirations for ICT, passion for ICT-based innovations, and concrete action plans for digital policies will find themselves at the forefront of new market opportunities, extended growth potential, and improved sustainability, having better chances to generate welfare for citizens. In this study, we found that most APEC economies, developing or developed, have been finding ways to leverage the potential of ICTs to contribute to these important goals. Also, a great amount of resources and efforts have been dedicated toward designing and implementing economy-specific digital policies; these policies have had achieved a noticeable degree of success in many APEC member economies.

5. Intellectual Property Rights

What are Intellectual Property Rights?

In considering what constitutes innovation policy, intellectual property rights (IPR) as the "use of property rights to induce innovations of various kinds" are considered one of the central and oldest institutions in the policy domain. Intellectual property refers to creations of the mind, such as inventions, literary and artistic works, and symbols, names, images, and designs.[1] Intellectual property rights as an institutional arrangement consist of various types of rights, including patents for inventions, trade secrets, copyrights, trademarks, and even design and database rights.

Intellectual property represents the creative thought that is embodied in inventions, books, music, and works of art. It is in the design of a car engine, the wings of a plane, the software that runs a computer, the devices and processes that run efficient manufacturing shop floors, the words that form a story, and the notes of a song. Patent, copyright, trade secret, and trademark laws give the creators of intellectual property the right to prevent others from using their creations, though some of these rights may exist only for a limited time. A patent gives an inventor of a type of circuit design the right to keep someone else from producing a circuit using the same process.[2] Copyrights allow a software company to prevent anyone from copying the software without permission. Trademarks protect brand names, designs, and other symbols (like the apple design on the Apple computer) that companies use to identify and distinguish their products in the marketplace.

The IPR arrangement is well-recognized through its long history (going back to the Middle Ages) as providing effective protections that enable innovators to achieve the returns necessary to continue to innovate and to promote the availability of leading-edge technologies. Economist Douglas North, one of the foremost scholars of economic history, argues that the introduction of intellectual property rights has had one of the most profound impacts on spurring economic growth in human history. North points out that average global economic growth rates for about one-and-a-half millennia prior to the Industrial Revolution were practically zero. Eighteenth century elites in England had practically the same per-capita income as their counterparts in third century Rome.[3] North has shown that the inflection point toward greater economic growth was the widespread development of patent systems in the nineteenth century.[4] By raising the private rate of return closer to the social rate of return, the introduction of intellectual property rights addressed the knowledge-asset incentive problem, allowing inventors to realize economic gain from their inventions, thereby catalyzing economic growth.

Recognition of intellectual property rights is a vital element if global trade and foreign direct investment are to thrive. Effective protection and enforcement of IPR encourages innovators to invest in research, development, and commercialization of technologies while promoting their dissemination. But weak intellectual property rights protections reduce the flow of foreign direct investment and technology transfer. Without adequate intellectual property protections, there will be less innovation overall, and this hurts all economies.

Overview of Development of International Intellectual Property Rights

The patent institution began to emerge around the 15th century in Europe, when kings and rulers granted the first exclusive rights to inventors. The first "patent law" was enacted by the Republic of Venice in 1474, attracting engineers from outside of the city-state.[5] By the early 1800s, the United States and most European countries had implemented their own national patent laws. But as the patent system spread across economies and as international business activities increased, demand for international regulation increased because the coverage of patentable inventions differed across economies and foreign inventors were often excluded from patenting rights or asked to pay very high fees.

The demand for the establishment of some form of international regime led to the creation in 1883 of the International Union for the Protection of Industrial Property, usually called the Paris Convention, concluded among eleven countries. The United States joined the convention in 1887 and Japan in 1899. The Paris Convention articulated several principles pertaining to international recognition of foreign patent and intellectual property rights that remain central today, including the principle of national treatment, which holds that each country must grant the same protection to nationals of the other member countries as it grants to its own nationals.[6] In 1886, the Berne Convention for the Protection of Literary and Artistic Works established protections for copyrights.

In 1967, the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations, assumed responsibility for promoting the protection of intellectual property throughout the world through cooperation among states and in collaboration with other international organizations. Still, "prior to 1995, the international distribution of patent rights was very uneven."[7] To address this, a comprehensive agreement—the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement—was reached in 1995. Coming into force concomitantly with the establishment of the World Trade Organization that same year, TRIPS was of particular importance from a trade perspective because it resulted in the inclusion of IPR issues within the realm of the rules-based multilateral trade system.

Through TRIPs, the WTO provides a forum for dispute settlement between signatory economies and allowing for trade sanctions against non-complying economies. TRIPS is a far-reaching agreement covering virtually all forms of intellectual property, including patents, copyrights, trademarks, trade secrets, and designs. TRIPS states explicitly that it builds on prior intellectual property treaties, such as the Paris and Berne Conventions, and does not conflict with them. TRIPS sets minimum standards that signatories must adhere to with regard to intellectual property rights, though economies are free to provide stronger rights, particularly through bilateral or multilateral trade agreements. TRIPS provides for minimum standards for duration (e.g. 20 years), coverage (e.g. invention subject matter), and enforcement mechanisms.[8] To address the concerns of developing economies, Articles 65 and 66.2 of TRIPS included transitional periods for developing and least developed economies, and called for developed economies to assist in technology transfer to developing economies. TRIPS has become the primary mechanism for enforcing international intellectual property rights.

The Importance of Intellectual Property Rights

Clearly delineated intellectual property rights are a *sine qua non* for an innovative economy. Intellectual property rights produce many benefits for developed and developing economies alike, but there are at least six principal benefits. First, stronger intellectual property rights spur innovative activity by increasing the appropriability of the returns to innovation, enabling innovators to capture more of the benefits of their own innovative activity. Second, as a condition of receiving certain intellectual property rights such as patents, innovators are required to disclose their knowledge, as opposed to keeping it secret, which creates knowledge spillovers that helps others to innovate.[9] Indeed, the spillover effects from innovative activity are tremendous. A number of studies have found that the rate of return to society from corporate R&D and innovation activities is at least twice the estimated returns that the company itself receives. Intellectual property rights allow innovators to capture a portion of the benefits of their innovative activity, which endows them with the resources to pursue the next generation of innovative activities, engendering a virtuous cycle of innovation for economies, which is the third benefit. Fourth, IPRs can help economies operate more efficiently and productively by reducing transaction costs. For example, trademarks signal information about the quality of products, which reduce consumer search costs.[10]

A fifth benefit of intellectual property rights pertains to the international diffusion of innovations, which refers to the introduction of foreign products, processes, and technologies into a destination economy.[11] Such innovation and technology diffusion can occur through several mechanisms, including trade, international licensing, foreign direct investment, or joint ventures. When economies extend intellectual property rights protections to not only their own enterprises but also to enterprises from foreign economies that seek to introduce new products, processes, or technologies into their markets, knowledge and technology diffuse across borders, producing benefits for consumers and enterprises in the foreign economy. As Maskus explains, trade and foreign direct investment are fundamental factors in this process as they are two of the main market-mediated channels by which ideas and intangible assets are disseminated internationally.[12] Thus, trade and FDI facilitate the gradual accumulation of knowledge capital in firms, sectors, and economies.[13] Such open trade in enabling general purpose technologies such as information and communications technology is vitally important for economies, for such enabling technologies impact the competitiveness of all sectors of an economy. For example, if an economy's weak IPR protections deter foreign enterprises from introducing and thus inhibit its domestic industries from accessing best-of-breed information and communications technologies, its domestic sectors such as banking, insurance, retail, and transportation are likely to suffer from missing out on these productivity-boosting products and technologies. Finally, a sixth benefit for economies, as explained subsequently, is that increased IPR protections have been shown to boost exports in developing economies.

Putting these benefits together, it's clear that effective intellectual property rights are vital to an economy's competitiveness. Enhancement of IPR systems and complementary policies help to improve competitiveness—at both the macro and the micro economic levels—via improved access to, and accumulation of, knowledge capital.[14] This is why reform of IPR protection is often cited as one part of a general strategy for promoting economic development. At the same time, effective IPR protections produce positive spillovers for the entire world.[15] By being able to earn profits from a larger global marketplace, innovative enterprises are able to reinvest those revenues in future generations of products,

processes, and technologies that continue to push forward the global technology frontier, producing benefits for citizens in all economies.

Despite the benefits that strong IPR protections bring to economies, some have expressed concerns about IPR in a development context, in particular with regard to access to technology, the ability of firms to "learn by doing," and the costs of implementing IPR systems. Others worry that either through competition or strategic behavior by firms, "patent thickets" may arise blocking the ability of others to exploit new technologies or limiting innovation in related areas.[16] Still others have argued that while strong intellectual property rights regimes make sense in developed economies, they are less useful for developing economies, whose industries in some cases may rely on imitative catch-up strategies designed to build off technologies created elsewhere.

In response to such criticisms, the central point is that the patent system has always been about finding the right balance between creating the incentives for innovation while promoting the diffusion of knowledge. Striking the right balance is why many economies (and agreements such as TRIPS) award patents with twenty-year coverage periods and not one-hundred-year coverage periods. And while to be sure problems have sometimes arisen with patent thickets, these often arise from poor-quality patent issuance. Ultimately, policymakers must recognize that the goal is to achieve a balanced, high-quality patent system that issues strong patents for truly innovative activity and that balances incentives to innovate with the goal of diffusing knowledge.

For the evidence shows that strong intellectual property rights protections are vitally important for both developed and developing economies alike. As a definitive 2010 OECD review of the effects of intellectual property rights protections on developing economies found, "the results point to a tendency for IPR reform to deliver positive economic results."[17] The study found that developing economy IPR reforms concerning patent protection have tended to deliver the most substantial results, but the results for copyright reform and trademark reform are also positive and significant. But to have the greatest impact on economic growth, IPR reforms must occur concomitantly with other positive complements, particularly those regarding inputs for innovative and productive processes and the ability to conduct business. These include policies that influence the macro-environment for firms as well as the availability of resources (e.g. related to education), the legal and institutional conditions, and the fiscal incentives.[18]

An exploration of the relationships between: IPR reform and trade, FDI, and technology transfer; IPR reform and innovation and R&D; and IPR reform and exports/industry growth reveals the benefits of stronger IPR protections for developed and developing economies alike.

Relationship of IPR Reform to Trade, FDI, and Technology Transfer

There is a strong relationship between the strength of an economy's intellectual property protections and the extent of trade, foreign direct investment, and technology transfer it participates in. In particular, direct investment in new technology areas such as computer software, semiconductors, and biotechnology is influenced by intellectual property rights policy environments.[19] For example, the United Nations Commission on Transnational Corporations (UNCTC) has found that weak IP rights reduce computer software direct investment and pharmaceutical investment.[20] Moreover, weak intellectual property rights

reduce flows of all these types of commercial activities—trade, foreign direct investment, and technology transfer—regardless of an economy's level of economic development.[21]

In contrast, strengthening of IPR protection has been shown to correlate with increased international trade flows.[22] In particular, there is a positive association between IPR protection and trade flows in high technology products.[23]

Strengthening of IPR protection has also been connected with increased inflows of FDI. In fact, research finds that a 1 percent increase in the protection of IPRs as measured by the Patent Rights Index (a measure of the strength of economies' IPR regimes) is associated with a 2.8 percent increase in the inflow of FDI.[24] Likewise, whenever an economy increased its trademark protection level by 1 percent, it recorded a 3.8 percent increase in FDI. Further, a 1 percent increase in copyright protection yielded a 6.8 percent increase in FDI.[25] Moreover, there is a virtuous cycle between FDI and protection of IP, whereby improvements in the IPR environment are associated with improved economic performance—in particular with respect to FDI—and, in turn, further improvements in the IPR environment. Moreover, stronger IPRs in developing economies are associated with an increase of technology-intensive FDI. For example, IPR reforms in China have had a positive and significant effect on inward FDI.[26]

There is further a strong correlation between IPR protection and technology transfer. In fact, IPR strengthening in economies—particularly with respect to patents—is associated with increased technology transfer via trade and investment.[27] Stronger patent rights in developing economies give enterprises from developed economies a greater incentive to research and introduce technologies appropriate to developing economies.[28] Similarly, weak patent rights in developing economies lead enterprises from developed economies to introduce less than best practice technologies to developing economies.[29]

The Relationship Between IPR Reform and Innovation/R&D

IPR reforms also introduce strong incentives for domestic innovation. For example, a study of eighteen developing economies concluded that poor provision of intellectual property rights deters local innovation and risk-taking.[30] In contrast, IPR reform is associated with increased innovative activity as measured by domestic patent filings, albeit with some variation across countries and sectors.[31] For example, Ryan, in a study of bio-medical innovations and patent reform in Brazil, finds that patents provided incentives for innovation investments and facilitated the functioning of technology markets.[32] Park and Lippoldt also observe that the provision of adequate protection for IPRs can help to stimulate local innovation, in some cases building on the transfer of technologies that provide inputs and spillovers.[33] In other words, local innovators are introduced to technologies first through the technology transfer that takes place in an environment where protection of IPRs is assured; then, they may build upon those ideas to create an evolved product or develop alternate approaches. But without protection from potential abuse of their newly developed technologies, foreign enterprises may be less willing to reveal technical information associated with their innovations.[34] The protection of patents and trade secrets provides necessary legal assurances for firms wishing to reveal proprietary characteristics of technologies to subsidiaries and licensees via contracts.

The relationship between IPR rights and innovation can also be seen in studies of how the introduction of stronger IPR laws with regard to patents, copyrights, and trademarks, affect R&D activity in an economy. A number of studies have found that R&D/GDP ratios are positively related to the strength of patent rights.[35] Cavazos, Cepeda, et al. find a positive influence of IPRs on the level of R&D in an economy. They find that for every 1 percent increase in the level of protection of IPRs in an economy (as measured by improvements to an economy's score in the Patent Rights Index), there was on average a 0.7 percent increase in the domestic level of R&D.[36] Likewise, a 1 percent increase in copyright protection was associated with a 3.3 percent increase in domestic R&D. Similarly, when trademark protection increased by 1 percent, it was associated with an R&D increase of 1.4 percent. Thus, increases in the protection of the IPRs leads to greater flows of inward FDI, which support higher levels of R&D, and ultimately innovation, in an economy.[37]

The Relationship between IPR Reform and Exports/Growth

There is also a significant correlation between stronger IPR protections and exports from developing economies, and between stronger IPR protections and the faster growth rates of certain industries. Yang and Kuo argue that stronger IPR protection can improve the export performance of firms benefitting from voluntary, market-driven technology transfer. In fact, trademark protection has a statistically significant association in relation to enterprises' export turnover, sales, and total assets. Cavazos, Cepeda, et al. find a significant association between copyrights and export turnover, and a positive influence of patent right protection on sales.[38]

In cross-country studies, researchers have also found that stronger patent rights are associated with faster company growth in IP-intensive industries such as pharmaceuticals. In fact, during the early 1990s, a one-standard-deviation increase in patent rights was associated with an increase in firm growth of 0.69 percent (an advantage amounting to nearly 1/5 of the average industry growth rate of 3.7 percent).[39]

Consequences of Not Implementing Strong IPR Protections

Economies that have not implemented—and/or do not enforce—robust intellectual property rights protections end up damaging themselves in at least three principle ways. First, they deter future innovative activity by their innovators. Second, they discourage trade and foreign direct investment. And by discouraging foreign entry, they only hurt their consumers and businesses, both by limiting their choices and by inhibiting their enterprises' ability to access best-of-breed technologies that are vital to boosting domestic productivity. Third, in economies with weak IP protections, firms are forced to invest undue amounts of resources in protection rather than in invention.

Ironically, developing economies' own economic development opportunities and intellectual property development potential are inhibited by their own weak intellectual property protections. For instance, the lack of effective protection for intellectual property rights has limited the introduction of advanced technology and innovation investments by foreign companies in China, reducing potential benefits to local innovation capacity.[40] While China has made progress in strengthening the protection of intellectual property over the past two decades—as attested to by indicators such as the Patent Rights Index—

uncertainty around the protection of intellectual property remains an important deterrent for foreign as well as domestic firms engaging in R&D-related activities, as studies such as those by Cavazos, Cepeda, et al. have found.[41]

Some economies not on the global technological frontier have used a strategy of intellectual property theft in an attempt to catch up with the technology frontier. But, as a study by Grossman and Helpman found, while intellectual property theft may actually help countries in the short-run, IP theft stifles incentives to embark on home-grown technology development, thus retarding economies' abilities to develop their long-term capability to compete by cultivating real skills at innovating new products, services, processes, and technologies.[42]

Ultimately, economies in which uncertainties in the IP environment persist are likely to fall short of their innovation potential as some firms may withdraw from innovative activities or divert energy into alternative approaches for IP protection.[43] Thus, if APEC economies are to realize their vision of fostering regional trade and foreign direct investment while at the same time maximizing their full innovation (and economic growth) potential, it's imperative that they both implement and enforce strong intellectual property rights protections.

Assessing Intellectual Property Rights Policy in APEC Economies

This section assesses APEC economies on the extent to which they offer effective protections for IP, their effectiveness at enforcing intellectual property rights, and the extent of IP theft in their economies. Table 5-1 shows the four indicators used to assess APEC economies' ranks regarding IPR protections. Thirty-five percent of the weight on the IPR indicator is allocated to a measure (the Park Index) of how effectively economies' laws provide intellectual property protections to innovators. 30 percent of the value is allocated to two measures of how effectively economies' legal systems actually enforce those intellectual property rights. And 35 percent of economies' scores on the IPR indicator is allocated to a measure of how much IP theft is actually occurring within economies. Economies' scores on these IPR protection indicators account for 17.5 percent of their aggregate scores.

Table 5-1: Intellectual Property Rights Indicators

Topic	Indicator	Source	Indicator Weight
Protection	IP Protection Rating (Park Index)	Walter G. Park	.35
Enforcement	Integrity of the Legal System	PRS Group	.15
	Legal and Political Environment	Property Rights Alliance	.15
IP Theft	Software Piracy Rate	Business Software Alliance/IDC Corporation	.35

As Table 5-2 shows, based on economies' scores on the four sub-indicators listed above, Australia, Canada, Hong Kong, Japan, Korea, New Zealand, Singapore, and the United States lead APEC economies in providing strong intellectual property rights protections. Brunei, Chile, Chinese Taipei, Malaysia, and Mexico are the mid-tier economies, followed by China, Indonesia, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam in the lower-tier.

Table 5-2: Rank of APEC Economies on Intellectual Property Rights (in alphabetical order)

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Australia	Mid-Tier	Brunei	Lower-Tier	China
	Canada		Chile		Indonesia
	Hong Kong		Chinese Taipei		Papua New Guinea
	Japan		Malaysia		Peru
	Korea		Mexico		Philippines
	New Zealand				Russia
	Singapore				Thailand
	United States				Vietnam

IP Protection

Beginning with IP protection, the so-called "Park Index" (Table 5-3) provides an index of patent rights that serves as a quantifiable measure of the strength of patent rights for 110 economies, including all APEC economies but Brunei. The Park Index presents the unweighted sum of five separate scores for: coverage (inventions that are patentable); membership in international treaties; duration of protection; enforcement mechanisms; and restrictions (for example, compulsory licensing in the event that a patented invention is not sufficiently exploited).[44] The index was designed to provide an indicator of the strength of patent protection in economies (though not the overall quality of economies' patent systems).[45] According to the latest Park Index (which uses data as of 2005), the United States, Canada, Japan, Korea, and Chile offer the strongest patent protection regimes among APEC economies, as Table 5-3 shows. Peru, Vietnam, Indonesia, Thailand, and Papua New Guinea afford the weakest patent protection. APEC economies averaged a score of 3.77 on the Park Index, just slightly ahead of the world average of 3.34.[46]

Comparing APEC economies' scores on the Park Index between 2000 and 2005 reveals that APEC economies strengthened their intellectual property protections by about 5 percent over that time period. The United States, Canada, and Japan retained the highest scores on the Park Index in both years, and likewise the composition of the bottom four economies was unchanged. In terms of progress on the Park Index, China, Malaysia, Papua New Guinea, Chinese Taipei, and Indonesia made the most improvement. No APEC economies saw their intellectual property protections weaken over that time period.

Table 5-3: Park Index Rating of Intellectual Property Protection[47]

APEC Economy	Park Index (2005)	APEC Economy	Park Index (2000)
United States	4.88	United States	4.88
Canada	4.67	Canada	4.67
Japan	4.67	Japan	4.67
Korea	4.33	Chile	4.28
Chile	4.28	Australia	4.17
Singapore	4.21	Korea	4.13
Philippines	4.18	Singapore	4.01

APEC Economy	Park Index (2005)		APEC Economy	Park Index (2000)
Australia	4.17		New Zealand	4.01
China	4.08		Philippines	3.98
New Zealand	4.01		Hong Kong	3.81
Mexico	3.88		Mexico	3.68
Hong Kong	3.81		Russia	3.68
Chinese Taipei	3.74		Peru	3.32
Russia	3.68		Chinese Taipei	3.29
Malaysia	3.48		China	3.09
Peru	3.32		Malaysia	3.03
Vietnam	3.03		Vietnam	2.90
Indonesia	2.77		Thailand	2.53
Thailand	2.66		Indonesia	2.47
Papua New Guinea	1.60		Papua New Guinea	1.40
Brunei	N/A		Brunei	N/A
APEC Average	**3.77**		**APEC Average**	**3.60**

IP Enforcement

While it's one thing to evaluate the legal protections that economies' intellectual property rights laws and regulations offer to intellectual property rights holders, it's another to evaluate the extent to which economies' enforce those intellectual property rights. Enforcement is contingent upon a number of factors pertaining to the quality of the economies' political and legal environment, including its adherence to the rule of law, its degree of judicial independence, the resources available for intellectual property rights enforcement, and the overall desire to enforce those rights. Several indicators provide insight into the quality of APEC economies' efforts at IPR enforcement. These indicators assess the overall quality of an economy's legal system, on the theory that it's a fair assumption that IP rights in an economy are as well or as poorly enforced as other elements of the legal system.

First, the PRS group provides a rating of legal system integrity for every APEC economy but Brunei, as Table 5-4 shows. The PRS Group's rating of legal system integrity is based on the International Country Risk Guide's Political Risk Component I for Law and Order, which contains two measures comprising one risk component. The 'law' sub-component assesses the strength and impartiality of the legal system, while the 'order' sub-component assesses popular observance of the law.[48] Canada, Australia, and New Zealand record the highest scores, with Canada scoring a perfect 10 and Australia and New Zealand tied for second at 9.17. Seven economies tie for fourth place with a 8.33 score. Indonesia and Peru, with scores of 5.0, and Papua New Guinea, the Philippines, and Thailand, with scores of 4.17 each, score the lowest among APEC economies on the PRS Group's rating of legal system integrity. APEC economies score a 7.13 on average.

Table 5-4: PRS Group Rating of Legal System Integrity[49]

APEC Economy	Legal System Integrity Rating (10=Best; 1=Worst)
Canada	10.00
Australia	9.17
New Zealand	9.17
Chile	8.33
Chinese Taipei	8.33
Hong Kong	8.33
Japan	8.33
Korea	8.33
Singapore	8.33
United States	8.33
China	7.50
Malaysia	6.67
Russia	6.67
Vietnam	6.67
Mexico	5.83
Indonesia	5.00
Peru	5.00
Papua New Guinea	4.17
Philippines	4.17
Thailand	4.17
Brunei	N/A
APEC Average	**7.13**

Another proxy to assess the enforcement of IPR protections is offered by The Property Rights Alliance's *2011 International Property Rights Index*, which uses four sub-measures to create a composite score of economies' legal and political environment in support of intellectual property rights. The four sub-measures are the degree of judicial independence, the rule of law, political stability, and the control of corruption. Data on judicial independence comes from WEF's *2010-2011 Global Competitiveness* report, which asks executives about "the extent to which the judiciary in your country is independent from political influence of members of government, citizens, or firms." Table 5-5 shows The Property Rights Alliance's rating of APEC economies' legal and political environment in support of intellectual property rights. New Zealand, Canada, Australia, Singapore, and Hong Kong offer the best environment, with aggregate scores ranging from 8.8 to 8.1. Indonesia, Mexico, Peru, the Philippines, and Russia offer the least conducive legal and political environment in support of IPR rights, with scores from 3.5 to 4.2.

Table 5-5: Property Rights Alliance Rating of Legal and Political Environment[50]

APEC Economy	IP Legal and Political Environment Rating (10=Best; 0=Worst)
New Zealand	8.8
Canada	8.4
Australia	8.3
Singapore	8.3
Hong Kong	8.1
Japan	7.6
Chile	7.3
United States	7.1
Brunei	7.0
Chinese Taipei	6.4
Korea	6.0
Malaysia	5.6
Vietnam	4.8
Thailand	4.6
China	4.5
Indonesia	4.2
Mexico	4.2
Peru	3.7
Philippines	3.5
Russia	3.5
Papua New Guinea	N/A
APEC Average	**6.1**

IP Theft

While it is instructive to assess ratings of how effectively economies protect intellectual property rights, there is no substitute for evaluating the extent to which intellectual property rights are actually being enforced in the marketplace. To examine that, this report assesses the extent of unlicensed software usage in member economies.

The Business Software Alliance's *Global Software Piracy Study, 2009* provides data on unlicensed software units as a percentage of total software units installed for all APEC economies but Papua New Guinea, as Table 5-6 illustrates. The United States, Japan, New Zealand, Australia, and Canada have the lowest rates of unlicensed software units as a percentage of total software units installed, with each of those economies experiencing software piracy rates of less than 30 percent, with the United States having

the lowest rate at 20 percent. In contrast, Peru, Thailand, China, Vietnam, and Indonesia have the highest incidence of software piracy among APEC economies, all above 70 percent.

Table 5-6: Software Piracy Rates[51]

APEC Economy	Unlicensed Software Units as Percentage of Total Software Units Installed (%)
United States	20
Japan	21
New Zealand	22
Australia	25
Canada	29
Singapore	35
Chinese Taipei	38
Korea	41
Hong Kong	47
Malaysia	58
Mexico	60
Chile	64
Brunei	67
Russia	67
Philippines	69
Peru	70
Thailand	75
China	79
Vietnam	85
Indonesia	86
Papua New Guinea	N/A
APEC Average	**53**

6. Domestic Market Competition

Why Domestic Market Competition is Important

While it has become increasingly popular for economic planners to focus on export-oriented growth, a vibrant domestic market supported by a sound and fair regulatory environment that allows both existing and new firms to compete on a level playing field remains the lynchpin of economic prosperity. Economies that support competitive domestic markets create the conditions for new entrepreneurial ventures to flourish while at the same time compelling established firms to continue to innovate and to boost their productivity. To be sure, economies need to support the expansion of high-value-added, globally traded industries. However, as a recent report from the McKinsey Global Institute, *How to Compete and Grow: A Sector Guide to Policy*, finds, economies that outperform their peers do not have a more favorable sector mix (e.g., more jobs in "high-tech" industries), but instead have firms in all sectors (including less exciting sectors like retail trade or transportation) that are more productive.[1] In other words, the productivity of all firms in an economy matters more than the mix of sectors which comprise the economy, and this holds true for both developed and developing economies alike. As the McKinsey report elaborates:

> Some observers believe that countries can outperform their peers because they have a mix of sectors that have a more favorable growth momentum. But the mix of sectors does not explain differences in the growth performance of countries with similar levels of income at all. The mix of sectors is surprisingly similar across countries at broadly equivalent stages of economic development. It is not the mix of sectors that decides the growth in economies, but rather the actual performance within the sectors compared with their counterparts in peer economies.[2]

McKinsey reached these conclusions by calculating the "growth momentum" of twelve economies (six developed and six developing), half of which are APEC economies (China, Japan, Korea, Mexico, Russia, and the United States). McKinsey first calculated the "growth momentum" of six leading developed nations: France, Germany, Japan, Korea, the United Kingdom, and the United States. The growth momentum calculation takes each economy's existing sectoral composition (e.g. the actual share of manufacturing, retail, construction, transportation, agriculture, etc. sectors in each economy) and predicts how much that economy would have increased its value-added if its sectors grew at the average growth rate of all economies' comparable sectors. It turns out that the growth rate predicted by an economy's initial sectoral mix falls into a small band for highly developed economies, from 1.8 percent to 2.3 percent, but that the actual growth rates exhibited a much wider spread, from 0.4 percent in Japan to 3.3 percent in the United States, indicating that some economies' sectors are substantially outperforming other economies' sectors. In other words, the comparatively greater productivity performance of U.S. sectors contributed to the U.S. compound annual growth rate between 1995 and 2005 being 0.9 percent larger than would otherwise have been expected, while Japan's comparatively lesser productivity performance growth over that time period was 1.7 percent less than would have been expected.

These findings apply not just to the developed world; similar results held when applied to a basket of six developing economies—Brazil, China, India, Mexico, Russia, and South Africa. McKinsey found that compound annual growth rates from 1995 to 2005 ranged from 3.6 percent in Russia, to 3.9 percent in Mexico, to 9.1 percent in China. These actual growth rates differ from the "growth momentum" predicted by these economies' initial sectoral mixes in 1995. That is, if each economy's sectors had grown at the average growth rate of the six economies' respective sectors, Russia's economy would have been expected to grow by 6.7 percent, Mexico's by 6.0 percent, and China's by 5.7 percent. In other words, from 1995 to 2005, the difference in performance of China's sectors meant that its compound annual growth was 3.4 percent better than expected, while the gap in Russia's actual vs. expected growth rate was 3.1 percent and Mexico's gap was 2.1 percent. In other words, even if economies start with a less favorable sector mix, many economies outperformed their peers in rate of growth.[3]

And what drives the performance of sectors in an economy? It turns out that one of the strongest drivers of productivity growth in economies is the existence of competitive marketplaces. As William Lewis, the former head of the McKinsey Global Institute, argues in *The Power of Productivity,* there is perhaps no factor more important to driving economic growth than the presence of competitive markets. Lewis argues that differences in competition in product markets are much more important than differences in labor and capital markets and therefore that policies governing competition in product markets are as important as macroeconomic policies.[4] This means that micro-economic factors, such as product- and labor-market regulations, competition policies, technology policies, etc. are as important to growth as macro-economic ones (if not more so). It also means that the productivity of an economy's firms is deeply connected to an economy's regulatory environment. Put simply, economies that create a climate of competition force their firms to become more productive and innovative. This includes removing regulatory restrictions, incumbent protections, and cross-border trade restrictions that limit competition.

Unfortunately, the restrictive regulatory regimes that many economies have in place can severely inhibit growth.[5] For example, McKinsey's *How to Compete and Grow* report observes that in some sectors, such as retail, regulations alone largely explain the wide variations in productivity and employment among economies. And because such sectors are so large, policy choices can have a significant impact on an economy's overall GDP. A regulatory environment that allows the expansion of more productive modern supermarkets and convenience stores raises productivity because larger chains can profit from scale benefits in purchasing, merchandising, and store operations. Yet many economies have chosen to protect small-scale mom and pop stores through barriers to foreign direct investment and competitive entry, zoning laws, and restrictions on the size of stores.[6]

For example, Argentina's grocery retail sector is one of the only ones in the world to have experienced large declines in productivity growth over the past two decades, primarily because its large, productive firms have lost market share due to the extreme regulatory restrictions placed on them.[7] Of course, Argentina is by no means alone in restricting competition in its domestic retail sectors. In Japan, laws limiting the entry of large supermarkets and providing incentives for small retailers to stay in business explain the country's high share of family retailers—and their low productivity.[8] Japan's government subsidizes mom and pop stores with generous loans, while its high capital-gains tax rate provides little incentive for owners to sell some of the most valuable real estate in the world. Consequently, Japan's

retail sector is comprised 50 percent of mom and pop stores, compared to 12 percent in the United States. Likewise, India's government, in an effort to protect its smaller merchants, has ordered that Wal-Mart can sell only to wholesalers and business owners and their family and friends.[9] Yet just like India and Japan, even many U.S. communities have passed zoning regulations specifically to thwart "big box" retailers. The state of Maryland passed legislation essentially forcing only Wal-Mart, but not smaller retailers, to provide health insurance to its workers.

And these are just examples from the retail sector, similar examples can be found across scores of industries in all economies. For example, every U.S. state has regulations that prohibit consumers from purchasing vehicles online in an attempt to protect automobile dealer jobs.[10] And as the advent of the Internet has enabled online business models, dozens of industries and professions—from insurance agents, mortgage brokers, investment bankers, securities traders, college professors, music and video stores, booksellers, radiologists, pharmacists, and veterinarians—have sought, often successfully, government protection from more efficient and lower cost (often e-commerce) entrants in an effort to thwart competition.

But in stark contrast to economies that have attempted to protect their sectors, such as retail, economies that have liberalized their retail sector have seen dramatic improvements in sector productivity, with consequent strong contributions to economic growth. Russian retail productivity has more than doubled in the past ten years, from 15 percent to 31 percent of U.S. levels, because of the increasing market share won by more modern retailers.[11] In Mexico, opening up the food retail sector to international competition has led to increasing competition and lowered prices, as Mexico saw an explosion in the number of convenience stores from a little more than 1,000 to more than 6,000 in five years. The Mexican consumer has been an outright beneficiary of this increased competitive intensity, as food prices have grown significantly less rapidly than other prices.[12]

Thus, raising the productivity of domestic non-traded sectors such as retail is not trivial; it can have profound economic impacts. For example, even despite some extremely productive and innovative multinational firms, overall Japanese productivity is just 70 percent of U.S. rates. Korea's productivity is just 50 percent of U.S. rates. The gap is even greater in developing nations. Overall productivity in India is but 8 percent of U.S. rates, while Chinese productivity is just 14 percent of U.S. rates.[13] For developed and developing economies alike, the message is clear: attracting more high-value-added export firms is not likely to be the major path to economic growth in the long run, boosting productivity in the vast swaths of the economy that are not traded internationally is.[14] And to boost productivity in these domestic, non-traded sectors—as well as to create the conditions in which entrepreneurial new firms can flourish—policies that ensure domestic competition are vital.

It's also important for economies to consider the effect regulations have on innovation. While classical economic theory holds that regulation inevitably imposes cost burdens on firms, causing them to reallocate their spending away from investments in innovation, there can be circumstances under which thoughtful regulations can spur innovation in an economy, as ITIF finds in a forthcoming report called *The Impact of Regulation on Innovation.*[15] In particular, flexible regulations, including incentive-based regulation and performance standards, tend to aid both market and social innovation by maximizing the implementation leeway available to firms, allowing the market to dictate cost-efficient and commercially

viable solutions. The study finds that the types of regulations which are most likely to spur innovation are generally those designed to reduce information asymmetries in marketplaces.

Assessing Domestic Market Competition in APEC Economies

Openness to competition in domestic markets is vital for sustained economic growth, but the degree to which domestic markets are transparent and open to competition varies considerably across APEC economies, with some economies such as Singapore, New Zealand, and Hong Kong leading the world while others have much further to go to foster competition, to reduce corruption, and to develop an entrepreneurial culture. In many developing APEC economies, similar to developing economies in other regions, a critical regulatory priority should be to reduce the use of bribes and ad hoc decision-making by local regulators. In all APEC economies, regardless of development, governments play a pivotal role in creating the right policy environment that fosters both local market competition and entrepreneurship.

Methodology

In this section, eighteen indicators are organized into three categories to assess economies' degrees of domestic market competition. The three categories are the regulatory environment; the competitive environment; and the entrepreneurial environment (Table 6-1). To calculate APEC economies' ranks, standard deviations were found for each indicator, which were then weighted based on each indicators' relative importance, and added together to produce an aggregate score.

The largest share of weight, 65 percent, amongst the market competition and entrepreneurship indicators is allocated to the regulatory environment because it pertains to a number of key policies that impact both enterprises' ability to effectively operate and innovate and economies' ability to allocate talent and capital to their most innovative enterprises. It's difficult for innovators to thrive in economies that make it difficult to do business. Ten percent of this weight is allocated to how easy economies make it for new businesses to start, in terms of the time, cost, and the number of procedures required. Economies that make it difficult for new businesses to arise only stifle and impede innovation. For innovation to flourish, enterprises must be able to acquire the requisite assets, including property, in a timely manner and have confidence that the contracts they enter into can readily be enforced (and together these indicators account for 15 percent of an economies' score with regard to their regulatory environment). For innovative enterprises, the ability to acquire talent is vital, so 25 percent of the weight for economies' regulatory environment is allocated to two measures of economies' labor market mobility, which evaluate how easy economies make it for talent to flow out of sunset industries or sectors and into the most dynamic and innovative sectors and enterprises in an economy. Likewise, how easy economies make it for businesses to close is an important factor in reallocating talent and capital to the most highly productive and innovative enterprises and sectors in an economy, and so is valued at 10 percent of an economy's score with regard to their regulatory environment. Corruption significantly impedes innovation, and thus it's important that enterprises operate in a corruption-free regulatory environment.

As noted previously, for innovation to flourish in an economy, it's vital that open competition be fostered, and so 25 percent of economies' scores are allocated to three indicators of an economies' competitive environment. Finally, 10 percent of an economy's score on the domestic market competition core

innovation policy area is devoted to economies' real rates of entrepreneurship, expressed as the number of new firms created per 1,000 workers.

Table 6-1: Domestic Market Competition and Entrepreneurship Indicators

Category Weight	Category	Indicator	Indicator Weight
65%	**Regulatory Environment**	**Starting a Business**	
		Time to start a business	.033
		Number of procedures to start a business	.033
		Cost to start a business	.033
		Acquiring Property	
		Time involved in buying/renting property	.025
		Number of procedures involved in buying/renting property	.025
		Enforcing Contracts	
		Number of procedures to enforce a contract	.033
		Time involved in enforcing contracts	.033
		Cost involved in enforcing contracts	.033
		Acquiring Talent	
		Rigidity of employment	.150
		Impact of pay on productivity	.075
		Closing a Business	
		Recovery rate when closing a business	.033
		Time needed to close a business	.033
		Cost involved in closing a business	.033
		Operating in a Corruption-Free Environment	
		Intensity of corruption	.075
25%	**Competitive Environment**	Intensity of local competition	.100
		Extent of market dominance	.075
		Efficiency of legal framework in challenging regulations	.075
10%	**Entrepreneurial Environment**	Number of new firms per 1,000 workers	.100

Summary Rankings

Among APEC economies, Australia, Canada, Chinese Taipei, Hong Kong, Japan, New Zealand, Singapore, and the United States lead on these eighteen domestic market competition and entrepreneurship indicators, as Table 6-2 summarizes. To differing degrees, these economies have found the sweet spot between regulatory regimes that are not overburdening and that make doing business

domestically flexible and competitive while at the same time providing new firms access to capital, training, and growth opportunities. These economies make it easy for firms to start, to access capital, to acquire property, to attract talented workers, to enforce contracts, to close or reorient operations when necessary, and to operate in a generally corruption-free environment. Though they certainly are not perfect, they have generally enacted policies that encourage domestic market competition (including that introduced by the domestic operations of foreign enterprises) and that encourage new firm entry. These governments have also promoted advanced G2B (government-to-business) e-government platforms that make it easier for firms to register, to submit required information, to comply with regulations, and to pay taxes. For example, Singapore has gone further than any other APEC economy in "melding" government services and private-sector regulatory compliance. Singapore's SingPass, which stands for "Singapore Personal Access," provides a common password that businesses and individuals can use to complete transactions with different government agencies online, including registering a company and filing business or income taxes. Many of the leading economies have also created and funded agencies geared toward encouraging entrepreneurship, such as the Small Business Administration in the United States, Canada's Industrial Research Assistance Program, Korea's Small and Medium Business Administration, and the Startup and Technology Division in Japan's Ministry of Economy, Trade, and Industry (METI).

Table 6-2: Rank of APEC Economies for Domestic Market Competition and Entrepreneurship (in alphabetical order)

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Australia Canada Chinese Taipei Hong Kong Japan New Zealand Singapore United States	Mid-Tier	Brunei Chile China Korea Malaysia Thailand Vietnam	Lower-Tier	Indonesia Mexico Papua New Guinea Peru Philippines Russia

In the middle of the pack are Brunei, Chile, China, Korea, Malaysia, Thailand, and Vietnam. These mid-tier economies are largely corruption free and have clear rules of the road for doing business. Some, such as Korea, are also global leaders in e-commerce policy and e-government. Yet despite being pioneers of digital marketplaces, policymakers in these economies have not gone far enough to foster an entrepreneurial society. For example, the number of new firms per workforce in Korea is just 12 percent of that in New Zealand.[16] Other economies in this group have just recently created sectors that are apt to spur new firm development and are still evaluating how best to promote such industries. For example, Malaysia, long dependent on petroleum, has begun expanding its personal electronics and light manufacturing sectors. Doing so has required rethinking what new firms require in terms of capital expensing, a skilled workforce, and a reliable regulatory framework. Of the economies in the middle rankings, Chile has made the most progress. Copper has traditionally been Chile's cash crop and the driver of government economic policy. However, recently President Piñera has put entrepreneurship at the heart of his government's economic strategy, stating that the dearth of new firms is a significant obstacle to growth and that, "Chile needs to work hard to regain its entrepreneurial and innovative

culture."[17] One program, *Start Up Chile*, established for this purpose provides grants for *foreign* entrepreneurs to develop their businesses in Chile.[18]

The economies in the lower-tier, including Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, and Russia, struggle with arbitrary regional bureaucracies and have large informal economies where entrepreneurs have little access to reliable capital or government assistance. They generally provide a more difficult environment for businesses to operate in, do not do as strong a job in ensuring competitive domestic markets, and are not characterized by rates of labor and capital market mobility as high as those found in the upper- and mid-tier economies. Also, they are sometimes not counted in global entrepreneurial statistics.[19]

Regulatory Environment for Business

From starting a business to acquiring property and talent and from enforcing contracts to closing down a business, public-sector regulations on private enterprise constitute "the rules of the road" for domestic firms, impacting every stage in the lifecycle of a business. In other words, public regulatory policies set the framework in which enterprises operate. Therefore, much can be learned about how effectively public policies and regulations engender competition by examining how easy economies make it for enterprises to start; to acquire property; to enforce contracts; to attract talent; to close; and to operate free of corruption.

Starting a Business

Table 6-3 assesses APEC economies on the number of procedures that are required to start a business, the time involved in starting a business, and the cost to start a business. Economies that make these processes easier are oriented towards fostering domestic market competition and spurring new firm growth. Indeed, academic evidence clearly shows that delays caused by entry regulations are associated with lower rates of firm entry.[20] Yet what stands out is the variability in these processes across APEC economies. Only one procedure is required to start a business in Canada and New Zealand, whereas China requires fourteen and Brunei and the Philippines fifteen procedures. APEC economies average seven procedures to start a business. Just as New Zealand requires only one form to start a business, so it takes only one day to start a business there, and just two in Australia and three in Singapore. A number of economies have made progress in streamlining the amount of time and expense it requires to start a new business. For example, Chinese Taipei has reduced the time it takes enterprises to check company names, to register retirement plans, and to apply for health insurance.

In contrast, it takes over 105 days to start a business in Brunei, and 44 or more in Vietnam, Indonesia, and Papua New Guinea.[21] While it still takes almost three weeks to start a business in Korea, that represents a dramatic improvement over the 17 months it once took to start a business there.[22] The average number of days required to start a business across APEC economies is 25. The cost to start a business (measured as the percent of income per capita) also varies dramatically across APEC economies, from 0.4 percent in Canada and New Zealand to 22.3 percent in Indonesia and 30.3 percent in the Philippines. Taken together, Table 6-3 shows that Canada, New Zealand, Australia, Singapore, Hong Kong, and the United States in particular excel at providing an environment where it's easy for new firms to emerge. The

Philippines, Indonesia, Papua New Guinea, and Vietnam have the most room for improvement, with other APEC economies for the most part grouped in the middle.

Table 6-3: Number of Procedures, Time, and Cost Involved in Starting a New Business[23]

APEC Economy	No. of Procedures to Start a Business	APEC Economy	Time to Start a Business (days)	APEC Economy	Cost to Start a Business (As % of Income Per Capita)
Canada	1	New Zealand	1	Canada	0.4
New Zealand	1	Australia	2	New Zealand	0.4
Australia	2	Singapore	3	Australia	0.7
Hong Kong	3	Canada	5	Singapore	0.7
Singapore	3	Hong Kong	6	United States	1.4
Chinese Taipei	6	United States	6	Hong Kong	2
Mexico	6	Mexico	9	Russia	3.6
Papua New Guinea	6	Korea	14	Chinese Taipei	4.1
Peru	6	Chinese Taipei	15	China	4.5
United States	6	Malaysia	17	Thailand	5.6
Thailand	7	Chile	22	Chile	6.8
Chile	8	Japan	23	Japan	7.5
Japan	8	Peru	27	Vietnam	12.1
Korea	8	Russia	30	Mexico	12.3
Indonesia	9	Thailand	32	Brunei	13.5
Malaysia	9	China	38	Peru	13.6
Russia	9	Philippines	38	Korea	14.7
Vietnam	9	Vietnam	44	Malaysia	17.5
China	14	Indonesia	47	Papua New Guinea	17.7
Brunei	15	Papua New Guinea	51	Indonesia	22.3
Philippines	15	Brunei	105	Philippines	30.3
APEC Average	**7**	**APEC Average**	**25.5**	**APEC Average**	**9.1**

Acquiring Property

The effective assignment, acquisition, and transfer of property rights constitutes another fundamental framework condition for competitive markets to flourish. Several studies have found that economies which have weak property rights, ambiguous or arbitrary regulatory enforcement, or cumbersome requirements are less likely to have more productive firms.[24] Table 6-4 examines the number of procedures and time involved in buying or renting property in the APEC economies. New Zealand and Thailand lead APEC economies, requiring only two procedures and just two days to buy or rent property.

Singapore and Chinese Taipei are also in the top five in both categories. On average, about five procedures and twenty-seven days are required to buy or rent property in the APEC economies, although it takes substantially more in some. The Philippines requires eight procedures and Korea seven to buy or rent property. And it can take an excessively long amount of time to buy or rent property in Malaysia, Vietnam, Papua New Guinea, and Mexico, the latter two requiring over seventy days. Such long timeframes slow the wheels of commerce and impede economic growth, placing these economies at a substantial disadvantage to their APEC peers. Malaysia has made strides in easing the transfer of property through the use of online stamping.

Table 6-4: Number Procedures and Time Required in Buying or Renting Property[25]

APEC Economy	No. Procedures to Buy or Rent Property	APEC Economy	Time to Buy or Rent Property (days)
New Zealand	2	New Zealand	2
Thailand	2	Thailand	2
Chinese Taipei	3	Australia	5
Singapore	3	Chinese Taipei	5
China	4	Singapore	5
Papua New Guinea	4	Peru	7
Peru	4	Korea	11
United States	4	United States	12
Vietnam	4	Japan	14
Australia	5	Canada	17
Hong Kong	5	Indonesia	22
Malaysia	5	China	29
Mexico	5	Chile	31
Canada	6	Philippines	33
Chile	6	Hong Kong	36
Indonesia	6	Russia	43
Japan	6	Malaysia	56
Russia	6	Vietnam	57
Korea	7	Papua New Guinea	72
Philippines	8	Mexico	74
Brunei	N/A	Brunei	N/A
APEC Average	**4.8**	**APEC Average**	**26.7**

Enforcing Contracts

Another hallmark of an effective, competition-enhancing regulatory environment is that it enables the timely and cost-efficient enforcement of private contracts. Economies in which it is time-consuming or prohibitively expensive to enforce contracts create a disincentive for enterprises to take on the risk associated with innovation, particularly when the innovation entails co-creation or co-development with a partner, supplier, or customer that might have contractual elements. If enterprises fear that enforcing contracts may be difficult, they may be less inclined to enter into innovative partnerships with other entities. Table 6-5 presents data on the number of procedures, time, and cost involved in enforcing contracts in APEC economies, revealing wide variability across these measures. Singapore leads on two of these measures—the number of procedures required and cost involved in enforcing a contract. The least number of procedures to enforce a contract are required in Singapore, Hong Kong, Australia, Japan, Malaysia, and New Zealand (thirty or less), while the most are required in Indonesia, Peru, Papua New Guinea, Chinese Taipei, and Brunei (all requiring forty or more procedures). The APEC average is thirty-six procedures to enforce a contract. Upper-tier APEC economies have gone furthest to make doing business easier. For example, New Zealand created new district court rules that streamline the process of enforcing contracts.[26] The civil justice system in Hong Kong enacted reforms in 2010 aimed at increasing the efficiency and cost-effectiveness of settling commercial disputes.

Table 6-5: Number Procedures, Time, and Cost Involved in Enforcing Contracts[27]

APEC Economy	# Procedures to Enforce a Contract	APEC Economy	Time to Enforce a Contract	APEC Economy	Cost to Enforce a Contract
Singapore	21	Singapore	150	Korea	10.3
Hong Kong	24	New Zealand	216	China	11.1
Australia	28	Korea	230	Thailand	12.3
Japan	30	Hong Kong	280	Russia	13.4
Malaysia	30	Russia	281	United States	14.4
New Zealand	30	Vietnam	295	Chinese Taipei	17.7
United States	32	United States	300	Hong Kong	19.4
China	34	Japan	360	Australia	20.7
Vietnam	34	Australia	395	Canada	22.3
Korea	35	China	406	New Zealand	22.4
Canada	36	Mexico	415	Japan	22.7
Chile	36	Peru	428	Singapore	25.8
Thailand	36	Thailand	479	Philippines	26.0
Philippines	37	Chile	480	Malaysia	27.5
Russia	37	Chinese Taipei	510	Vietnam	28.5
Mexico	38	Brunei	540	Chile	28.6
Indonesia	40	Canada	570	Mexico	32.0

Peru	41	Indonesia	570	Peru	35.7
Papua New Guinea	42	Malaysia	585	Brunei	36.6
Chinese Taipei	47	Papua New Guinea	591	Papua New Guinea	110.3
Brunei	58	Philippines	842	Indonesia	122.7
APEC Average	**36**	**APEC Average**	**425**	**APEC Average**	**31.4**

On average, it takes fourteen months to enforce a contract across the APEC economies, with a range from half-a-year in Singapore to as much as 28 months in the Philippines. It takes twice as long on average to legally enforce contracts in Canada and Indonesia (570 days) than in Korea (230 days), and twice as many in Singapore as the United States. The cost to enforce a contract, defined as a percentage of the claim, is least in Korea, China, Thailand, Russia, and the United States but is a prohibitive amount in Papua New Guinea and Indonesia. On average, the cost to enforce a contract across APEC economies is 31 percent of the value of the claim, although this number is skewed by the disproportionate cost in Papua New Guinea and Indonesia, as the cost is less than average in sixteen of the twenty-one APEC economies.

Closing a Business

In addition to enabling productivity improvements within existing firms, innovation empowers the creation of new (and ideally more productive and competitive) firms, and this turbulent, dynamic process of firm churn and turnover is a vital source of renewal and growth in economies. Innovation's demand for constant renewal holds true at both the firm- and economy-level. At the firm level, research by Carl Franklin and Larry Keeley suggests that firms that do not replace at least 10 percent of their revenue stream annually with new products or services are likely to be out of business within five years.[28] The emergence of ICT has only accelerated this dynamic, across both ICT-producing and ICT-consuming industries. As MIT economist Eric Brynjolfsson finds, there has been a significant increase in the volatility of firm competitiveness in the information industries, reflecting the increase in ICT innovation.[29] In fact, this has contributed to a dramatic widening since the mid-1990s in the disparity in profits between the leading firms in industries that use technology intensively. Today, the leaders truly benefit from innovation while the innovation laggards pay a stiff price.

Just as businesses must constantly renew themselves, so must economies. For example, within U.S. manufacturing, it was the reallocation of production from less productive firms to more productive ones that accounted for significantly more than half the growth in manufacturing productivity between 1976 and 1996.[30] Firms either innovated and became more productive, or they lost market share and jobs. Innovation likewise accelerates the pace of turnover of firms in an economy. Whereas at the beginning of the last century the average lifespan of an S&P 500 company was greater than sixty years, today the average lifespan is just twenty years. Ninety-eight percent of American companies disappear within eleven years.[31] The average lifespan of a company in Japan and Europe is 12.5 years. Despite sounding regressive, this process of churn is actually vitally important to a nation's economic health. In fact, every year over 750,000 new establishments open in the United States, 500,000 of which are new startup companies, creating over seven million new jobs. At the same time, nearly 700,000 establishments close

each year in the United States, destroying over six million jobs in the process.[32] Economies in which firm creation and dissolution is impaired constrain the dynamic effects that innovation brings to an economy.

Thus, economies that make it more difficult for businesses to close impede the reallocation of capital and talent towards more promising ventures. Table 6-6 assesses the recovery rate from closing a business, along with the time and costs involved in closing a business. These metrics can help identify weaknesses in economies' bankruptcy law and the main procedural and administrative bottlenecks in the bankruptcy process.[33]

Table 6-6: Cost, Time, and Recovery Rate in Closing a Business[34]

APEC Economy	Cost of Closing Business (% estate)	APEC Economy	Time to Close Business (years)	APEC Economy	Recovery Rate (cents/$)
Singapore	1	Canada	0.8	Japan	92.7
Brunei	4	Singapore	0.8	Singapore	91.3
Canada	4	Australia	1.0	Canada	91.2
Chinese Taipei	4	Hong Kong	1.1	Chinese Taipei	82.2
Japan	4	New Zealand	1.3	Australia	81.8
Korea	4	Korea	1.5	Korea	81.7
New Zealand	4	United States	1.5	United States	81.5
Peru	7	China	1.7	Hong Kong	81.2
United States	7	Mexico	1.8	New Zealand	79.1
Australia	8	Chinese Taipei	1.9	Mexico	66.7
Hong Kong	9	Malaysia	2.3	Brunei	47.2
Russia	9	Brunei	2.5	Thailand	43.5
Chile	15	Thailand	2.7	Malaysia	39.8
Malaysia	15	Papua New Guinea	3.0	China	36.4
Vietnam	15	Peru	3.1	Chile	28.2
Indonesia	18	Russia	3.8	Peru	27.2
Mexico	18	Chile	4.5	Russia	25.3
China	22	Vietnam	5.0	Papua New Guinea	23.9
Papua New Guinea	23	Indonesia	5.5	Vietnam	18.6
Thailand	36	Philippines	5.7	Indonesia	13.2
Philippines	38	Japan	N/A	Philippines	4.5
APEC Average	**12.6**	**APEC Average**	**2.6**	**APEC Average**	**54**

The regulatory cost of closing a business is an astounding 38 percent of a firm's value in the Philippines, compared to only 1 percent in Singapore and 4 percent in Brunei, Canada, Chinese Taipei, Japan, Korea, and New Zealand. The cost to close a business in China and Papua New Guinea exceeds 20 percent, while Thailand joins the Philippines in imposing steep costs to close a business. The average cost of closing a business in APEC economies is 12.6 percent. Canada, Singapore, Australia, Hong Kong, and New Zealand allow the most expeditious closing of businesses in APEC economies, while it can take 4.5 years or more to close a business in Chile, Vietnam, Indonesia, and the Philippines. On average, it takes 2.6 years to close a business in APEC economies. Recovery rates (defined as cents recovered on the dollar), calculate how many cents on the dollar claimants (e.g. creditors, tax authorities, and employees) can recover from an insolvent firm. Recovery rates are highest in Japan, Singapore, and Canada, where as much as 90 percent or more can be recovered by claimants in a bankruptcy proceeding. Recovery rates are lowest in the Philippines, Indonesia, and Vietnam, where claimants can only recover a fraction of assets in a bankruptcy proceeding. Taking these three measures together, Singapore, Canada, Chinese Taipei, Australia, and Korea make it easiest to close and recover the assets from a firm, while this process is most time- and cost-consuming in the Philippines, Indonesia, and Papua New Guinea.

Flexible Labor Markets

Just as an economy needs to put in place mechanisms to enable failing or unsuccessful businesses to close so capital can be reallocated to other opportunities, so an economy needs labor flexibility so that talent can be deployed to the most productive pursuits. Indeed, labor market flexibility is a vital component of the adaptive capacity of an economy and its ability to innovate. In fact, in a 2004 report for the OECD, Eric Bartlesman of Amsterdam's Free University found that the "rates of innovation" between U.S. and EU businesses were actually the same. But Bartelsman found that the United States did a better job than Europe of more quickly allocating capital and labor to the most promising start-up businesses with new innovative business models, so the United States was spawning more high-tech "winners," even though the actual underlying rates of innovation were analogous.[35]

Table 6-7 displays data from the World Bank's Rigidity of Employment Index (scored from 0-100, best to worst) for APEC economies. The index measures the regulation of employment, specifically the hiring and firing of workers and the rigidity of working hours. The index includes six quantitative measures of labor market flexibility: ratio of minimum wage to the average value-added per worker; hindrances to hiring additional workers; rigidity of hours; difficulty of firing redundant employees; legally mandated notice period; and mandatory severance pay. By this measure, Australia, Brunei, Hong Kong, Singapore, and the United States have the most flexible labor markets in not just APEC economies, but also the world. Within APEC, Korea, Russia, Peru, Indonesia, Mexico, and Chinese Taipei have the most rigid labor markets. With the average APEC economy score 19.5 on the Rigidity of Employment Index, labor markets in Indonesia, Mexico, and Chinese Taipei are more than twice as constrained as the APEC average.

Table 6-7: Rigidity of Employment in APEC Economies[36]

APEC Economy	Rigidity of Employment Index (0=Best; 100=Worst)
Australia	0
Brunei	0
Hong Kong	0
Singapore	0
United States	0
Canada	4
New Zealand	7
Malaysia	10
Thailand	11
Japan	16
Chile	18
Vietnam	21
Philippines	29
China	31
Korea	38
Russia	38
Peru	39
Indonesia	40
Mexico	41
Chinese Taipei	46
Papua New Guinea	N/A
APEC Average	**19.5**

Another way to assess the productivity of an economy's workforce is to look at the extent to which pay is related to productivity. If there is not a strong relationship between pay and productivity, this suggests that government policies may be forcing businesses to retain non-productive employees, whether by making it difficult to release redundant or non-productive employees, imposing overly generous minimum wages that are in excess of the value-added by certain workers, or requiring that businesses provide other benefits to employees in excess of the value they are adding. Table 6-8 shows World Economic Forum survey data on the relationship between pay and productivity in APEC economies. Pay is most closely related to productivity in Singapore, Chinese Taipei, Hong Kong, Malaysia, and Vietnam (which score from 5.6 to 5.1) and least closely related in the Philippines, Peru, and Mexico, which registered scores of 3.8, 3.7, and 3.5 respectively. APEC economies averaged a 4.6 score on this measure. Enterprises in the economies that scored highest on this measure have the greatest ability to reward

employees based on their performance, equipping them with a powerful tool to attract the best talent to their firms. Economies that score at the bottom often shackle the productivity of their businesses by compelling them to retain employees whose output in many cases does not equal their compensation. Also, it turns out there is a strong negative correlation (-0.7) between weak regulatory regimes (as defined by the World Bank) and the pervasiveness of merit-based pay.[37]

Table 6-8: Pay and Productivity[38]

APEC Economy	Pay and Productivity (7=Best; 1=Worst)
Singapore	5.6
Chinese Taipei	5.4
Hong Kong	5.4
Malaysia	5.1
Vietnam	5.1
United States	4.9
Brunei	4.8
Japan	4.8
China	4.7
Indonesia	4.6
Korea	4.5
Thailand	4.5
Canada	4.4
New Zealand	4.4
Chile	4.3
Australia	4.2
Russia	4.2
Philippines	3.8
Peru	3.7
Mexico	3.5
Papua New Guinea	N/A
APEC Average	**4.6**

Corruption-Free Regulatory Environment

The extent of corruption in an economy also significantly affects the regulatory environment for the firm. Unfortunately, corruption and bribery persist in some APEC economies. Corruption includes both bribes paid to local bureaucrats for services or favors as well as the misuse of political power by government officials to interfere with economic decisions. The economic literature is clear: corruption is a significant

deterrent to long-run economic growth. Mauro finds that corruption lowers FDI and domestic investment rates, which in turn dampens economic performance.[39] And Tanzi and Davodi find that while corruption actually increases public sector spending (likely crowding out private sector investments), it reduces the productivity of public expenditures considerably.[40] In the mid- to long-term, corruption and bribery eat away at the competitive elements of an economy as firms are rewarded for "playing the game" instead of producing the highest quality at the lowest costs.

Table 6- 9 shows the extent of irregular payments and bribes in APEC economies.

Table 6-9: Irregular Payments and Bribes in APEC Economies[41]

APEC Economy	Irregular Payments and Bribes (7=Best;1=Worst)
New Zealand	6.7
Singapore	6.6
Hong Kong	6.3
Canada	6.2
Japan	6.2
Australia	6.0
Chile	5.7
Chinese Taipei	5.1
Brunei	5.0
United States	5.0
Korea	4.6
Malaysia	4.5
China	4.1
Peru	4.1
Thailand	4.0
Mexico	3.6
Indonesia	3.4
Russia	3.2
Vietnam	3.2
Philippines	2.8
Papua New Guinea	N/A
APEC Average	**4.8**

New Zealand, Singapore, Hong Kong, Canada, and Japan, with scores ranging from 6.7 to 6.2, have the lowest incidences of irregular payments and bribes in APEC economies according to survey data provided

by the World Economic Forum. In contrast, the Philippines, Vietnam, Russia, Indonesia, and Mexico score lowest on this indicator, with scores of 2.8 to 3.6, falling considerably below the APEC average score of 4.8. One of the easiest ways that economies scoring lower on this indicator can reduce corruption is by introducing "disintermediation" between services and citizens.[42] By automating procedures that would traditionally require interaction with a local bureaucrat, information technology helps reduce the power asymmetries between officials and citizens, thereby reducing the likelihood of forced bribes and corruption.

Competitive Environment for Business

The preceding fourteen indicators assessing how easy economies' regulations make it for enterprises to start; to acquire property; to enforce contracts; to attract talent; to close; and to operate free of corruption have provided various snapshots of how effectively economies foster competitive domestic marketplaces. They're important individually, but don't tell a holistic story. The following three indicators "bubble up" the effectiveness of the preceding policies into a broader, higher-level view of how effectively economies' regulatory policies engender competitive markets.

Intensity of Local Competition

The World Economic Forum offers a measure of the intensity of competition in an economy by asking executives how they would "assess the intensity of competition in the local markets in your country" (where "local markets" refers to the domestic market at the national economy level).[43] On this measure, Chinese Taipei with a 6.1 score, Japan with a 5.8 score, Australia and Korea at 5.7, and Canada, China, and the United States with 5.6 scores have the most competitive domestic markets in APEC economies, as Table 6-10 shows. Russia, Mexico, and Vietnam have the least competitive markets, with scores of 4.1, 4.5, and 4.8 respectively, followed by the Philippines and Peru with scores of 4.9. The APEC average score is 5.3. In general, markets appear more competitive in developed than developing APEC economies, suggesting that boosting the competitiveness of domestic markets should be an important policy priority in economies wishing to close development gaps with upper-tier economies.

Table 6-10: Intensity of Local Competition[44]

APEC Economy	Intensity of Local Competition (7=Best;1=Worst)
Chinese Taipei	6.1
Japan	5.8
Australia	5.7
Korea	5.7
Canada	5.6
China	5.6
United States	5.6
Chile	5.5
Hong Kong	5.5

APEC Economy	Intensity of Local Competition (7=Best;1=Worst)
Singapore	5.5
Brunei	5.3
Malaysia	5.3
Thailand	5.3
Indonesia	5.1
New Zealand	5.0
Peru	4.9
Philippines	4.9
Vietnam	4.8
Mexico	4.5
Russia	4.1
Papua New Guinea	N/A
APEC Average	**5.3**

A related indicator of the degree of competition in domestic markets is the extent of market dominance, which measures the degree to which corporate activity in an economy is dominated by a few business groups or spread among many firms (where a score of 7 indicates an economy with competition spread among many firms and a score of 0 indicating competition dominated by a few business groups). As Table 6-11shows, on this measure, Japan, Chinese Taipei, the United States, Australia, Canada, and Singapore rate most highly, with scores ranging from 5.9 to 5.0. APEC economies on average scored a 4.2 on the extent of market dominance. Peru, Russia, Korea, the Philippines, and Mexico score lowest on this measure, with Mexico scoring a 2.9.

Table 6-11: Extent of Market Dominance[45]

APEC Economy	Extent of Market Dominance (7=Best; 1=Worst)
Japan	5.9
Chinese Taipei	5.7
United States	5.3
Australia	5.1
Canada	5.0
Singapore	5.0
China	4.8
Malaysia	4.6

APEC Economy	Extent of Market Dominance (7=Best; 1=Worst)
Indonesia	4.2
New Zealand	4.2
Vietnam	4.0
Hong Kong	3.7
Thailand	3.7
Brunei	3.6
Chile	3.5
Peru	3.4
Russia	3.4
Korea	3.2
Philippines	3.2
Mexico	2.9
Papua New Guinea	N/A
APEC Average	**4.2**

While it's surprising that executive opinion would regard Japan as not having business activity dominated by a few business groups (given the history of the *keiretsu* in Japan), Japan's strong score on this indicator may reflect the strength of its small-medium sized enterprises (the so-called *chuken kigyo)* which dominate specialized global markets in many industries. In fact, Japanese companies serve more than 70 percent of the worldwide market in at least thirty industrial technology sectors worth more than $1 billion.[46] In contrast, Korea's position, with its history of the *chaebol* business conglomerates, as well as Mexico's strong orientation toward business conglomerates, appears more in line with expectations

Related to governments' ability to foster a domestic market in which competition flourishes is the extent to which governments afford enterprises the ability to contest and seek redress for government actions or regulations which may hamper competition. The World Economic Forum surveys business executives regarding economies' efficiency in enabling private businesses to challenge the legality of government actions and/or regulations (Table 6-12).

Hong Kong leads by an order of magnitude on this measure, scoring a 5.8, followed by New Zealand, Singapore, Australia, and Canada with scores ranging from 5.3 to 4.9. Mexico, Korea, Peru, the Philippines, and Russia score lowest, with scores ranging from 3.4 to 2.8. APEC economies on averaged scored 4.1. Low scores on this indicator signal that regulators may be subject to capture by entrenched interests (whether businesses, unions, parties, etc.) and therefore more susceptible to issuing decisions or regulations that protect incumbent players.

Table 6-12: Efficiency of Legal Framework in Challenging Regulations[47]

APEC Economy	Efficiency of Legal Framework in Challenging Regulations (7=Best; 1=Worst)
Hong Kong	5.8
New Zealand	5.3
Singapore	5.3
Australia	5.0
Canada	4.9
Chile	4.6
Malaysia	4.4
Japan	4.3
United States	4.3
Chinese Taipei	4.1
China	4.0
Thailand	4.0
Indonesia	3.9
Brunei	3.8
Vietnam	3.8
Mexico	3.4
Korea	3.2
Peru	3.1
Philippines	2.8
Russia	2.8
Papua New Guinea	N/A
APEC Average	**4.1**

Entrepreneurial Environment

Why Entrepreneurship is Important

As noted, the most important path to economic growth for developed and developing economies alike is to raise the productivity of the existing sectors (and firms therein) of their economy. However, this is not to say that entrepreneurial new firms do not also play an important part in promoting economic growth and renewal. New firms promote economic growth and innovation if they inject fresh ideas and technologies into the market and replace older, less innovative incumbents. In addition, a small share of new, high-growth firms are also responsible for the lion's share of new job creation. Indeed, in several APEC economies, including the United States and Korea, young firms (those under five years) have been

responsible for virtually all new jobs created over the past several years.[48] In the United States, new and small businesses accounted for roughly 70 percent of all new jobs, created in the past decade.[49] Canada's SMEs account for 80 percent of new jobs and 82 percent of new technologies created in the economy.[50] Yet all new firms are not created equal. Indeed, just 5 percent of start-ups account for 50 percent of economic growth and jobs from start-ups.[51]

The quality of an economy's regulatory environment is critical for fostering new firm creation. In an exhaustive study of 84 countries, Klapper, Amit, and Guillen find there is a strong relationship between entrepreneurial activity and the indicators that impact domestic market competition (financial markets, economic growth, and the quality of the legal, regulatory, and governing environment).[52]

Table 6-13 shows the number of new firms created per 1,000 workers employed in APEC economies in 2009. On this measure, Hong Kong and New Zealand lead APEC with 19 and 17 firms, respectively, formed for each 1,000 workers employed in 2009. They are followed by Canada, Singapore, and Australia. Mexico, Thailand, the Philippines, and Indonesia score lowest on this measure of new firm creation, all averaging less than one new firm created per 1,000 workers. On average, APEC economies created four new firms per 1,000 workers employed in 2009. The United States' underwhelming performance on this indicator likely reflects the economic downturn of the late 2000s.

Notwithstanding the United States' subpar performance in 2009, historically APEC economies that lead in new firm creation have generally been advanced economies such as Hong Kong, New Zealand, Singapore, and the United States. These economies rely on new firms to bring new technologies to market, to encourage venture funding, and to accelerate domestic R&D. These "innovation entrepreneurs" are often called "gazelle firms."[53] In 2010, high-growth gazelles, while only making up one percent of firms, accounted for 40 percent of new jobs in advanced economies.[54] For example, Hong Kong, with its low corporate tax rate and supportive business environment is the premier location for high-tech Chinese start-ups seeking to be listed on international stock exchanges. And because of its proximity to China's large labor market and growing consumer base, Hong Kong has become a central location for foreign investors looking to establish an Asian presence. The development of the Shenzhen/Hong Kong Innovation Circle, an agreement structured to facilitate tech transfer and commercial links between Hong Kong's high-tech startups and Shenzhen's world class R&D facilities, has further solidified Hong Kong's ability to attract foreign entrepreneurs.[55]

Other APEC economies with robust entrepreneurial bases such as New Zealand, Canada, and Singapore have implemented an array of policies to nurture young firms. For example, Canada's Industrial Research Assistance program has successfully fostered innovation within SMEs for over forty years. The program links Canadian high tech entrepreneurs with international partners and provides customized technical and financial support to over 8,000 firms a year.[56] For its part, Japan has traditionally had difficulty creating small businesses that are as productive as its larger incumbent firms, in part because the majority of its small businesses operate in low-growth industries.[57] In order to tackle this issue, Japan has made starting a business easier and less costly by creating an SBIR-like program called the Small Business Enterprise Agency and by focusing funding on SME.[58]

Table 6-13: New Firms Per 1,000 Workers Employed[59]

APEC Economy	New Firms Per 1,000 Workers Employed
Hong Kong	19.19
New Zealand	17.08
Canada	7.56
Singapore	7.40
Australia	6.38
China	6.30
U.S.	4.30
Peru	2.65
Russia	2.61
Malaysia	2.55
Taiwan	2.42
Chile	2.12
S. Korea	1.72
Japan	1.28
Mexico	0.61
Thailand	0.59
Philippines	0.19
Indonesia	0.18
Brunei	N/A
Papua New Guinea	N/A
Vietnam	N/A
APEC Average	**4.78**

Mid-tier economies have different needs for their entrepreneurial sector (and their small-medium sized enterprises). These economies are already global but do not have the vibrant, high-tech, entrepreneurial base of the upper-tier economies. Beyond raising the productivity of the major domestic sectors of their economy (such as mining), economies such as Malaysia and Chile also have opportunities to grow through new firms that help transition the economy from resource-driven to entry-level technical industries, such as light manufacturing. Malaysia is a particular success story for the mid-tier economies. Before the 1990s, Malaysia was a low-income, resource-drive economy; however through a series of sound policies and economic decisions, it was able to link small, local firms into multinational corporation's industrial supply chains, particularly in China and Korea. For example, the government introduced the Industrial Linkage Program and the Global Supplier Program, which help Malaysian SMEs become suppliers of mechanical and electronic parts or services for MNCs. Doing so not only

enhanced the technological capabilities of small firms but also helped to establish Malaysia as a major hub of FDI.[60]

Finally, lower-tier economies are predominantly emerging markets like Indonesia, Thailand, and Papua New Guinea. One of the interesting components of the entrepreneurial environment in these following economies is that they do not lack new firms as much as they lack new firms that are incorporated. Most new firms in developing APEC economies exist within the informal sector and are therefore not captured by the data. These firms are generally family-oriented, hiring within the family unit with little ability to invest and grow beyond one or two informal employees. Economies with largely informal entrepreneurs can capture the most value through new firms that promote technology transfer, multinational FDI, and move beyond necessity-driven household businesses to new firms operating in the formal sector. Policies geared toward promoting new, scalable firms in lower-tier economies have had mixed results. For example, the Philippines passed the "Magna Carta for SMEs" in 1997 with robust funding and tech support policies but has reduced funding levels by 80 percent in the past decade. Thailand's Industrial Technology Assistance Program was originally established to help young firms gain technical know-how to attract inward FDI, however to date the program does little more than fund trips abroad for a few selected entrepreneurs.[61] Japan's relatively low rate of new firm creation results in part from a cultural bias toward stable large employers and an avoidance of the risk entailed by entrepreneurial startups.

7. Government Procurement

Governments are the world's largest procurers of goods and services. The WTO's *Trade Policy Reviews* of 19 of the 21 APEC economies[1] finds that, on average, APEC economies invest approximately 6.5 percent of GDP on government procurement, or about $2.1 trillion annually. Of course, there is wide variety among APEC economies, with Australia, Canada, and Chile investing 2.6, 1.35, and 2.9 percent of GDP in government procurement, while Japan, Korea, Malaysia, and New Zealand all invest greater than 10 percent of GDP.

Table 7-1: Government Procurement Expenditures (thousands)[2]

APEC Economy	Procurement % GDP (2008 or 2009)	GDP (2008)	Procurement ($ 2009)
Australia	2.6%	$1,010,699,000	$26,278,174
Brunei	4.1%	$14,417,000	$643,818
Canada	1.4%	$1,510,957,000	$20,400,000
Chile	2.9%	$169,573,000	$5,045,000
China	2.0%	$4,401,614,000	$88,032,280
Chinese Taipei	10.4%	$402,690,000	$44,336,693
Hong Kong	3.9%	$215,147,000	$8,260,862
Indonesia	8.0%	$511,765,000	$40,941,200
Japan	16.8%	$4,923,761,000	$827,191,848
Korea	10.0%	$947,010,000	$94,701,000
Malaysia	11.9%	$222,219,000	$26,444,061
Mexico	4.3%	$1,088,128,000	$46,847,000
New Zealand	11.2%	$128,492,000	$14,391,104
Papua New Guinea	10.0%	$8,092,000	$809,200
Peru	8.0%	$127,406,000	$5,586,000
Philippines	9.0%	$168,580,000	$15,172,200
Russia	17.0%	$1,676,586,000	$285,019,620
Singapore	8.9%	$181,939,000	$16,100,000
Thailand	2.5%	$273,248,000	$6,829,542
Vietnam	6.0%	$89,829,000	$5,389,740
United States	3.8%	$14,264,600,000	$535,000,000
Total	**6.5%**	**$32,336,752,000**	**$2,113,419,341**

In 2009, the United States allocated 3.75 percent of its GDP, approximately $535 billion, to government procurement. The value of China's government procurement market (excluding procurements made by SOEs) has been estimated at $88 billion, and if construction projects are included, hundreds of billions of dollars.[3] Table 7-1 summarizes the available data on government procurement expenditures in APEC economies.

The sheer volume of government procurement activity makes it vitally important that governments get public procurement policies right. Effective government procurement practices ensure citizens receive best-value products and services that maximize the benefit derived from public expenditures. Indeed, a core principal of market-based trade is that government purchases should be made on the basis of the best value for government, not on the basis of national preferences.[4] And because government procurement accounts for such a large share of most economies, ensuring fair and open government procurement practices has become a vital aspect of realizing liberalized global trade. Yet this kind of procurement can and should be consistent with government efforts to drive innovation through their procurement practices. For these reasons, it's important that APEC members' government procurement policies be transparent, non-discriminatory, openly competitive, and performance-based.

Government Procurement as a Driver of Innovation

Governments can orient their procurement policies to become strong drivers of innovation, and as such procurement policy is an important and legitimate component of economies' innovation strategies. Smart public procurement policies can stimulate private innovation and innovative solutions.[5] They position governments to boost demand for innovative technologies, products, and services, in part by acting as lead users, or "early adopters," that help prove out technologies or foster the development of new markets. Extensive research documents this role of demand in spurring innovation, with one study of over 1,000 firms finding that, in over half, innovation stems from new requirements and demand.[6] Governments can play an important and legitimate role in spurring that demand. For example, one study found that between 1984 and 1998, 48 percent of projects leading to successful innovation in Finland were triggered by public procurement or regulation.[7] And a study by Rothwell finds that over longer time periods, state procurement policies triggered greater innovation impulses in more areas than did R&D subsidies, and they did so without having to include any "buy domestic" requirements.[8]

Globally, new interest has emerged in the value of demand-side approaches to innovation, and more specifically, in the use of public demand as an engine for innovation.[9] Governments in many countries have begun to use the power of the purse to promote innovation, in part by making innovation an explicit metric when awarding public sector contracts. The first step countries have taken is to acknowledge that doing so requires explicit policies and strategies to incentivize innovation. For example, Japan's Ministry of Economic Trade and Industry developed an integrated procurement process aimed at expanding technology procurement horizontally across government which promoted the rapid adoption of ubiquitous 3G networks.[10] The Australian Government has committed to driving innovation in the private sector by being a demanding and discerning customer.[11] Australia's revised *Commonwealth Procurement Guidelines*, released in December 2008, observes that agencies should ensure that wherever possible their processes allow for suppliers to provide innovative solutions to their requirements.[12] Australian agencies

are encouraged to single out innovative ideas by evaluating extra-unique features of proposals as a separate criterion.

To stimulate the development of near field communications (NFC)-enabled mobile payments and the use of mobile phones as electronic wallets, Singapore's Infocomm Development Authority (IDA) formed a roundtable group of banks, mobile network operators, and transit companies with the intent of fostering industry collaboration towards the establishment of an interoperable infrastructure for the introduction of NFC-enabled commerce. Recognizing that developing a fully interoperable NFC environment would generate a market size eight times larger than a non-interoperable environment, IDA is promoting the establishment of a trusted third party to ensure full interoperability between the NFC services of all mobile operators and service providers. Like Japan and Korea, Singapore's government is also supporting the deployment of NFC-capable terminals in public venues including mass transit facilities, cash-based retail segments, and other public agencies, expanding the range of locations in which consumers are able to use their phones as an electronic wallet and thus helping jumpstart adoption of this advanced technology.[13] To generate real-time traffic information, both China and Singapore have partnered to equip their taxi cab fleets (in return for issuing taxi cab licenses) with transponders reporting the taxis' locations and speeds, thus generating real-time traffic information.[14] Beijing found that by collecting traffic information from just 10,000 taxis and commercial vehicles, it could generate real-time traffic information covering the vast majority of its roadways.[15]

When practical, governments should be early adopters of new technology rather than solely relying on industry to lead the way. Through technological leadership in its purchases, governments can play an important role in spurring markets and proving concepts. For example, government agencies can pursue green ICT initiatives by establishing telework policies and by creating telework best practices. Governments can lead on promoting adoption of digital signatures for e-government applications.[16] Governments can purchase leading edge vehicles (like plug-in hybrids) for their vehicle fleets and take the lead in adopting energy-efficient green building practices.

But it is important to recognize that strategic public procurement policies need not be tantamount to an industrial policy that picks winners or selects national champion firms in key technologies or industries. While strategic public procurement should identify key broad emerging technologies that appear ripe for innovation, making specifications as to which firms or even to which solutions should be favored or selected is likely to be counterproductive. As Edler and Georghiou explain, "Eventually under competitive conditions preferred solutions will emerge but this happens in all markets. What must be achieved is an open process the result of which is that winners emerge."[17] In other words, strategic public procurement is not and should not be another variation of a picking winners strategy that chooses one solution over another through state intervention or that builds up national champions in particular industries. Rather, effective strategic public procurement policies seed marketplaces for new technologies or industries as a platform upon which private sector market-based competition can occur. Innovation through public procurement cannot be "ordered;" rather, it has to be the result of a sophisticated articulation of demand for innovative products or services and of a transparent competitive process.[18]

Moreover, while governments should view innovation as an explicit goal of the public procurement process, there are legitimate ways to do so, and there are illegitimate ways which distort global trade by

giving unfair preferences to domestic firms.[19] Edler and Georghiou observe that not violating the rules of free trade and open competition while still justifying procurement in terms of innovation is (along with institutional adaption) the primary challenge for procurement policies that are integrated with innovation policy strategies.[20] Foremost, when including innovation as a consideration in awarding government procurement, the criteria considered should be transparent, publicly disseminated, and apply equally and consistently to foreign and domestic enterprises alike. Moreover, the source of an enterprises' intellectual property, technology, or products specified to fulfill the proposal should not be a consideration in the government's evaluation, as this risks locking in inferior technology. (That is, an economy's government should not require that the intellectual property, technology, or products an enterprise references as part of its bid to fulfill a government contract have been created inside the economy.) Furthermore, enterprises from all economies should be afforded a fair and equal opportunity to compete for public procurement contracts in a non-discriminatory fashion, and award decisions on those bids should be announced in a timely and transparent manner. Policies seeking to promote innovative government procurement should never be designed to explicitly or implicitly favor domestic firms over foreign ones. Ultimately, governments want "best value" from their procurement activity, but when they exclude foreign firms from competition, they often only end up with "second best value."

Unfortunately, many governments' procurement policies have long favored domestic players, effectively blocking foreign competitors (including sometimes foreign firms producing inside the nation) from successfully bidding for public procurement contracts.[21] While there is nothing wrong with countries using open, competitive government procurement policies to drive innovation, when economies apply blatant measures to discriminate against foreign-owned companies in government contracting it becomes an unacceptable practice, even more so if government-directed state-owned enterprises account for a large share of an economy. Such practices are economically harmful for several reasons.

First, governments that perfunctorily favor domestic bidders over foreign ones in government procurement contracts hurt themselves and their own citizens if they have not thoroughly evaluated the merits of foreign bidders' products and services in a good-faith effort to select best-value bids. Businesses and citizens suffer by receiving inferior technology, products, or services, while often paying more for the privilege. Further, by not selecting superior bids, economies miss out on opportunities for learning and technological improvements, which tend to spill over within the market in which the procurement takes places. And they can get locked into inferior technology systems. At the same time, advanced public procurement is likely to enhance the technological level of domestic competition and also create incentives for local producers to face the technological challenge posed by advanced demand. In the long run, this benefits all economic agents in a location, as competition among producers and accompanying services and suppliers of the innovation is upgraded. [22]

Second, government procurement practices that unfairly favor domestic players substantially undermine the principles of global free trade. They may also contravene economies' legal obligations under the World Trade Organization's Government Procurement Agreement (GPA). The Agreement, signed by forty-one nations—including seven APEC economies, as discussed subsequently—prohibits restrictions on government purchases between member countries, stating that companies in other signatory countries will be treated no less favorably than domestic companies, a principle known as national treatment.

However, whether economies are members of the GPA or not, national treatment is the fundamental commitment upon which the world trading system relies, and economies that fail to accord national treatment to foreign competitors in government procurement undermine both the cause and the realization of liberalized trade. Therefore, while government procurement policies have a legitimate role to play in spurring innovation, it's imperative that they are not used to distort free trade by giving unfair preferences to domestic competitors.

Assessing Government Procurement Policy in APEC Economies

As Table 7-2 shows, this section assesses APEC economies' adoption of the above government procurement principles based on four indicators: their accession to the World Trade Organization's Government Procurement Agreement (GPA), the degree of procurement accounted for by state-owned-enterprises, economies' score in Transparency International's Corruption Perceptions Index, and their effectiveness in procuring advanced technology products. Economies' scores on these government procurement indicators account for 15 percent of their aggregate score.

By far, economies' participation in the WTO's Government Procurement Agreement is the most significant measure of their commitment to the principles of global free trade (and its innovation-promoting effects) in the context of government procurement, and so it accounts for 40 percent of economies' scores on the government procurement policy indicator. Economies in which state-run or state-supported enterprises command a disproportionate share of economic activity significantly constrain market-based competition and the productivity- and innovation-enhancing effects it spurs (as described in the previous chapter). Thus, 20 percent of an economy's score on government procurement is allocated to a measure of the extent of how pervasive government-run or -supported enterprises are as a share of the economy's GDP. Innovation will not thrive if government procurement activity is marked by corruption (instead of on identifying and selecting the most innovative products, technologies, or solutions to secure from government procurement activity) and so 20 percent of an economy's score on government procurement is allocated to a measure of the extent of corruption in the economy. Finally, governments can play an important role in being early adopters and deployers of advanced technology products, and so 20 percent of economies' scores on government procurement is allocated to a measure of how successfully they procure advanced technology products.

Table 7-2: Government Procurement Policy Indicators

Indicator	Source	Indicator Weight
Participation in WTO Government Procurement Agreement	WTO	.40
Government Enterprise and Investment Indicator	Economic Freedom of the World Index	.20
Corruption Perceptions Index	Transparency International	.20
Government Procurement of Advanced Technology Products	World Economic Forum	.20

On these measures, Canada, Chinese Taipei, Hong Kong, Japan, Korea, Singapore, and the United States represent upper-tier APEC economies in adopting government procurement policies that are transparent, non-discriminatory, openly competitive, and performance-based. Australia, Chile, and New Zealand

represent mid-tier APEC economies in adopting these principles, with Brunei, China, Indonesia, Malaysia, Mexico, Papua New Guinea, Peru, the Philippines, Russia, Thailand, and Vietnam constitute the lower-tier economies (Table 7-3).

Table 7-3: Rank of APEC Economies on Government Procurement Policies (in alphabetical order)

Tier	APEC Economy	Tier	APEC Economy	Tier	APEC Economy
Upper-Tier	Canada	Mid-Tier	Australia	Lower-Tier	Brunei
	Chinese Taipei		Chile		China
	Hong Kong		New Zealand		Indonesia
	Japan				Malaysia
	Korea				Mexico
	Singapore				Papua New Guinea
	United States				Peru
					Philippines
					Russia
					Thailand
					Vietnam

Membership in the WTO's Government Procurement Agreement

The WTO's Government Procurement Agreement prohibits restrictions on government purchases between member countries, stating that companies in other signatory countries will be treated no less favorably than domestic companies in accordance with the principles of national treatment and non-discrimination. Seven APEC economies—Canada, Chinese Taipei, Hong Kong, Japan, Korea, Singapore, and the United States—are parties to the GPA (Table 7-4).

Table 7-4: Membership in World Trade Organization's Government Procurement Agreement

Status	APEC Economy	Status	APEC Economy
Signatories	Canada	Non-Members	Brunei
	Chinese Taipei		Indonesia
	Hong Kong		Malaysia
	Japan		Mexico
	Korea		Papua New Guinea
	Singapore		Peru
	United States		Philippines
Observers	Australia		Russia
	Chile		Thailand
	China		Vietnam
	New Zealand		

Four APEC members—Australia, Chile, China, and New Zealand—are observers to the GPA, meaning that they participate in the discussions at the meetings and follow the proceedings of the WTO Committee on Government Procurement, but are not obliged to fulfill commitments related to the Agreement. Australia is the world's only major industrialized country that is not a GPA signatory.[23] China, which promised to accede to the GPA as part of its entrance to the WTO in 2001, continues to negotiate its accession to the agreement. In January 2011, China agreed to submit a revised offer to the WTO Government Procurement Committee before the Committee's final meeting of 2011.[24]

However, even economies that are GPA members can go further toward liberalizing their government procurement policies. This is because when economies accede to the GPA, they provide a list of which government entities, or which types of procurements, are subject to the GPA requirements, exempting the rest of their government procurement activities from GPA coverage. For example, in Canada, federal government procurements are subject to Canada's GPA commitments, but provincial level procurement activity is not. At Canada's provincial and municipal levels, various procurement regimes exist applying domestic preferences such as price preferences and domestic content requirements in favor of goods or services produced or sold within the territory.[25] Likewise, while Japan's GPA coverage does include all central government entities, all 47 prefectures, and 12 designated cities, it has excluded many of the lower layers of its local administration (e.g. cities and villages), markets estimated to be worth as much as $74 billion, from its GPA commitments.[26] Likewise, the quality of China's anticipated accession to the GPA will be contingent upon the extent of government procurement activity it makes subject to the agreement. China has argued in the past that goods and services purchased by its state-owned enterprises should be seen as exempted from the national treatment obligations of WTO/GATT and WTO/GATS.[27]

Trade-Restricting Public Procurement Policies

The Center for Economic Policy Research's Global Trade Alert (GTA) database extensively catalogs instances of trade-distorting government/local procurement policies disadvantaging foreign commercial interests which governments around the world have implemented.[28] While clearly they are unable to document every instance, their findings are instructive, with China and Russia having the most documented instances among APEC economies of government/local procurement preferences favoring domestic businesses logged in the GTA database. However, such practices—particularly with regard to "buy local" preferences in government procurement—were seen in developed (Australia, Canada, Japan, and the United States) and developing APEC economies (including Indonesia, Malaysia, Peru and others) alike. This suggests that all APEC economies have some room for improvement in implementing impartial and non-discriminatory government procurement practices; however, some economies have more room for improvement than others.

In particular, China has gone far beyond what other APEC economies have done in introducing local content requirements by conceiving an overarching indigenous innovation strategy that seeks to use government procurement policies specifically to advance the innovation capabilities of domestic enterprises and industries, in part by favoring domestic intellectual property (IP) by requiring the use of domestically developed intellectual property or technology in many government procurement contracts. In November 2009, China unveiled an indigenous innovation product accreditation scheme—a list of products invented and produced in China that were to receive preferences in government procurement.[29]

While China's government has subsequently rescinded official adoption of the indigenous innovation product accreditation system, at a practical level its effects remain. For example, as of February 2011, the U.S.-China Business Council identified 61 indigenous innovation catalogues at the provincial and municipal level, and noted that, in Shanghai's catalogue, of 523 products made in China, only two appeared to involve foreign companies, and in those two cases, the companies were joint ventures with majority Chinese partner ownership.[30]

On January 19, 2011, in a United States-China Joint Statement from the White House Office of the Press Secretary, China stated that "it will not link its innovation policies to the provision of government procurement preferences."[31] This was a welcomed development that will hopefully be given full and lasting force and effect by Chinese officials at the central, provincial, and local levels. Even then, however, the statement did not apply by its terms to purchases made by China's state-owned enterprises, to the National Development Reform Commission (NDRC) concession projects, including the acquisition of turbines for large wind farms, nor to any of the sixteen major priority projects contained in China's Medium and Long Term Plan for Scientific Development.[32] Moreover, on July 5, 2011, China's Ministry of Finance rescinded the delinkage of the innovation catalogues with central government procurement. Taken together, the Chinese government's measures do not appear to have had the full legal effect of repealing/rescinding all of China's approximately thirty provincial and municipal indigenous innovation product accreditation measures. That is, the delinking of innovation policies from government procurement preferences has not been for certain accomplished across China yet. Unfortunately, the reality is that foreign enterprises' access to Chinese government procurement remains severely limited.[33]

Trade-Promoting Public Procurement Policies

To be sure, there are—in contrast to the above—a number of good, trade-promoting government procurement policies in evidence among APEC economies. Russia has created a single consolidated Website (www.zakupki.gov.ru) to announce the government procurement tenders (and auctions) from state and municipal bodies.[34] The application process as well as bidding is done electronically and all documents are available on the Website. Foreign producers are able to participate in government procurement bids from this Website. The list of providers which are considered as non-reliable (who did not fulfill prior contract obligations) is also listed online.

The Philippines has implemented a clearer and more coherent system of government procurement. Up to 2003, more than 60 laws, executive orders, presidential decrees, and administrative orders governed the Philippines' procurement process, which resulted in confusion and conflicting interpretation, which increased the likelihood of delay and irregularities in the bid evaluation process.[35] In response, the Philippines' Government Procurement Reform Act imposed a uniform procurement system within the public sector; prescribed competitive bidding; and clearly specified the methods and stages of purchasing to be followed, including the roles, responsibilities, accountability and manner of appointment of procurement officials and committees.[36]

Though the Korean government invested $1 billion between 2003 and 2007 in e-procurement systems, it estimates that, taking account of both the ability to repurpose government personnel and time-saving measures across the government, e-government saves far more than its costs. Korean officials estimate

that e-government has produced $16 billion worth of indirect economic benefits from more efficient government procurement, trade, and construction. Overall, Korea's government estimates that for every dollar it has invested in e-government since 2003, it has saved $17.

In fact, one study finds that countries—including Korea, Hong Kong, Singapore, and the United States—that implement e-procurement systems realize savings of 13 percent in the form of lowered transaction costs, reduced paper work, rapid ordering processes, wider vendor choices, and more bidders.[37] That's important because research on public procurement finds that increasing the number of bidders for a government procurement contract substantially reduces the price paid by the state, especially when initially five or fewer firms bid.[38] And given their sheer size, even small improvements in procurement efficiency can have substantial economic effects. For example, in a study of thirty-nine developing economies, twenty-one reported that just a ten percent increase in procurement efficiency would yield as much value as a 50 percent increase in the foreign aid they received in a given year.[39]

Extent of State-Owned Enterprises (SOE) Activity

The *Economic Freedom of the World* report measures the degree to which the policies and institutions of economies are supportive of economic freedom.[40] One measure the report uses is the extent to which economies use private rather than government enterprises to produce goods and services. Government firms play by rules that are different from those to which private enterprises are subject. They are not dependent on consumers for their revenue or on investors for capital. They often operate in protected markets. Thus, economic freedom is reduced as government enterprises produce a larger share of total output.[41] State-owned enterprises often enjoy other advantages, including monopoly access to markets through sharply constrained (foreign and domestic) competition; public subsidies, including preferential access to free or discounted land, capital, and even labor; or exemptions from certain laws and regulations. In other words, in economies in which state-owned enterprises account for a disproportionate share of economic activity, private market-based economic activity is substantially distorted. To measure this, *The Economic Freedom of the World* report uses an index of government enterprise and investment based on the number, composition, and share of output supplied by state-operated enterprises and government investment as a share of total investment. Economies are ranked from 10 to 0, with those where there are few SOEs and where government investment is generally less than 15 percent of total investment receiving a 10 and those where the economy is dominated by SOEs and government investment exceeds 50 percent of total investment receiving a 0.[42]

On this measure, six APEC economies—Australia, Canada, Chile, Hong Kong, Japan, and Russia—score a 10, while another five score an 8—Korea, New Zealand, Papua New Guinea, Peru, and the United States. With another six APEC economies scoring a 7, the APEC-wide score on this indicator is a robust 7.4, as Table 7-5 shows. Only three APEC economies score less than a 7. Vietnam's score of 4 reflects a substantial number of state-owned enterprises operating in many sectors, including manufacturing, and government investment accounting for 30 to 40 percent of total investment in the economy, while Malaysia's score of 2 reflects an even greater presence of SOEs and government investment accounting for 40 to 50 percent of the economies' total investment.[43] China's score reflects the fact that state-owned enterprises still account for about 40 percent of GDP, and an even greater share on other measures.[44] For example, the explicit state share of employment was 57 percent as of October 2010, and the state-owned

Assets Supervision and Administration Commission indicates that the assets of its firms have grown from the equivalent of 60 percent of GDP in mid-2003 to 62 percent of GDP in mid-2010.[45] Economies where state-owned enterprises constitute a large share of GDP miss out on the economic efficiencies that private sector competition engenders (as the chapter on domestic competition and entrepreneurship explains), which over time often leads to stagnating productivity growth in such economies.

Table 7-5: "*Economic Freedom of the World*" Government Enterprise and Investment Rating[46]

APEC Economy	Government Enterprise and Investment Rating (10=Best; 0=Worst)	Government Investment as a Share of Total Investment in Economy (%)
Australia	10	11.2
Canada	10	14.7
Chile	10	10.4
Hong Kong	10	N/A
Japan	10	13.3
Russia	10	14.6
Korea	8	17.0
New Zealand	8	16.9
Papua New Guinea	8	N/A
Peru	8	16.6
United States	8	18.9
Indonesia	7	N/A
Mexico	7	24.9
Philippines	7	22.5
Singapore	7	N/A
Chinese Taipei	7	23.0
Thailand	7	24.1
Vietnam	4	N/A
Malaysia	2	46.5
China	0	53.2
Brunei	N/A	N/A
APEC Average	**7.4**	**21.9**

Transparency and Accountability

Transparency and accountability are vital for effective governance. A lack of transparency and accountability can limit investment and resulting innovation. If government procurement awards are not

based on meritorious "best value" selections of the most innovative and cost-efficient solutions or technologies but are instead based on bribery, kickbacks, or other corrupt activity, then government procurements are unlikely to select the most innovative technologies or solutions and thus the overall level of innovation in a society will suffer, leaving the economy with less innovation than it would otherwise achieve.

Indeed, corruption—the abuse of entrusted power for private gain—can bring staggering financial and social costs to economies, adding 15 to 25 percent to the cost of government procurement, and in some cases as much as 40 to 50 percent.[47] Corruption robs citizen of the ability to enjoy best-value and best-quality products and services, while forcing society to pay more for inferior products and services. Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships.[48] Transparency International's Corruption Perceptions Index (CPI) measures 178 economies according to the perception of corruption in the private and public sectors. The 2010 CPI finds that nearly three-quarters of the 178 countries in the index score below five, on a scale from 10 (highly clean) to 0 (highly corrupt). The CPI asks survey questions relating to bribery of public officials, kickbacks in public procurement, embezzlement of public funds, and questions that probe the strength and effectiveness of public sector anti-corruption efforts.[49]

Two APEC economies—New Zealand and Singapore—lead the world (with Denmark) as having the least corruption in their public and private sectors with a score of 9.3 in the 2010 Corruption Perceptions Index.[50] Among APEC economies, they are joined in the top five by Canada, Australia, and Hong Kong, with scores ranging from 8.9 to 8.4 (Table 7-6). The United States places ninth among APEC economies with a 7.1 score. APEC economies averaged a 5.4 on the 2010 CPI, placing APEC slightly ahead of the global average. China places fifteenth with a 3.5 score. Indonesia, Vietnam, the Philippines, Papua New Guinea, and Russia score the lowest in the 2010 CPI. Chile showed the greatest improvement among APEC economies from 2009 to 2010 in mitigating corruption, its score jumping from 6.7 to 7.2

Table 7-6: Transparency International's Corruption Perceptions Index[51]

APEC Economy	Corruption Perceptions Index (10=Best;0=Worst)
New Zealand	9.3
Singapore	9.3
Canada	8.9
Australia	8.7
Hong Kong	8.4
Japan	7.8
Chile	7.2
United States	7.1
Chinese Taipei	5.8
Brunei	5.5

APEC Economy	Corruption Perceptions Index (10=Best;0=Worst)
Korea	5.4
Malaysia	4.4
China	3.5
Thailand	3.5
Peru	3.4
Mexico	3.1
Indonesia	2.8
Vietnam	2.7
Philippines	2.4
Papua New Guinea	2.1
Russia	2.1
APEC Average	**5.4**

Government Procurement of Advanced Technology Products

Finally, the World Economic Forum's *2010-2011 Global Competitiveness Report* includes a question asking executive opinion about whether "government procurement decisions foster technological innovation in your country?"[52] As noted, this reflects an appropriate role government procurement policies can play in enabling government to serve as a lead user of advanced technologies. Singapore, Chinese Taipei, Malaysia, the United States, and China score the highest on this indicator, with Singapore in the lead by an order of magnitude, scoring a 5.4, 14 percent higher than Chinese Taipei, Malaysia, and the United States, all tied for number two at 4.7 (Table 7-7). APEC economies averaged a score of 4.1, but just six economies scored less than the average, reflecting that government procurement policies in those economies could much more effectively foster technological innovation. New Zealand, Russia, Peru, Mexico, and the Philippines have the greatest room for improvement on this indicator.

Table 7-7: Government Procurement of Advanced Technology Products[53]

APEC Economy	Government Procurement of Advanced Technology Products (7=Best;1=Worst)
Singapore	5.4
Chinese Taipei	4.7
Malaysia	4.7
United States	4.7
China	4.5
Vietnam	4.4
Canada	4.3

APEC Economy	Government Procurement of Advanced Technology Products (7=Best;1=Worst)
Hong Kong	4.3
Brunei	4.2
Indonesia	4.2
Australia	4.1
Chile	4.1
Japan	4.1
Korea	4.1
Thailand	3.7
New Zealand	3.6
Russia	3.5
Mexico	3.3
Peru	3.3
Philippines	2.7
Papua New Guinea	N/A
APEC Average	**4.1**

Conclusion

In all economies, governments are the largest procurers of products and services. Governments should leverage their procurement activities to stimulate private sector innovation, in part by transparently rewarding innovative bid proposals and in part by conscientiously acting as early lead users that foster the development and acquisition of advanced products and technologies in the interest of seeding new markets. However, enterprises from all economies should be eligible to compete for public procurement contracts, and the source of enterprises' intellectual property or technology used in making bids (unless illegally acquired) should not be a consideration in awarding government procurement contracts. Governments must resist the temptation, especially in times of heightened economic duress, to perfunctorily favor domestic participants with local content requirements. At all times, government procurement practices should be transparent, accountable, non-discriminatory, performance-based, and openly competed. Effective government procurement practices have an important role to play in further liberalizing global trade, spurring innovation, and producing better outcomes for citizens in all APEC economies.

8. Conclusion

APEC economies have set a standard in their advocacy for greater regional economic integration and comprehensive trade facilitation and liberalization. The opportunity before APEC is to extend this focus to make the APEC region the world's most innovative. To realize this vision, APEC member economies need to implement policies with regard to trade, science and R&D, ICT, intellectual property rights, domestic market competition, and government procurement in ways that maximize their innovation capacity but without distorting global trade. To accomplish this, APEC economies' policies will have to be predicated on transparent, non-discriminatory, market-based principles that embrace both global standards and the free flow of talent, capital, information, products, services, and technologies. Moreover, APEC economies' innovation policies need to accord respect for innovators' intellectual property rights, while creating incentives for them to keep innovating in ways that promote improvements in economic growth and quality of life. By tackling the next generation of trade and innovation policy issues, APEC is poised to continue to be one of the world's leading forces for greater trade liberalization, economic integration, and economic growth.

Notes

Executive Summary Notes

[1] To calculate economies' final overall ranks, raw scores for each of the indicators were first standardized. Using these standardized scores, a weighted average score was calculated for each economy for each core innovation policy area and then in aggregate. The tiers are then calculated as three equidistant partitions between the resulting maximum and minimum scores in each section and overall. The number of economies in each tier can vary widely within section rankings; for example, an economy whose average score is a relative outlier may be the sole member of a tier. Economy scores are calculated with available data only; missing values are ignored and do not affect a country's position in the tiered rankings.

Chapter 1 Notes

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[57] World Trade Organization, *Trade Policy Review: Australia* (Geneva: WTO, 2011), http://www.wto.org/english/tratop_e/tpr_e/tp344_e.htm; World Trade Organization, *Trade Policy Review: Brunei Darussalam* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp296_e.htm; World Trade Organization, *Trade Policy Review: Canada* (Geneva: WTO, 2011), http://www.wto.org/english/tratop_e/tpr_e/tp346_e.htm; World Trade Organization, *Trade Policy Review: Chile* (Geneva: WTO, 2009), http://www.wto.org/english/tratop_e/tpr_e/tp320_e.htm; World Trade Organization, *Trade Policy Review: China* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp330_e.htm; World Trade Organization, *Trade Policy Review: China* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp299_e.htm; World Trade Organization, *Trade Policy Review: Hong Kong, China* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp341_e.htm; World Trade Organization, *Trade Policy Review: Indonesia* (Geneva: WTO, 2007), http://www.wto.org/english/tratop_e/tpr_e/tp285_e.htm; World Trade Organization, *Trade Policy Review: Japan* (Geneva: WTO, 2011), http://www.wto.org/english/tratop_e/tpr_e/tp343_e.htm; World Trade Organization, *Trade Policy Review: Korea, Republic of* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp304_e.htm; World Trade Organization, *Trade Policy Review: Malaysia* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp325_e.htm; World Trade Organization, *Trade Policy Review: Mexico* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp295_e.htm; World Trade Organization, *Trade Policy Review: New Zealand* (Geneva: WTO, 2009), http://www.wto.org/english/tratop_e/tpr_e/tp316_e.htm; World Trade Organization, *Trade Policy Review: Papua New Guinea* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp339_e.htm; World Trade Organization, *Trade Policy Review: Peru* (Geneva: WTO, 2007), http://www.wto.org/english/tratop_e/tpr_e/tp289_e.htm; World Trade Organization, *Trade Policy Review: The Philippines* (Geneva: WTO, 2005), http://www.wto.org/english/tratop_e/tpr_e/tp249_e.htm; World Trade Organization, *Trade Policy Review: Singapore* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp302_e.htm; World Trade Organization, *Trade Policy Review: Separate Customs Territory of Taiwan, Kinmen and Matsu* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp332_e.htm; World Trade Organization, *Trade Policy Review: Thailand* (Geneva: WTO, 2007), http://www.wto.org/english/tratop_e/tpr_e/tp291_e.htm; World Trade Organization, *Trade Policy Review: United States* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp335_e.htm; World Trade Organization, *Trade Policy Review: United States* (Geneva: WTO, 2006), http://www.wto.org/english/tratop_e/tpr_e/tp261_e.htm.

[58] World Trade Organization, *Trade Policy Review: The Philippines* (Geneva: WTO, 2005), http://www.wto.org/english/tratop_e/tpr_e/tp249_e.htm.

[59] Ibid. 2010 international equivalence ratio estimate is author's calculation based on the Philippines national standards goals and national data reported by the WTO.

[60] World Trade Organization, *Trade Policy Review: United States* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp335_e.htm; World Trade Organization, *Trade Policy Review: United States* (Geneva: WTO, 2006), http://www.wto.org/english/tratop_e/tpr_e/tp261_e.htm.

[61] Ibid.

[62] World Trade Organization, *Trade Policy Review: Chile* (Geneva: WTO, 2009), http://www.wto.org/english/tratop_e/tpr_e/tp320_e.htm.

[63] Ibid.

[64] Ibid.

[65] Ibid.

[66] Ezell and Atkinson, *The Good, Bad, and Ugly of Innovation Policy*.

[67] World Trade Organization, *Trade Policy Review: Korea, Republic of* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp304_e.htm.

[68] World Trade Organization, *Trade Policy Review: Mexico* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp295_e.htm.

[69] World Trade Organization, *Trade Policy Review: China* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp330_e.htm; World Trade Organization, *Trade Policy Review: China* (Geneva: WTO, 2008), http://www.wto.org/english/tratop_e/tpr_e/tp299_e.htm.

[70] Ibid.

[71] Ezell and Atkinson, *The Good, Bad, and Ugly of Innovation Policy*.

[72] World Trade Organization, *Trade Policy Review: China* (Geneva: WTO, 2010), http://www.wto.org/english/tratop_e/tpr_e/tp330_e.htm.

[73] Ibid.

Chapter 3 Notes

[1] See literature review in Robert D. Atkinson, "Effective Corporate Tax Reform in the Global Innovation Economy" (technical report, Information Technology and Innovation Foundation, Washington, D.C., 2009), http://www.itif.org/files/090723_CorpTax.pdf.

[2] Coe and Helpman, "International R&D Spillovers." The G7 countries are Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

[3] Aside from stipulating that the R&D must be performed domestically.

[4] See Charles I. Jones and John C. Williams, "Measuring the Social Return to R&D," *Quarterly Journal of Economics* 113, no. 4 (1998): 1119-1135; Edwin Mansfield, "Social Returns from R&D: Findings, Methods, and Limitations," *Research Technology Management* 34, no. 6 (1991): 24-27; Eric Brynjolfsson, Lauren Hitt, and Shinkyu Yang, "Intangible Assets: How the Interaction of Information Technology and Organizational Structure Affects Stock Market Valuations."

[5] J. G. Tewksbury, M. S. Crandall and W. E. Crane, "Measuring the Societal Benefits of Innovation," *Science* 209, no. 4457 (1980): 658-62.

[6] Australian Bureau of Industry Economics, *R&D, Innovation and Competitiveness: An Evaluation of the R&D Tax Concession* (Canberra: Australian Government Publishing Service, 1993). In 2011, Australia replaced its system of R&D super deductions with a system of R&D tax credits.

[7] Marcel Dagenais, Pierre Mohnen and Pierre Therrien, "Do Canadian Firms Respond to Fiscal Incentives to Research and Development?" (working paper, CIRANO, Québec, 1997).

[8] Dominique Guellec and Bruno van Pottelsberghe de la Potterie, "The Impact of Public R&D Expenditure on Business R&D," *Economics of Innovation and New Technology* 12, no. 3 (2003): 225-243.

[9] Martin Falk, "What Drives Business R&D across OECD Countries?," (working paper, Austrian Institute of Economic Research, Vienna, 2004).

[10] Guntram B. Wolff and Volker Reinthaler, "The Effectiveness of Subsidies Revisited: Accounting for Wage and Employment Effects in Business R&D," *Research Policy* 37, no. 8 (2008): 1403-1412.

[11] Robert D. Atkinson, "Expanding the R&E Tax Credit to Drive Innovation, Competitiveness and Prosperity," *Journal of Technology Transfer* 32, no. 6 (2007): 617-628.

[12] Deloitte, *2010 Global Survey of R&D Tax Incentives* (New York: Deloitte, 2011), http://www.investinamericasfuture.org/PDFs/Global_RD_Survey_2011.pdf.

[13] Ibid.

[14] KPMG, *R&D Incentives and Services Adding Value across ASPAC* (Amstelveen, Netherlands: KPMG, 2008), http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/rd_aspac_O_0807.pdf.

[15] Requiring that the R&D be performed domestically is an acceptable practice, however.

[16] The "Frascati" definition of R&D expenditure provides a baseline for grading individual economies' definitions of eligible expenditure, although there are several acceptable exemptions from the Frascati definition, including social science R&D, marketing expenses and indirectly-related expenditure. (For example, some economies, such as Norway, deem services expenditures such as ethnographic social research and concept piloting and prototyping as eligible for tax incentives. See SkatteFun, http://www.forskningsradet.no.) Likewise, while including capital expenditure related to R&D is a good practice, economies are not graded on capital expenditure eligibility in this study, due to the difficulty in

parsing the effects of incentives for R&D capital expenditure from other, more general capital expenditure incentives present in many tax codes. See Organization for Economic Co-operation and Development, *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development* (Paris: OECD, 2002).

[17] Stephen J. Ezell and Robert D. Atkinson, *The Good, The Bad, and The Ugly (and The Self-Destructive) of Innovation Policy: A Policymakers Guide to Crafting Effective Innovation Policy* (Washington, D.C.: Information Technology and Innovation Foundation, 2010), http://www.itif.org/files/2010-good-bad-ugly.pdf.

[18] Methodology: Incentives policies were reviewed using multiple sources. Policies were scored on the five criteria outlined as best practices in R&D and high-technology tax incentives. Generosity was scored by comparing the credits' rates, deduction rates (as a function of the corporate tax rate) and tax reduction/holiday rates (and applicable time periods) across economies for large companies and SMEs. OECD "b-index" scores were incorporated in the analysis, where available; see OECD, *Science, Technology and Industry Scoreboard 2009* (Paris: OECD, 2009). Other factors included in the analysis were the base expenditure amount, refundability, ceilings and caps, carryfoward and carryback, and the presence of additional incentives such as accelerated depreciation allowances, and VAT reductions and exemptions. Tax reductions and holidays typically provide a much larger tax bonus compared to credits and deductions, but apply to a narrower taxpayer base, and thus the size of the base, and whether it applied to broad industries or technologies verses a narrow range of firms was factored into the analysis. The "Frascati" definition of R&D expenditure provided a baseline for grading individual economies' definitions of eligible expenditure, although there are several acceptable exemptions from the Frascati definition, including social science R&D, marketing expenses, and indirectly-related expenditure; see Organization for Economic Co-operation and Development, *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development* (Paris: OECD, 2002). Likewise, while including capital expenditure related to R&D is a good practice, economies were not graded on capital expenditure eligibility in this analysis, due to the difficulty in parsing the effects of incentives for R&D capital expenditure from other, more general capital expenditure incentives present in many tax codes.

Source: Deloitte, 2010 Global Survey; Ernst & Young, Research Incentives; KPMG, R&D Incentives and Services; OECD, R&D Tax Incentives; Expert Group on Impacts of R&D Tax Incentives, Design and Evaluation of Tax Incentives for Business Research and Development: Good Practice and Future Developments (Brussels: European Commission, 2009), http://ec.europa.eu/invest-in-research/pdf/download_en/tax_expert_group_final_report_2009.pdf; Deloitte, International Tax and Business Guide: China (New York: Deloitte, 2010), http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Intl%20Tax%20and%20Business%20Guides/2010/dtt_tax_guide_china_2010.pdf; "R&D Tax Credit: Frequently Asked Questions," AusIndustry, June 21, 2011, http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxCredit/Documents/RDTaxCreditFAQs.pdf; Deloitte, "Mexico Tax Alert: R&D Cash Benefit Extended for 2011," news release, December 14, 2010, http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Alerts/dtt_tax_alert_Mexico_141210.pdf; Deloitte, "Tax Alert:

Hong Kong Government to Explore Introduction of R&D Tax Incentives," news release, June 2009, http://www.kpmg.com.cn/en/virtual_library/Tax/tax_alert/Taxalert0909.pdf; Ernst & Young, "International Tax Alert: Taiwan Releases Assessment Rules on Research and Development Tax Credit under Statute of Industrial Innovation," new release, January 7, 2011, http://www.ey.com/Publication/vwLUAssets/Taiwan,_International_Tax_Alert,_07.01.2011/$FILE/Taiwan,%20International%20Tax%20Alert,%2007.01.2011.pdf; David Noe, "R&D Tax Incentive in Chile" (presentation, TIP Workshop on R&D Tax Treatment in OECD Countries: Comparisons and Evaluations, Paris, December 10, 2007), http://www.oecd.org/dataoecd/59/62/40023795.pdf; "Additional Incentives," InvestChile, Chilean Economic Development Agency, accessed July 13, 2011, http://www.hightechchile.com/investchile_services/additional_incentives; United Nations Conference on Trade and Development, Economic Commission for Latin America and the Caribbean, Science, Technology and Innovation Policy Review: Peru (New York: United Nations, 2011), http://www.unctad.org/en/docs/dtlstict20102_en.pdf; "Business and Investment Incentives," Brunei Economic Development Board, accessed July 27, 2011, http://www.bedb.com.bn/doing_incentives.html.

[19] "R&D Tax Credit: Frequently Asked Questions," AusIndustry, June 21, 2011, http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxCredit/Documents/RDTaxCreditFAQs.pdf.

[20] Sharyn Sturgeon, Australian Department of Innovation, Industry, Science and Research, personal communication, July 26, 2011.

[21] Deloitte, *2010 Global Survey*.

[22] Deloitte, *2010 Global Survey*; OECD, *R&D Tax Incentives: Rational, Design, Evaluation* (Paris: OECD, 2010), http://www.oecd.org/dataoecd/61/13/46352862.pdf.

[23] David Noe, "R&D Tax Incentive in Chile," (presentation, TIP Workshop on R&D Tax Treatment in OECD Countries: Comparisons and Evaluations, Paris, December 10, 2007), http://www.oecd.org/dataoecd/59/62/40023795.pdf; "Additional Incentives," InvestChile, Chilean Economic Development Agency, accessed July 13, 2011, http://www.hightechchile.com/investchile_services/additional_incentives; The remaining 65 percent is eligible for tax deduction.

[24] Hong Kong Innovation and Technology Commission, “Research and Development Cash Rebate Scheme” (white paper, Hong Kong, April 2010), http://www.itc.gov.hk/ch/doc/funding/ITC_lft_sx_op4_29.pdf.

[25] Deloitte, *2010 Global Survey*, 34.

[26] Deloitte, *2010 Global Survey*; KPMG, *R&D Incentives and Services*.

[27] See KPMG, *R&D Incentives and Services*.

[28] Deloitte, *2010 Global Survey*; KPMG, *R&D Incentives and Services*.

[29] Deloitte, *2010 Global Survey*; KPMG, *R&D Incentives and Services*; OECD, *R&D Tax Incentives*; Deloitte, *International Tax and Business Guide: China* (New York: Deloitte, 2010),

http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Intl%20Tax%20and%20Business%20Guides/2010/dtt_tax_guide_china_2010.pdf.

[30] Deloitte, *2010 Global Survey*, 21. Malaysia also offers a 50 percent standard deduction (with a ceiling at 70 percent of taxable income) for companies that do not qualify for the super deduction.

[31] KPMG, *R&D Incentives and Services*.

[32] Ibid.

[33] "Business and Investment Incentives," Brunei Economic Development Board, accessed July 27, 2011, http://www.bedb.com.bn/doing_incentives.html.

[34] KPMG, *R&D Incentives and Services*.

[35] KPMG, *R&D Incentives and Services*; Deloitte, "Tax Alert: Hong Kong Government to Explore Introduction of R&D Tax Incentives," news release, June 2009, http://www.kpmg.com.cn/en/virtual_library/Tax/tax_alert/Taxalert0909.pdf.

[36] Ernst & Young, *Research Incentives*.

[37] Deloitte, *2010 Global Survey*; Deloitte, "Mexico Tax Alert: R&D Cash Benefit Extended for 2011," news release, December 14, 2010, http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Alerts/dtt_tax_alert_Mexico_141210.pdf.

[38] United Nations Conference on Trade and Development, Economic Commission for Latin America and the Caribbean, *Science, Technology and Innovation Policy Review: Peru* (New York: United Nations, 2011), http://www.unctad.org/en/docs/dtlstict20102_en.pdf; Patricia Guerra, "New ICT Ministry Proposed under Humala's Platform," *Business News Americas*, June 10, 2011, http://www.bnamericas.com/news/technology/new-ict-ministry-proposed-under-humalas-platform.

[39] Methodology: Government R&D expenditure is the value of R&D financed by the government sector in each economy. Figures are presented as a share of GDP for year 2007. Year 2007 figures were estimated for Australia, Brunei, Chile, Hong Kong, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam by multiplying each economy's most recent available figure by the average growth rate in APEC governments' R&D expenditure as a share of GDP across the time period. The data is sourced primarily from the UNESCO Institute for Statistics. GDP data comes from the World Bank. Data for Chinese Taipei is from the OECD and National Statistics, Republic of Taiwan (China).

Source: UNESCO Institute for Statistics, Reports, Science and Technology (GERD financed by government; accessed June 2, 2011), http://stats.uis.unesco.org/unesco/ReportFolders/ReportFolders.aspx; World Bank, World Development Indicators (gross domestic product; accessed June 2, 2011), http://data.worldbank.org/data-catalog/world-development-indicators; OECD, Science, Technology and R&D Statistics (gross domestic expenditure on R-D by sector of performance and source of funds; accessed June 2, 2011); Taiwan Directorate General of Budget, Accounting and Statistics, National Accounts, Statistical Tables (principle figures; accessed

June 2, 2011); 2007 ranking estimated from most recent available data for Australia, Brunei, Chile, Hong Kong, Indonesia, Malaysia, Philippines, Thailand, and Vietnam; no data available for Papua New Guinea and Peru.

[40] U.S. Committee on Prospering in the Global Economy of the 21st Century and U.S. Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, D.C.: National Academies Press, 2007).

[41] Wesley M. Cohen, Richard R. Nelson and John P. Walsh, "Links and Impacts: The Influence of Public Research on Industrial R&D," *Management Science* 48, no. 1 (2002): 1-23; For a review of the econometric evidence, see Paul A. David, Bronwyn H. Hall and Andrew A. Toole, "Is Public R&D a Complement or Substitute for Private R&D? A Review of the Econometric Evidence," *Research Policy* 29, no. 4 (2000): 497-529.

[42] While the United States is an upper-tier economy, its level of government support for R&D has fallen since the 1980s.

[43] "Top Universities," Quacquarelli Symonds Limited, accessed May 13, 2011, http://www.topuniversities.com/.

[44] Methodology: Higher education R&D performance is the value of R&D performed in (rather than financed by) each economy's higher education sector. Figures are presented as a share of GDP for year 2007. Year 2007 figures were estimated for Australia, Brunei, Chile, Hong Kong, Indonesia, Malaysia, Peru, the Philippines, Thailand, and Vietnam by multiplying each economy's most recent available figure by the average growth rate in APEC economies' higher education R&D performance as a share of GDP across the time period. The data is sourced primarily from the UNESCO Institute for Statistics, and GDP data is from the World Bank. Data for Chinese Taipei is from the OECD and National Statistics, Republic of Taiwan (China).

Source: UNESCO Institute for Statistics, Reports, Science and Technology (GERD financed by government; accessed June 2, 2011), http://stats.uis.unesco.org/unesco/ReportFolders/ReportFolders.aspx; World Bank, World Development Indicators (gross domestic product; accessed June 2, 2011), http://data.worldbank.org/data-catalog/world-development-indicators; OECD, Science, Technology and R&D Statistics (gross domestic expenditure on R-D by sector of performance and source of funds; accessed June 2, 2011); Taiwan Directorate General of Budget, Accounting and Statistics, National Accounts, Statistical Tables (principle figures; accessed June 2, 2011); 2007 ranking estimated from most recent available data for Australia, Brunei, Chile, Hong Kong, Indonesia, Malaysia, Peru, Philippines, Thailand, and Vietnam; no data available for Papua New Guinea.

[45] Wendy H. Schacht, "Patent Ownership and Federal Research and Development (R&D): A Discussion of the Bayh-Dole Act and the Stevenson-Wydler Act" (technical report, Congressional Research Service, Washington, D.C., 2000), http://ncseonline.org/nle/crsreports/science/st-66.cfm.

[46] Gregory D. Graff, "Echoes of Bayh-Dole? A Survey of IP and Technology Transfer Policies in Emerging and Developing Economies," in *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices*, eds. Anatole Krattiger et al. (Oxford: MIHR; Davis, CA:

PIPRA, 2007), 175-176, http://www.iphandbook.org/handbook/ch03/p03/; Hepeng Jia, "China Allows Academics to Own Patents," *Chemistry World*, news release, January 4, 2008, http://www.rsc.org/chemistryworld/News/2008/January/04010802.asp.

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[48] Risaburo Nezu et al., Technology Transfer, Intellectual Property and Effective University-Industry Partnerships: The Experience of China, India, Japan, Philippines, the Republic of Korea, Singapore and Thailand (Geneva: World Intellectual Property Organization, 2007), http://www.wipo.int/freepublications/en/intproperty/928/wipo_pub_928.pdf.

[49] M. V. Ramani, "Technology Commercialization by Academic Institutions of Far East Countries: A Review," *Society for Technology Management*, newsletter, July 2009, http://www.fenwick.com/docstore/publications/ip/technology_transfer_considerations.pdf.

[50] Methodology: Economies' intellectual property policies and (university) technology transfer systems were reviewed using multiple sources. Economies were scored on the extent to which they have a formalized law (or equivalent, as with Singapore) granting universities ownership of IP resulting from university-performed research financed by the government. Economies with a formalized (or equivalent) law received the highest score; economies with only informal practices of granting universities' ownership were assigned an average score, provided that they had functioning university technology transfer systems in place; economies with no formal policy and an underdeveloped university technology transfer system were assigned the lowest score.

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Chapter 7 Notes

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