



THAILAND

INDUSTRIALIZATION AND ECONOMIC CATCH-UP

THAILAND INDUSTRIALIZATION AND ECONOMIC CATCH-UP

COUNTRY DIAGNOSTIC STUDY



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Foreword

Thailand has undergone major industrial and social transformation amid rapid economic growth and development for over half a century. It is now the second largest economy with the 4th highest income per capita in the Association of Southeast Asian Nations. It has successfully shifted its economy from agriculture to export-oriented manufacturing, while integrating key production, particularly automobiles and electronics, into regional value chains. It has also been quite successful in attracting foreign direct investment, particularly in export-oriented sectors.

Now, as an upper-middle-income country, however, it faces new challenges. Wages are rising rapidly and productivity growth needs to keep up. Overall labor productivity grew 1.9% between 2007 and 2012, but with marked differences across sectors: it increased 2.5% in manufacturing, 1.9% in services, and 0.9% in agriculture. The country is also losing competitiveness in low-wage, low-skilled goods to less-developed, labor-abundant countries. Exports of labor-intensive goods will soon fall below imports of those goods.

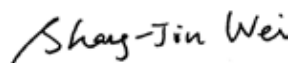
As Thailand has transitioned from an agrarian to industrial economy, its manufacturing and service industries have also moved from the lower-end of the global value chain to the higher end. However, both horizontal and vertical transitions remain incomplete. The agriculture sector still employs almost 40% of the workforce. Employment in manufacturing has stagnated, while the bulk of the workforce remains engaged in low-productivity, small-scale activities in trading and services.

Moving further up the global value chain and reaching high-income status requires upgrading industrial sophistication and increasing domestic value addition in exports. Failure to do so, or to establish a broader base of innovative firms and improve competitiveness in the services sector, may constrain longer-term growth potential and, more importantly, the prospect of creating an adequate number of quality jobs for inclusive growth.

This report identifies five major challenges in this transition: (i) enhancing research and development and international technology transfers; (ii) elevating workers' skills and their industrial relevance; (iii) addressing structural impediments to competition, notably in services; (iv) providing advanced transport and logistics infrastructure; and (v) improving access to finance and technology for micro, small, and medium-sized enterprises. Thailand needs to enhance the domestic content of production capabilities for current technology and capital-intensive export industries. To do so, it is critical that it reinforces local suppliers' linkages to global production networks and intensifies technology transfer from major global players to local producers. Reaching the higher-value economic segment requires not only innovation and advanced technologies in production and processing, but also an environment that is conducive to new businesses and investments. Maintaining a reasonably stable economic and political environment is crucial to restoring investor confidence.

Major transformation is in order: accelerating market reform and enhancing competition, establishing effective social and educational policy, upgrading infrastructure for a modern industrial and service economy, and promoting regionally balanced growth and development.

As a trusted partner, the Asian Development Bank is committed to supporting Thailand in its development goals. I hope that the analysis and policy suggestions this report offers are found useful for the country's transition toward a modern industrial and service economy.



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Contents

Foreword	iii
Acknowledgments	iv
Boxes, Figures, and Tables	vi
Abbreviations and Acronyms	viii
Thailand Fast Facts	ix
Highlights	x
1. Overview: Economic Transformation and Industrial Upgrade	1
2. Technological Progress: Limited International Technology Transfer	10
2.1 Technological Performance to Date	10
2.2 Technology Upgrading through Production Networks	19
3. Challenges in the Transition to High-Income Status	24
3.1 Research and Development	24
3.2 Education Quality and Skills Mismatch	29
3.3 Constrained Competition in Services	38
3.4 Infrastructure Gaps for a Modernizing Economy	43
3.5 Small and Medium-Sized Enterprises and the Missing Middle	48
4. Policy Recommendations: Addressing the Challenges	51
4.1 Closing the Technology Gap	51
4.2 Upgrading Skills, Managing the Workforce	52
4.3 Fostering Competition in Services	53
4.4 Creating Integrated Networks for Moving Goods, People, and Information	54
4.5 Promoting Regionally Balanced and Inclusive Growth	55
References	57

Boxes, Figures, and Tables

Boxes

3.1	Achieving High-Growth and High-Income Status through Services Market Expansion	40
3.2	Testing Competition Policy: Four Key Cases in the Services Sector	42
3.3	Competition in Telecommunications	46
4.1	Encouraging Research and Development through Public Procurement	52

Figures

1.1	Thailand's Growth Path at Different Growth Rates, 2014–2030	3
1.2	Sector Shares in GDP, 1960–2014	4
1.3	Shares of Major Production Sectors in GDP, 2014	4
1.4	Real Gross Capital Formation by Type, 1990–2013	7
1.5	Foreign Direct Investment, 1985–2014	8
1.6	Domestic Value Added in Gross Exports, Selected Economies, 1995–2011	9
2.1	Share of Global High-Tech Exports, Top 15 Economies, 2012	10
2.2	Value-Added Composition of Manufacturing, Thailand and the Republic of Korea, 1990–2013	11
2.3	The Trend of Revealed Comparative Advantage, Selected Economies, 1980–2013	13
2.4	Trend of Thailand's Revealed Comparative Advantage of SITC 7 Exports, 1980–2013	14
2.5	Share of Parts and Components in Total Manufactured Exports and Imports in Thailand, 1990–2012	15
2.6	Share of Final Manufactured in Total Manufactured Exports and Imports in Thailand, 1990–2012	15
2.7	Sophistication of Export Baskets in Selected Countries, 1980–2013	16
2.8	Disaggregation of Exports by Technological Sophistication Group, Selected Economies, 2013	16
2.9	Disaggregation of Exports by Technological Sophistication Group, Thailand, 1980–2013	16
2.10	Technical Sophistication of Export and Import Baskets in Thailand, 1980–2013	17
2.11	Number of Commodities with More Than 1% World Market Share, Selected Economies	17
2.12	Product Diversification: Number of Commodities with Comparative Advantage ($RCA \geq 1$), Selected Economies, 1980–2013	18
2.13	Number of Core Products with Comparative Advantage ($RCA \geq 1$), Selected Economies, 1980–2013	19
2.14	Global Network Trade Index—Automotive Industries	20
2.15	Structure of Thailand's Automobile Industry in 2014	21
2.16	Share of Parts and Components in Motor Vehicle Exports and Imports	21
2.17	Global Network Trade Index—Electric/Electronics Industries	22
2.18	Share of Parts and Components in Information and Communication Technology Exports and Imports	23
3.1	Research and Development Expenditure, Selected Economies, 2014	25
3.2	Research and Development Expenditure in Thailand, 2000–2016	26
3.3	Private Investment in Research and Development, Thailand, 2009	27
3.4	Patent Applications in Thailand, 1980–2013	28

3.5	Most Problematic Factors for Doing Business in Thailand, 2014	31
3.6	Main Causes of Job Vacancies in Thailand	31
3.7	Tertiary Enrollment by Discipline, Selected Countries	32
3.8	Firms Rating Certain Skills as Poor or Very Poor, 2004 and 2007	33
3.9	Labor Productivity in Thailand, 2001–2012	33
3.10	Industrial Labor Productivity, Selected Economies, 2000–2011	34
3.11	Trends in Mathematics and Science Achievement of Thai Students (8th Grade), 1995–2011	37
3.12	TVET Take-Up in Thailand, 2011	37
3.13	Share of Business Services in Total Employment, 2007	39
3.14	Labor Productivity in Services	40
3.15	Infrastructure and Global Competitiveness, Selected Economies, 2015	44
3.16	Cost to Export, Selected Economies, 2014	47
3.17	Cost to Import, Selected Economies, 2014	48
3.18	Liner Shipping Connectivity Index, 2010–2015	48
3.19	Small and Medium-Sized Enterprises' Share of GDP, 2007–2011	49
3.20	Sector Breakdown of Small and Medium-Sized Enterprises' Output, 2007–2011	49

Tables

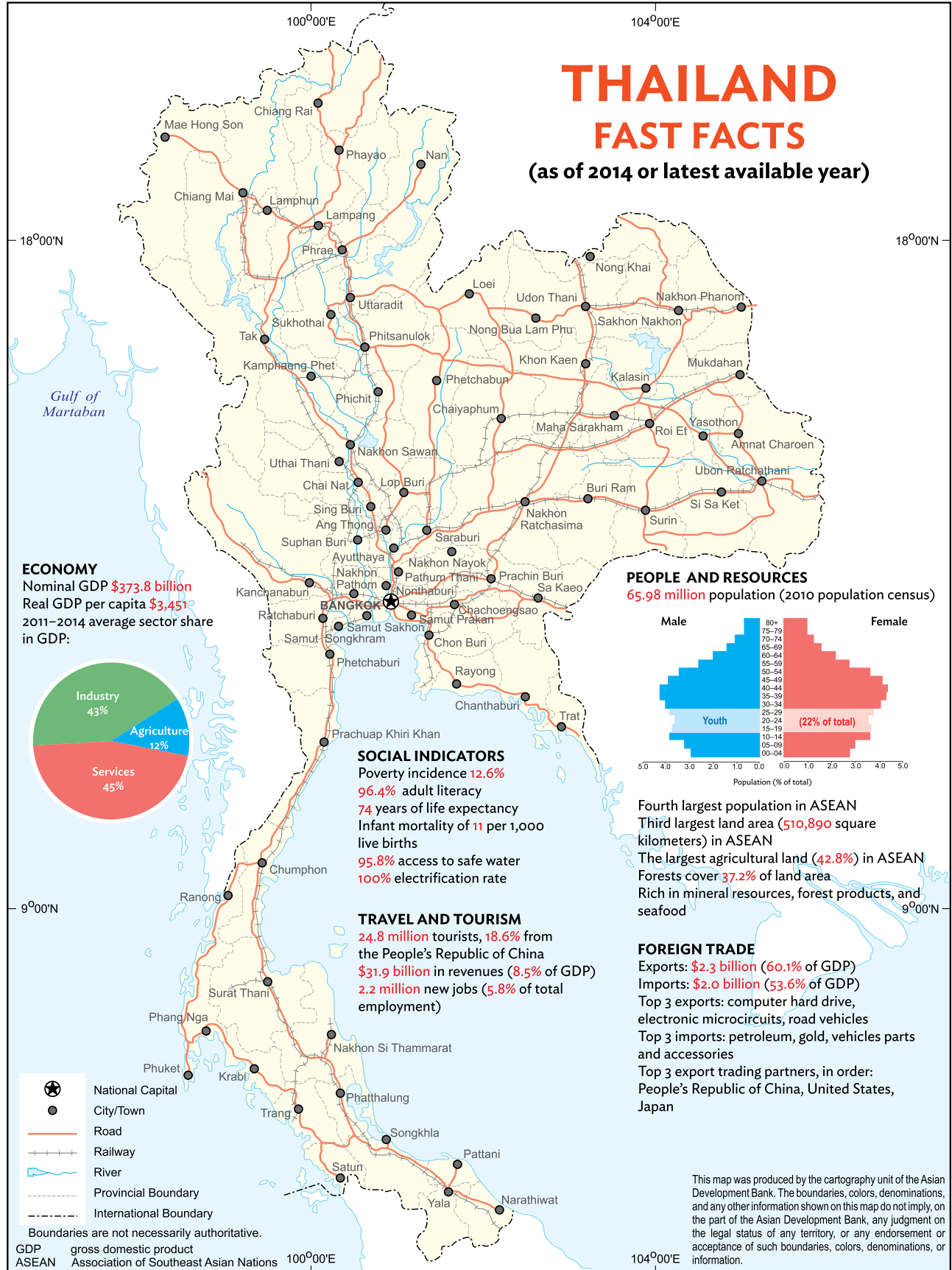
1.1	Real GDP Growth Rates, 1971–2014	2
1.2	Per Capita Real GDP, 1985–2014	2
1.3	GDP Average Annual Growth and Contribution of Major Production Sectors, 1961–2014	5
1.4	Contribution of Manufacturing Industry Subsector to GDP Growth, 1961–2014	5
1.5	Gross Regional Product, Population, and GRP per Capita	6
1.6	Sector Shares in Regional GDP, 1981, 1983, 2013	6
1.7	Thailand Domestic Value Added in Exports by Industry, 1995–2011	9
2.1	Export Shares, 1980 and 2013	12
2.2	Share of the Top 10 Export Items in Total Exports in Thailand, 1990, 2000, and 2013	13
2.3	Revealed Comparative Advantage of SITC 7 Exports in 2013	14
2.4	Diversification of Exports by Commodity Group, Selected Economies, 2013	18
3.1	Expenditure on Research and Development by Source	25
3.2	Allocation of Budget for Innovation Activities	26
3.3	Number of Researchers	27
3.4	Patent Applications, Selected Economies, 2014	28
3.5	International Property Rights Index, 2012	28
3.6	Educational Attainment of Labor Force in Thailand, 18–65 years old, 2011	30
3.7	Labor Force with Secondary and Tertiary Education, Selected Countries	30
3.8	Gross Enrollment Ratio in Thailand, 1971–2013	35
3.9	School Enrollment, Selected Economies	35
3.10	Educational Attainment of Labor Force by Region, 18–65 years old, 2011	35
3.11	PISA Scores, Selected Economies, 2012	36
3.12	Thailand's PISA Scores	36
3.13	Share of Services in Value Added, Selected Economies, 1990 and 2010	39
3.14	Legal Limits on Foreign Equity in the Services Sector in Selected ASEAN Economies	41
3.15	Basic Infrastructure in High- and Middle-Income Countries in Asia	43
3.16	Telecommunications Indicators, Selected Economies, 2014	45
3.17	Access to Computer and Internet, Selected Economies, 2013	45
3.18	Logistics Performance Index Rankings, Selected Economies, 2014	46
3.19	Days to Export and Import in Thailand, Trading across Borders, 2006–2015	47

Abbreviations and Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
FDI	foreign direct investment
GDP	gross domestic product
GRP	gross regional product
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
PRC	People's Republic of China
R&D	research and development
RCA	revealed comparative advantage
SITC	Standard International Trade Classification
SMEs	small and medium-sized enterprises
TIMSS	Times International Mathematics and Science Study
TTCA	Thailand Trade Competition Act
TVET	technical and vocational education and training

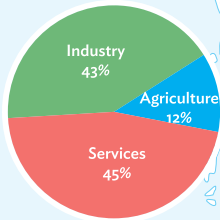
THAILAND FAST FACTS

(as of 2014 or latest available year)



ECONOMY

Nominal GDP **\$373.8 billion**
 Real GDP per capita **\$3,451**
 2011–2014 average sector share in GDP:



SOCIAL INDICATORS

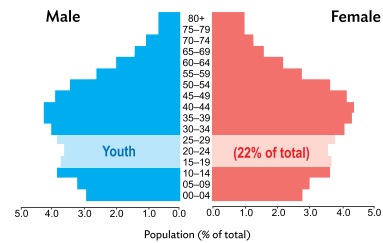
Poverty incidence **12.6%**
96.4% adult literacy
74 years of life expectancy
 Infant mortality of **11** per 1,000 live births
95.8% access to safe water
100% electrification rate

TRAVEL AND TOURISM

24.8 million tourists, **18.6%** from the People's Republic of China
\$31.9 billion in revenues (**8.5%** of GDP)
2.2 million new jobs (**5.8%** of total employment)

PEOPLE AND RESOURCES

65.98 million population (2010 population census)



Fourth largest population in ASEAN
 Third largest land area (**510,890** square kilometers) in ASEAN
 The largest agricultural land (**42.8%**) in ASEAN
 Forests cover **37.2%** of land area
 Rich in mineral resources, forest products, and seafood

FOREIGN TRADE

Exports: **\$2.3 billion** (**60.1%** of GDP)
 Imports: **\$2.0 billion** (**53.6%** of GDP)
 Top 3 exports: computer hard drive, electronic microcircuits, road vehicles
 Top 3 imports: petroleum, gold, vehicles parts and accessories
 Top 3 export trading partners, in order: People's Republic of China, United States, Japan

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- National Capital
- City/Town
- Road
- Railway
- River
- Provincial Boundary
- International Boundary

GDP gross domestic product
 ASEAN Association of Southeast Asian Nations

Highlights

Thailand joined the ranks of the upper-middle-income countries in 2011, with sustained high growth and rapid poverty reduction. Gross domestic product (GDP) grew an average of 9.5% per year between 1987 and 1996 on the back of political stability, a business-friendly regulatory environment, a large domestic market, open access to foreign investment, and greater participation in regional value chains. In the years following the Asian financial crisis of 1997–1998, growth slowed to an average 3.9% during 2000–2014. The slowdown may have been largely due to a series of shocks that hit the economy—a coup in 2006 and subsequent political unrest; the global financial crisis and demand slump of 2008–2009; and massive flooding in 2011. The series of events dampened investor confidence and affected domestic demand and growth performance. However, some of the reasons for this decline are also structural.

Challenges as an upper-middle-income economy

Thailand has successfully transformed its economy from agriculture to export-oriented manufacturing, while integrating key manufacturing production into the regional value chain, particularly in automobiles and electronics. Moreover, it has established a regional hub for key transport and logistics with a world-class airport, while its economic base has been diversified into tourism, health care, and other services.

As wages rise, however, productivity needs to keep pace for the economy to stay competitive. Thailand boasts a few world-class industries and services, such as automobiles or high-end hospitality, but the bulk of its workforce remains in low-productivity activities in trading and services. The agriculture sector still employs almost 40% of workers. Growth and structural transformation have also largely concentrated in and around Bangkok. The North, Northeast, and far South lag behind Bangkok and the Central region in economic growth and social development.

Thailand needs to move into the higher-value segment of economic activity and create high-quality jobs. Innovation, adaptation, and use of technology are critical to such growth, driving improvements in productivity and enabling the production of more sophisticated and higher-value goods and services. An educated and skilled workforce, alongside supportive infrastructure and market systems, is essential for attracting investment in high-tech manufacturing, advanced research and design, and high-productivity services.

This report identifies the main constraints to Thailand's transition to a more modern industrial and service economy. Further major transformation is in order: this includes accelerating market reform and enhancing competition; upgrading infrastructure for a modern industrial and service economy; improving access to finance and technology for micro, small, and medium-sized enterprises (MSMEs); establishing effective social and educational policy; and promoting regionally balanced growth and development.

1. Research and development and technology transfer from abroad

Technology transfer has been a key element in the export-oriented growth strategies pursued among the first crop of Asia's "miracle" economies. Thailand is now well integrated into regional and global production networks. But to move up the global value chain, it needs to enhance efforts to absorb and apply imported technology and develop indigenous high-tech industries.

- Thailand is the 12th largest automobile producer in the world and a leading producer of hard disk drives, making it a major exporter of high-value goods, ranking 14th in the world. However, much of the technology for this is borrowed from multinational firms and has not spilled over into other domestic firms. Innovation is weak in the domestic business community, with relatively low research and development (R&D) and limited patenting.
- The large majority of local firms remain Tier 2 and 3 suppliers—that is, with relatively low industrial sophistication. Tier 1 suppliers, by contrast are mainly foreign firms, as are finished goods assemblers. The electronics subsector, notably the production of hard disk drives, relies on imports for high-value inputs.
- R&D spending is low, at about 0.25% of GDP, and has been stagnant near that level for more than a decade. Government has established infrastructure for public research in science and technology, but funding is limited. More private sector R&D is needed, especially in the auto and electronics sectors.
- Support for science, technology, and innovation remains fragmented, and a focused and effective strategy for upgrading supportive infrastructure is needed.
- Legal protection of property rights is weaker in Thailand than in higher-income counterparts in East and Southeast Asia, weakening incentives for innovative research and commercial inventions.
- Stronger links are needed between higher education institutions and the private sector. Limited interaction has tended to focus on needs-based consultancies and the troubleshooting of process bottlenecks, rather than fostering innovation through high-value, long-term collaboration.

2. Skills enhancement and business and education partnerships

The skill level of the Thai workforce, though improved significantly since the late 1990s, trails the level of now high-income Asian countries when they were at Thailand's current level of development. In 2014, 45% of the labor force had primary education, 28% secondary and 20% higher education, a substantial improvement from 2001 when most of the labor force had reached only elementary education (62%). But a significant skills gap exists due to less-than-desirable business and education partnerships.

- Secondary-level math and science performance is considerably below that of high-income countries elsewhere. International test scores improved marginally or declined in the 2000s.
- Gross enrollment in secondary school has tripled in 2013 since the early 1990s, but about 14% of the age cohort still does not attend school. Enrollment is below levels in Eastern Europe, the most recent region to gain high-income status. Universal upper secondary education by 2015 remains a challenging target.
- Public investment in education improved in the 2000s over the previous decade, but remains below 5% of GDP and lags behind Malaysia and Viet Nam.
- Education strategy needs to be better linked to business needs. Social science and business programs remain favored subjects. Far fewer students enter the applied and natural sciences and the share of students in science-related disciplines lags behind high-income countries. Thailand needs more English skills as it expands as a logistics and transport hub and strengthens tourism.

3. Competition in services and regulatory environment

Regulatory constraints inhibit effective competition and behind-the-door trade barriers remain significant, both notably in services. The services sector contributes nearly half of GDP and a large share of employment. But its share of total value added fell from 51% to 43% between 1990 and 2010, bucking the trend of high- and middle-income countries. Based on disaggregated data in 2010, communications, finance, and business services are particularly low, at 7.7% of total value added, compared with 16.1% in the Republic of Korea, 14.6% in Malaysia, and 29.6% in Singapore.

- Restrictions on foreign investment in the services sector have hampered competition, especially in telecommunications, tourism, media, and finance. The country lags behind on its commitments to open up its services sector under the Association of Southeast Asian Nations (ASEAN) Economic Community.
- While a competition law has been in place since the late 1990s, its enforcement—and enforceability—have been questioned. The administrative and legal structures to support the law have been weak, and few specific cases of anticompetitive behavior have been settled by the law.
- A few key players dominate telecommunications and it has taken some time to generate effective competition. Several public services (utilities) are also dominated by state-owned enterprise monopolies and oligopolies, including power, natural gas purchase and distribution, and water supply. Recent efforts have sought to open these areas to competition through private investment.
- Labor productivity in the services sector is considerably below that of industry. Services have created significant new employment, but many new jobs have been channeled into low-wage areas in repair and personal services.

4. Quality of transport and logistics infrastructure

Thailand is ranked 71st among 140 economies in the World Economic Forum's Global Competitiveness Report (2015–2016) in quality of overall infrastructure, compared with Malaysia (16th), Taipei, China (21st), Republic of Korea (20th), and Singapore (4th). It is also ranked 32nd among 160 countries on overall logistics competitiveness in the World Bank's 2014 Logistics Performance Index, well below Singapore and Malaysia. Particular concerns are telecommunications—critical for the high-tech economy—and a railway sector that is rapidly losing relevance. Economic opportunities from a more integrated region, especially the ASEAN Economic Community in 2015, depend on efficient cross-border transfers, which require transportation and logistics infrastructure connecting the value chain across the region.

- Infrastructure spending as a share of GDP has been falling since the Asian financial crisis and is now about 1% (or about 4% of total government expenditures). In particular, inadequate investment in transport infrastructure—particularly for trade, transit, and transport facilitation with neighboring countries—has constrained Thailand's role as a regional hub. The government's plan to upgrade the national railway system and increase infrastructure investment would help.
- The transport system could be better integrated as a seamless intermodal system, supported by soft infrastructure—for example, an efficient document processing and goods clearance system—and the effective use of information and communication technology.
- While Thailand has physically adequate land and sea transport systems, its export costs are higher by 13% and 29% compared with Malaysia and Singapore, respectively, due to higher inland transportation and handling fees. While import costs are even higher by 25% compared with Malaysia, and by 73% with Singapore, due to high administrative costs in customs clearance and technical control, Thailand is also not as well connected to global shipping networks as Malaysia and Viet Nam.
- Rail transport has suffered from considerable underinvestment, leaving the sector's share of the freight market at about 2.5% in 2013, down from 9.0% in 2000. Without support and restructuring, it could become irrelevant in 10 years.

- Urban roads remain a concern, causing costly delays for people and business, notably in Bangkok. The natural environment has also suffered from a dependence on fossil fuels.

5. Micro, small, and medium-sized enterprise access to finance and technology

Thailand suffers a “missing middle” in enterprise size, with a few large firms dominating output, and small firms numerous. Over 99% of firms are small and medium-sized enterprises (SMEs), accounting for about 36% of GDP and three-quarters of enterprise-based employment. These firms—important for the Central region and outlying provinces—need to be productive and innovative.

- Finance is a key constraint on growth and expansion of small enterprises into medium-sized firms. Thailand ranks relatively low on access to credit—partly because it lacks a public assets registry to help provide collateral for bank lending—and on ease of starting a business.
- Finance to assist firms of all sizes needs to develop further, including commercial banks, business agents, venture capital, and the Market for Alternative Investments, a small-cap stock market. The government’s SME Bank and the Thailand Credit Guarantee Corporation are also designed to fill gaps in private sector financial institutions. But it is unclear how adequate this is for innovative, high-growth firms.
- MSMEs also lack technological capacity due to insufficient R&D spending and limited access to technology. While the Industrial Technology Assistance Program is designed to support technology development and the capacity of SMEs in the manufacturing sector, its scope and funding size remain limited.

Policy suggestions

1. Strengthen research and development and support technology absorption

- Increase R&D spending through the government research network and catalyze private R&D.
- Support science and technology research at universities and research institutes and encourage commercialization of such research by linking it to industry needs.
- Strategically position and aggressively promote Thailand as a high-tech center and research base for global production firms.
- Develop a network of government agencies and domestic firms that keeps abreast of quality, technology, and delivery standards of parts and components in key subsectors dominated by foreign firms such as automobiles and electronics.
- Streamline patent approval and improve the enforcement of intellectual property rights.
- Assess and expand the model of science and technology parks initiated through the Thailand Science Park and Software Park Thailand.

2. Upgrade workers’ skill levels

- Review the current education budget. Raise education expenditure above a minimum of 5% of GDP, while ensuring that increased funding improves learning outcomes.
- Strengthen higher education systems and promote natural and applied sciences in tertiary education.
- Improve teaching in math, science, and other subjects at secondary schools to strengthen the foundations for technical and vocational education and training (TVET) and higher education. Improve teacher training, create incentives for good teaching and improve accountability.
- Strengthen the link between education and jobs while using the recent Commission for Higher Education initiatives to link tertiary education with industry. Encourage industry involvement with training institutions

through advisory panels, sector skills councils, and related arrangements. Engage industry in setting national skills competency standards.

- Increase availability and access to highly specialized vocational education and training and ensure that content is systematically aligned with industry needs.

3. Reduce structural impediments to competition

- Allow greater competition in services, by increasing foreign participation. Raise foreign ownership thresholds in services to the target set for the ASEAN Economic Community.
- Level the playing field between private and state-owned enterprises. Ensure greater private sector entry into the power, natural gas, and water sectors.
- Monitor ownership concentration in key services sectors to ensure adequate competition. Anticompetitive behavior tends to be high in sectors dominated by Thai conglomerates.

4. Expand investment in integrated and efficient infrastructure

- Plan and increase infrastructure investment to improve intermodal connectivity.
- Facilitate public-private partnerships in transport (and other areas) to meet funding needs.
- Restructure the railway sector, improve its management, and increase investment. Ensure connection to emerging rail systems in the Greater Mekong Subregion.
- Improve cross-border transport and logistic systems for easy and low-cost movement of goods and people.

5. Support better finance to small and medium-sized enterprises

- Support innovative start-ups and SMEs, especially in high-tech sectors, through policy incentives and assistance in attracting venture capital and equity finance.
- Create a public assets registry to help SMEs secure bank finance. Expand coverage of the public credit bureau.
- Better allocate support to SMEs outside of Central Thailand through the SME Bank, the Thailand Credit Guarantee Corporation, and other SME support programs.
- Improve SME access to technology and support links among medium-sized and larger manufacturing firms for technological upgrading.

Chapter 1

Overview: Economic Transformation and Industrial Upgrade

Thailand is now the second largest economy and has the 4th highest income per capita in the Association of Southeast Asian Nations (ASEAN). It is the 22nd largest economy in the world. In 2011, after more than 20 years as a lower-middle-income country, it reached upper-middle-income status.¹

The country has also undergone substantial industrial and social transformation alongside rapid economic growth and development over the last half century, and has transformed its industrial base from agriculture to export-oriented manufacturing. It has done so while integrating key manufacturing production, particularly in automobiles and electronics, into regional and global value chains. The world-class Suvarnabhumi Airport has also established Bangkok as a regional hub for transport and logistics, and the country's economic base has diversified into tourism, health care, and other services.

A series of shocks over the past decade has hit the economy in the last 10 years, however, including a coup in 2006 and subsequent political unrest, the global financial crisis and demand slump of 2008–2009, and massive flooding in 2011. Growth moderated to an annual average of 3.9% during 2000–2014, much slower than the 9.5% of 1987–1996, before the Asian financial crisis.

While the economy staged a notable comeback in 2010 and 2012 following the global financial crisis of 2008–2009, concerns remain about long-term growth potential. As an upper-middle-income country, Thailand faces new challenges. Wages are rising rapidly, which requires productivity to keep pace for industries to remain competitive. Despite the visible shift from an agrarian to an industrial economy, employment in manufacturing has stagnated. While parts of the economy are engaged in world-class export sectors, such as automobiles and electronics or in high-end hospitality and other services, the bulk of the workforce remains in low-productivity, small-scale activities in trading and services. The agriculture sector still employs almost 40% of the workforce.

Regional imbalances are another challenge. Areas near and around Bangkok are highly developed, but a key challenge remains in spreading activity to the less-developed North, Northeast, and far South regions.

Failure to upgrade and move to higher-value segments of global production networks, establish a broader base of innovative firms, and improve competitiveness in services may constrain longer-term growth potential and, more importantly, the prospect of creating an adequate number of quality jobs that can make growth inclusive. Moving into the higher-value economic

¹ These income categories, established by the World Bank, are defined by the thresholds set in gross national income in current dollars based on the Atlas method. In 2014, Thailand's gross national income per capita of \$5,410 was higher than the lower range of the upper-middle-income threshold of \$4,036, but considerably lower than the upper range of the threshold of \$12,475.

sectors requires not only innovation and advanced technologies in production and processing, but also an environment that is conducive to new businesses and investments. Major transformation is in order: this means accelerating market reform and enhancing competition, upgrading infrastructure for a modern industrial and service economy, improving access to finance and technology for micro, small, and medium-sized enterprises, establishing effective social and educational policy, and promoting regionally balanced growth and development.

Thailand has transitioned to an upper-middle-income country, but recent economic growth has lagged behind low- and middle-income Southeast Asian neighbors.

Thailand has been a development success story, with sustained growth and impressive poverty reduction, particularly in the 1980s, when gross domestic product (GDP) grew 7.8% a year on average, which was the second highest among comparators after the Republic of Korea. However, this high growth momentum was interrupted by the Asian financial crisis of 1997–1998,

followed by the fallout from the global financial crisis of 2008–2009 and the devastating flood in 2011. More recently, during 2011–2014, GDP growth has slowed to 2.5% (Table 1.1).

Income per capita has increased considerably after decades of steady economic growth, by 2014 reaching at least three times the 1985 level (Table 1.2), pushing poverty rates lower. The share of the population living below the national poverty line reached 12.6% in 2012, down from 65.3% in 1988 (World Bank, WDI).

However, growth was the lowest in the ASEAN region during 2011–2014, at 2.5%. The economy contracted 2.3% in 2009, and, even though it rebounded in 2010 by 7.8%, devastating floods saw near-zero growth in 2011 (0.1%). Growth gained a second wind in 2012 (6.5%).

Yet, simple projections based on possible growth rates suggest that Thailand has a lot of growing to do. Gross national income per capita grew an average of 2.9% during 2005–2014. Continuing at that pace, it would take 11 years, or until 2025, for Thailand to become a high-income country. But with fewer negative shocks,

Table 1.1: Real GDP Growth Rates, 1971–2014 (%)

Year	Indonesia	Republic of Korea	Malaysia	Philippines	Taipei, China	Thailand	Viet Nam
1971–1980	7.9	9.0	7.8	5.9	7.4	6.9	...
1981–1990	6.4	9.7	6.0	1.7	7.6	7.8	4.6
1991–2000	4.2	6.5	7.1	2.9	6.2	4.5	7.6
2001–2010	5.2	4.4	4.6	4.8	3.9	4.3	6.6
2011–2014	5.7	3.0	5.4	5.9	3.0	2.5	5.7

... = data not available, GDP = gross domestic product.

Note: Data for Viet Nam started in 1985.

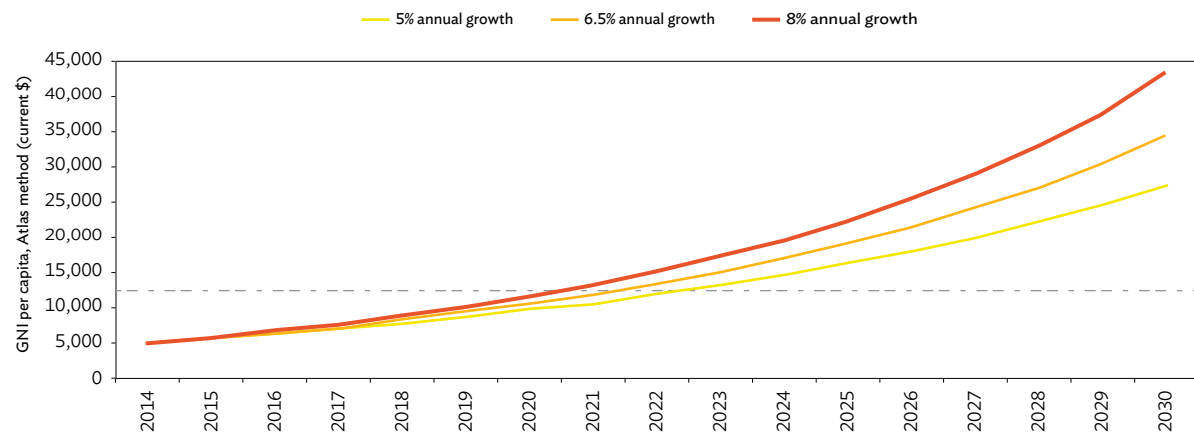
Sources: For Taipei, China: Asian Development Bank. Statistical Database System Online. <http://www.adb.org/data/sdbs> (accessed October 2015); for others: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed August 2015).

Table 1.2: Per Capita Real GDP, 1985–2014 (in 2005 \$)

Country	1985	1990	1995	2000	2005	2010	2014
Cambodia	...	...	263	329	471	605	745
Lao PDR	245	262	308	375	472	629	794
Viet Nam	268	301	410	532	699	900	1,078
Indonesia	655	840	1,129	1,086	1,273	1,570	1,866
Philippines	907	1,002	993	1,061	1,201	1,403	1,649
Thailand	1,047	1,572	2,280	2,206	2,690	3,164	3,451
Malaysia	2,609	3,147	4,348	4,862	5,554	6,319	7,304
Brunei Darussalam	30,806	26,831	27,294	25,926	25,914	24,589	25,140
Singapore	12,193	16,554	21,651	24,921	29,870	34,758	38,088

... = data not available, GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic.

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed August 2015).

Figure 1.1: Thailand's Growth Path at Different Growth Rates, 2014–2030


GNI = gross national income.

Note: Thailand is an upper-middle-income country, with a per capita GNI of \$5,340 in 2013 (the threshold for upper middle income is \$4,125). The dashed line indicates the threshold for high income (and the upper boundary for upper middle income) at \$12,736 per capita GNI. Income thresholds are based on World Bank classifications.

Sources: Asian Development Bank estimates using the GNI data from World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed October 2015); for population projections medium-fertility variant, 2014–2050: United Nations (UN). 2014. *The World Population Situation in 2014: A Concise Report*. New York: UN.

the country could grow faster, at 5% it would take 9 years (by 2023) to reach that income level; at 8%, it would take 7 years (by 2021) (Figure 1.1).

Thailand's economic restructuring has been significant in the past 3 decades.

An inter-sectoral shift from agriculture to industry has occurred, with services retaining an important role. The economic shocks and consequently more moderate growth of the past 15 years have not impeded this long-term secular trend. But the transformation into a fully industrialized economy is far from complete, and a significant intra-sectoral transformation into higher-value segments within the manufacturing and services sectors is at an early stage.

The industry sector expanded rapidly in the past several decades, accounting for 42% of GDP in 2014, from 30% in the early 1980s (Figure 1.2). Over the same period, agriculture's share of output has fallen significantly, from about 25% to just over 12%. Thailand's sectoral shares are broadly similar to those

of other large developing economies in Southeast Asia, notably Indonesia, Malaysia, the Philippines, and Viet Nam (Figure 1.3).²

But structural transformation is far from complete.

While agriculture's share of GDP has declined sharply, its share of the labor force has not. Agriculture accounts for 12% of output, but around 40% of employment.³ This suggests still significant room for rural labor shedding.⁴ The government has put a high priority on improving agricultural productivity in its 11th National Economic Social Development Plan, which targets increasing the proportion of agriculture and agro-industry sectors in GDP to at least 16%. Improving productivity in the agriculture sector will boost rural incomes and promote more regionally balanced growth while freeing up underemployed rural labor for potentially more productive industrial and service sectors.

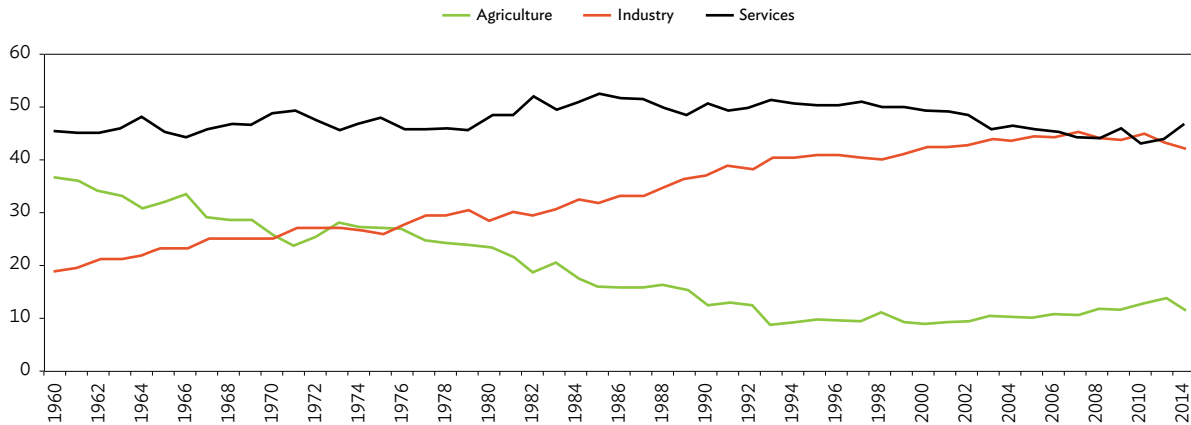
The share of labor in manufacturing has been relatively flat since the mid-1990s, peaking at 16% in 2005 with

² Among the region's high-income economies, industry (oil) dominates Brunei Darussalam, whereas services are preeminent in Singapore. Agriculture continues to play a major role in the less-developed economies of Cambodia, Lao People's Democratic Republic, and Myanmar (not shown in the figure).

³ Agriculture in industrialized economies, such as Australia, Japan, the Republic of Korea, and Taipei,China, account for 1%–3% of GDP.

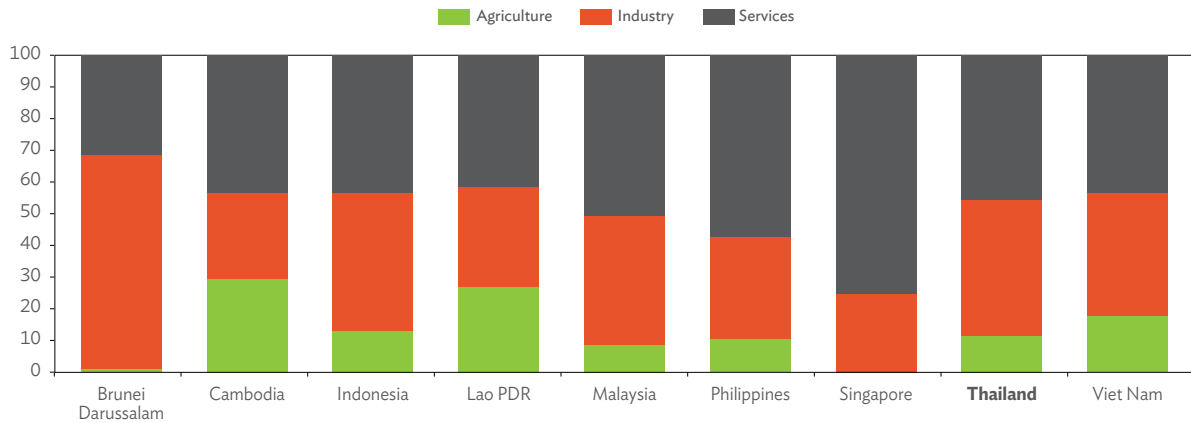
⁴ Agriculture's share of employment is currently less than 7% in Australia, Japan, the Republic of Korea, New Zealand, and Taipei,China.

Figure 1.2: Sector Shares in GDP, 1960–2014 (%)



GDP = gross domestic product. Source: Calculations based on data from World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

Figure 1.3: Shares of Major Production Sectors in GDP, 2014 (%)



GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic. Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

5.6 million workers. It has fallen since then to below 14%. Increases in services have made up for the declines in agriculture and manufacturing employment—and the sector now accounts for 39% of the labor force.

As part of this structural transformation, the contribution of the respective sectors to output growth has also evolved over time (Table 1.3). Agriculture's contribution declined considerably from about 22% in the 1960s to about 10% during 2011–2014. Growth in the sector fell to around 2% annually over the last 2 decades as increases in crop productivity waned. The

services sector contributed just over one-half of GDP growth from the 1960s to the 1980s and then yielded preeminence to industry in the 1990s. However, growth in both industry and services has slowed markedly in the past 15 years, lowering GDP growth overall.

The manufacturing subsector, now accounting for about three-quarters of industrial output, posted strong growth of about 10% annually during the 1960–1980s. While its growth slowed to about 5%–7% during the 1990s and 2000s, its share in GDP and contribution to overall growth rose to the highest

Table 1.3: GDP Average Annual Growth and Contribution of Major Production Sectors, 1961–2014 (%)

Period	Agriculture				Industry			Services		
	GDP Growth Rate	Growth Rate	Share to GDP	Contribution to GDP Growth	Growth Rate	Share to GDP	Contribution to GDP Growth	Growth Rate	Share to GDP	Contribution to GDP Growth
1961–1970	7.6	5.1	31.1	21.7	11.2	22.8	27.6	8.0	46.0	50.7
1971–1980	6.9	4.0	25.4	14.8	9.3	27.9	33.4	7.1	46.7	51.8
1981–1990	7.8	3.9	16.8	9.2	10.5	32.8	41.5	7.7	50.3	49.3
1991–2000	4.5	1.7	10.0	5.2	6.2	40.2	53.2	3.8	49.8	41.6
2001–2010	4.3	2.2	10.6	5.3	5.4	43.7	54.1	3.8	45.7	40.6
2011–2014	2.5	2.5	12.3	9.4	0.5	42.8	9.3	4.4	44.9	81.3

GDP = gross domestic product.

Source: Calculations based on data from World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

levels. During 2011–2014, however, manufacturing sector growth and its contribution to GDP growth declined substantially (Table 1.4).

Wage rates in Thailand did increase in the early 1990s, with hardly any corresponding increases in labor productivity (Nipon and Somkiat 2001). The country faced increasing competition from low-wage countries such as the People’s Republic of China (PRC), India, the Philippines, and Viet Nam. During 1996–2001, including the Asian financial crisis years, Fukao (2013) estimates that Thailand’s annual growth rate of labor productivity was 7.83 percentage points lower than the level during the high-growth period of 1985–1996, before the crisis. Of this, about 2 percentage points decline in labor productivity following the crisis was due to the marked slowdown in the shift of labor from agriculture to high-productivity sectors; the remaining 5.83 percentage points has been attributed to a drop in total factor productivity, which led to a decline in capital accumulation within each sector.⁵

The manufacturing sector is becoming more capital-intensive as Thailand loses the competitive advantage of abundant labor and low wages. The shares of labor-intensive sectors, such as food and textiles, have declined steadily, while shares rose in industries such as automobiles and electronics, which are relatively capital-intensive (Kim 2012), with possible implications for the ability of these industries in the manufacturing sector to generate employment.

Table 1.4: Contribution of Manufacturing Industry Subsector to GDP Growth, 1961–2014 (%)

Period	Manufacturing		
	Growth Rate	Share to GDP	Contribution to GDP Growth
1961–1970	11.6	14.2	19.6
1971–1980	10.1	19.0	26.2
1981–1990	9.9	23.3	28.5
1991–2000	7.3	29.5	46.6
2001–2010	5.5	34.4	43.7
2011–2014	0.3	34.1	4.7

GDP = gross domestic product

Source: Calculations based on data from World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

Regional development disparities and inequalities are also significant.

Growth and structural transformation have largely concentrated in and around Bangkok. Table 1.5 illustrates substantial differences in income, population, and the nature of economic activity across the seven geographic regions used in aggregating the gross provincial product of Thailand’s 77 provinces. The three faster-growing, richest regions account for nearly 68% of national GDP, but just 36% of the population. That means that the four poorer regions are home to about 64% of the population, but produce only about one-third of national output. The Northeastern region is especially lagging, accounting for about 28% of the

⁵ See Fukao (2013). The shift effect is equal to the sum of the effects of the expansion of capital-intensive sectors and of labor reallocation. The intra-sectoral effect is equal to the sum of the capital-labor reallocation effect and of capital deepening within each sector.

population, but only 11% of output. Moreover, the ratio of per capita GDP between the Eastern region (the richest) and Northeast (the poorest) was 6 in 2013, a large regional disparity by international standards, and one that has not improved over the past 3 decades.

Over the last 30 years, the gap between the poorer and richer regions has widened, with per capita income expanding nearly three times faster in the richer. Per capita income in the richer group was 3.9 times that of the poorer group in 2013 (Table 1.6). Indeed, even within the richer region there has been very little income convergence, although the relatively small Eastern region, with development of its petrochemical activities and other capital-intensive industries, has recently overtaken Bangkok and vicinities for the top

spot in regional per capita income. The Central region is making only modest progress in closing the gap.

The structure of regional production evolved only slightly between 1981 and 2013. The poorer regions continue to rely on agriculture, as agriculture accounts for nearly 30% of gross regional product (GRP), although that reliance has weakened by 9 percentage points of GRP, shifting resources largely to small-scale manufacturing. Meanwhile, the richer regions expanded in manufacturing and services as agriculture dwindled to about 3% of GRP. Notably, the share of services in GRP in the richer regions increased only slightly over a long period of sustained increases in income, while it did not change in the poorer group. Despite marked differences in income between the

Table 1.5: Gross Regional Product, Population, and GRP per Capita

Region	GRP in 2013 (B million)	Population ('000 people)	GRP per Capita	GRP Growth 1981-2013
Bangkok and vicinity	5,723,246	15,203	376,463	5.5
Central	748,582	3,131	239,078	5.8
Eastern	2,327,906	5,406	430,584	7.6
Faster-growing regions	8,799,734	23,740	370,668	5.9
Northeastern	1,403,267	18,828	74,532	5.7
Northern	1,135,633	11,557	98,268	4.4
Southern	1,114,868	9,044	123,270	4.6
Western	456,530	3,586	127,294	4.3
Slower-growing regions	4,110,298	43,015	95,556	5.2
Thailand	12,910,038	66,755	193,395	5.3

B = Thai baht, GRP = gross regional product.

Sources: National Economic and Social Development Board Database. <http://eng.nesdb.go.th/Default.aspx?tabid=96> (accessed October 2015), and ADB estimates.

Table 1.6: Sector Shares in Regional GDP, 1981, 1983, 2013 (%)

	Poorer Regions		Richer Regions		Thailand	
	1981	2013	1983	2013	1983	2013
Agriculture	37.6	28.5	9.6	3.3	21.4	11.3
Industry	17.0	25.3	39.6	42.4	30.1	37.0
Manufacturing	8.4	15.6	32.9	33.4	22.6	27.7
Services	45.4	46.1	50.8	54.3	48.5	51.7
GDP	100.0	100.0	100.0	100.0	100.0	100.0
Ratios of per capita GDP						
Richer/poorer	3.9	3.9	...	...	...	...
Richer/Thailand	...	...	2.2	1.9	...	...
Share of population	73.9	64.4	26.1	35.6		

... = not applicable, GDP = gross domestic product.

Sources: National Economic and Social Development Board databases (accessed October 2015), and ADB estimates.

two regional groups, population shifted only modestly to the richer region. Since labor participation rates are broadly uniform across the country, with essentially no unemployment, labor productivity in the various regions is broadly reflected in the disparity in per capita income levels.

Lagging growth and growing income gaps in the poorer regions reflect low investment in physical and human capital and, consequently, low productivity in these regions.

A study of recent budget expenditures (World Bank 2012a) indicated that the Bangkok area, with 17% of the population, received 72% of total budget expenditures; the Northeast, with 34% of the population, received only about 6%. This and similar small shares of budget resources for other lagging regions is a major factor behind disparities in the provision of infrastructure and the quality of educational and health services. While concentrating resources on developing Bangkok, with its port and the nearby provinces, likely offered the best opportunity for achieving rapid national growth, the challenge now is to broaden the scope of growth. It is also to reduce economic and structural imbalances across domestic regions by balancing the focus of public expenditure and inducing greater private investment to increase growth both in lagging regions and the whole country.

Relatively low investment has been the key economic weakness over the past decade or longer.

The investment rate has averaged more than 26% over the past decade, down sharply from 41% of GDP in the high-growth period in the 1990s prior to the Asian financial crisis. Total investment has not regained its precrisis level in absolute terms, although, admittedly, the precrisis level may have been largely exaggerated due to prevailing asset price booms. Nonetheless, investment in machinery and equipment, which also fell sharply during the Asian financial crisis, has regained its precrisis level in recent years (Figure 1.4). Construction investment has remained generally lower than levels of the early 1990s prior to the real estate boom years.

The slowing of foreign direct investment and the fall in high-technology exports is a concern for the sustainability of growth.

Where domestic investment fell, foreign investment picked up part of the slack. Foreign direct investment (FDI) became significantly more important in the years following the Asian financial crisis, accounting for between 10% and 30% of investment in most years (1999–2008) prior to the global financial crisis (Figure 1.5). Its role is crucial, as the bulk of FDI is oriented toward higher-value-added manufacturing. But FDI

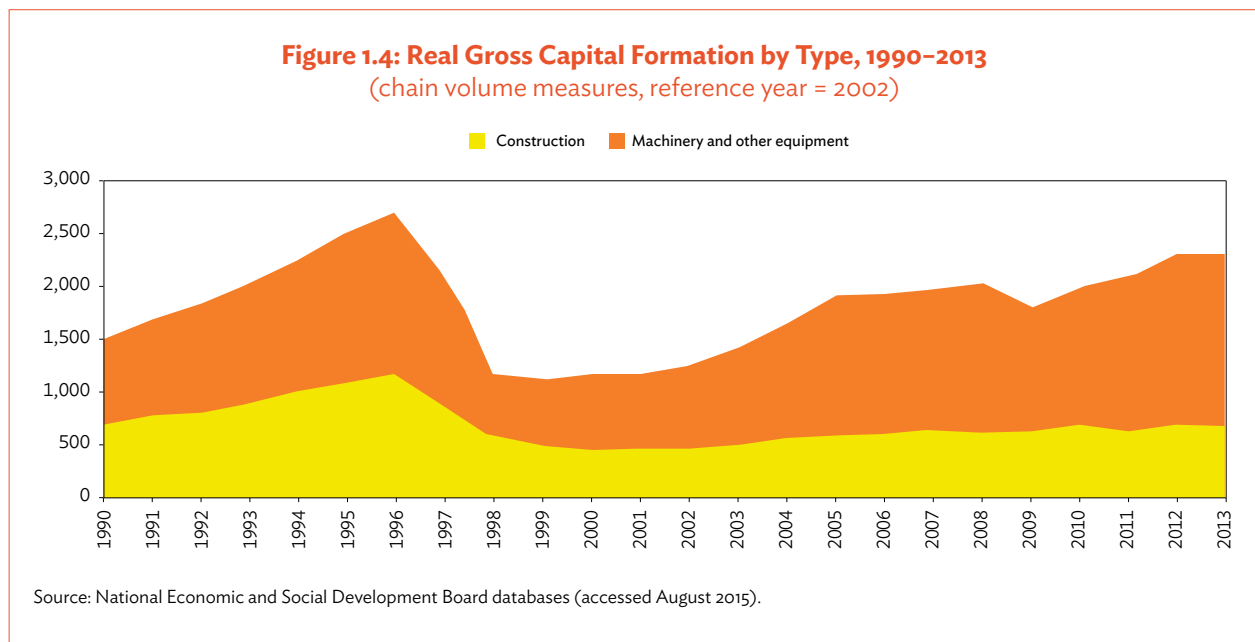
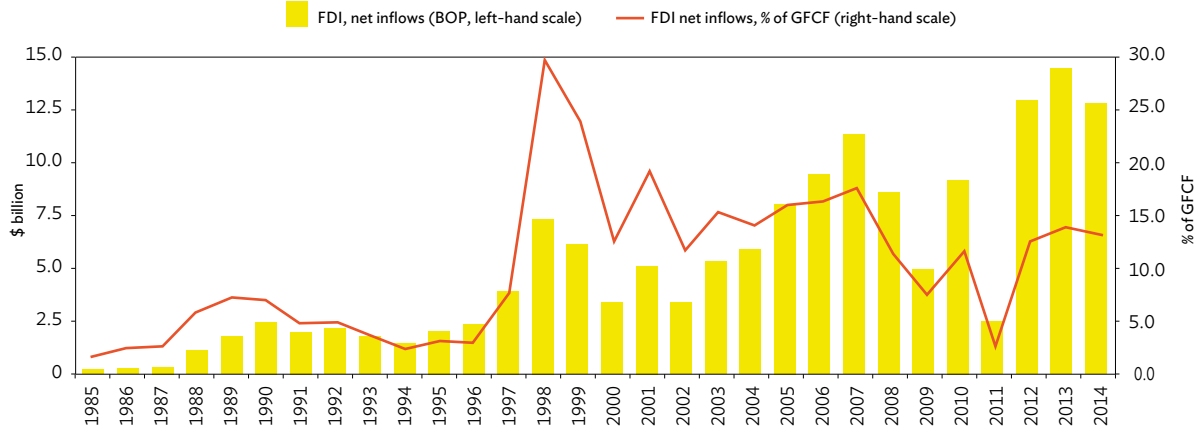


Figure 1.5 Foreign Direct Investment, 1985-2014



BOP = balance of payments, FDI = foreign direct investment, GFCF = gross fixed capital formation.
 Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed August 2015).

inflows slowed in the wake of the global financial crisis, and the share of FDI in total financial flows has been trending lower since peaking in 2007. It is now under 13%, although the dollar value of FDI recovered to a relatively high \$12.7 billion in 2014. Taken together, the fall of FDI as a share in fixed investment in recent years—along with the fall to 25% from just over 30% in the early 2000s in the share of high-technology exports in total manufactured exports—is worrisome. On the other hand, outward FDI by Thai companies to neighboring ASEAN economies has increased sharply in recent years, reflecting the shortage of operational workers and relatively high wage rates in Thailand.

Enhancing domestic value addition will have important implications for the sustainability of economic growth and employment generation.

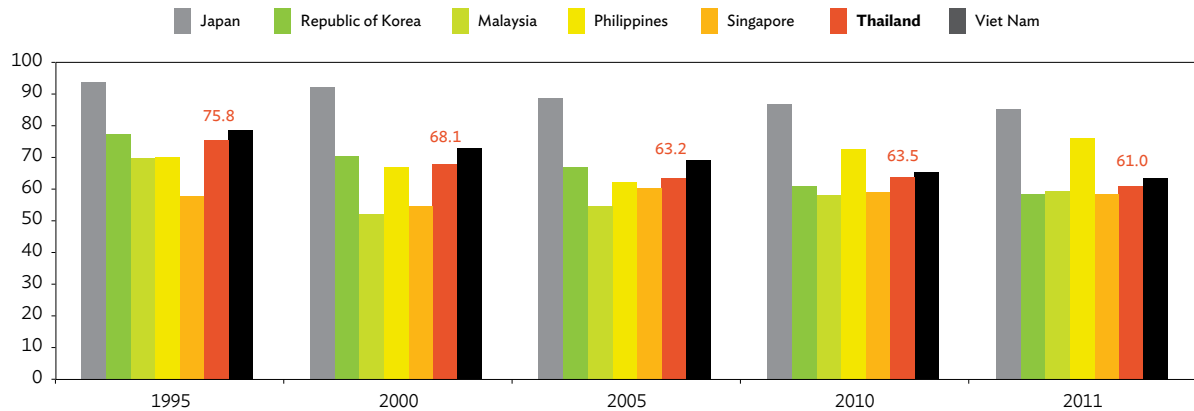
Although until now Thailand has attracted FDI quite successfully to move up the global value chain and join the camp of high-income economies, particularly in export-oriented sectors, it needs to upgrade industrial sophistication and increase domestic value addition in its exports. The domestic-value-added content in total gross exports declined overall during 1995–2011, while the gross exports-to-GDP ratio increased from

33.0% in 1995 to 54.2% by 2011; domestic value added in gross exports during the same period declined from 75.7% to 61.0% (Figure 1.6).

Analyzing the disaggregated data gains more insight into the domestic-value-added content in exports. Table 1.7 breaks down the different sectors by domestic value addition, showing that total manufacturing and transport equipment, along with basic metals and machinery equipment, are the major sectors responsible for this decline. This also reflects the declines in the country’s comparative advantage and competitiveness in these sectors. Of particular concern associated with this is a fall in both FDI inflows and domestic value addition after the global financial crisis.

To strengthen competitiveness, and sustain high and inclusive growth, Thailand needs to develop sectors with high value-adding activities and employment-generation potential. Growth and employment potential therefore depend on how well the country can diversify into new sectors and activities and move up the global value chain into high-value-added manufacturing and, eventually, high-skill services sectors.

Figure 1.6: Domestic Value Added in Gross Exports, Selected Economies, 1995–2011
(% of total exports)



Source: OECD iLibrary. OECD.Stat. http://www.oecd-ilibrary.org/economics/data/oecd-stat_data-00285-en (accessed August 2015).

Table 1.7: Thailand Domestic Value Added in Exports by Industry, 1995–2011 (%)

Industry	1995	2000	2005	2010	2011
Total	75.71	68.08	63.16	63.43	61.01
Agriculture, hunting, forestry, and fishing	90.44	86.76	83.53	83.64	81.91
Mining and quarrying	89.92	89.12	84.15	84.78	82.48
Total Manufactures	68.23	60.35	55.52	55.16	51.66
Wood, paper, paper products, printing, and publishing	75.52	75.90	70.28	66.49	61.40
Chemicals and non-metallic mineral products	71.24	64.14	59.32	60.05	55.41
Coke, refined petroleum products, and nuclear fuel	70.44	53.37	38.51	44.02	40.56
Rubber and plastics products	72.76	67.68	64.79	66.05	62.60
Other non-metallic mineral products	74.88	70.69	61.51	65.24	59.90
Basic metals and fabricated metal products	52.94	56.54	43.89	42.46	37.23
Machinery and equipment, nec	51.69	53.28	47.95	51.59	44.38
Electrical and optical equipment	51.40	40.66	39.88	41.68	37.51
Computer, electronic, and optical equipment	51.05	39.09	37.36	39.27	34.75
Electrical machinery and apparatus, nec	52.90	45.87	46.78	50.02	46.58
Transport equipment	51.81	48.75	49.44	50.58	45.12
Electricity, gas, and water supply	82.54	77.39	63.23	67.21	62.49
Construction	71.80	64.17	54.27	58.04	52.67
Total Business Sector Services	88.53	84.25	80.72	82.12	80.44
Transport and storage, post, and telecommunication	83.86	75.18	69.45	71.58	68.96
Community, social, and personal services	80.15	75.72	74.74	75.00	71.30

...nec = not elsewhere classified.

Source: OECD iLibrary. OECD.Stat. http://www.oecd-ilibrary.org/economics/data/oecd-stat_data-00285-en (accessed August 2015).

Chapter 2

Technological Progress: Limited International Technology Transfer

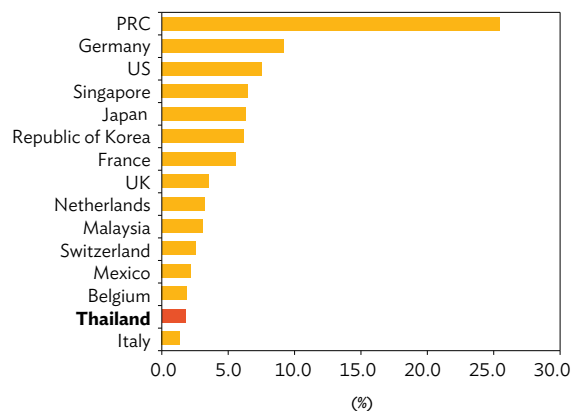
2.1 Technological Performance to Date

Thailand's record in technology acquisition and innovation is complex and uneven.

On the one hand, it is a leading producer of high-tech products, notably in automobiles and electronics. It is the 12th largest automobile producer in the world, specializing in light trucks, and is a leading production site for hard disk drives. The country is thus a major exporter of high-value goods, ranking 14th in the world (Figure 2.1). Multinational firms provide much of the technology for this production, which from the 1980s onward capitalized on Thailand's stable economy, low-cost workforce, and large domestic market to develop production clusters.

Yet, innovation is an area for further improvement; the technology foreign companies provided has not spilled over to domestic firms, while the domestic business community has invested relatively less in innovation. Research and development (R&D) is weak, with limited patenting activity. The government has established a system of innovation through science parks, research grants, and public research institutions covering areas ranging from metallurgy and food processing to nanotechnology and biotechnology, but the impact of these efforts is yet to be seen.

Figure 2.1: Share of Global High-Tech Exports, Top 15 Economies, 2012



PRC = People's Republic of China, UK = United Kingdom, US = United States.

Note: The data indicate a country's total share of world exports in high-tech goods.

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed on September 2015).

Gauging the technological level of a country is not easy and is normally done by proxy—by charting the sophistication of goods produced. More advanced technology is needed to make more complex goods. While analyzing domestic production is useful, more standardized and detailed production data are provided by exports. Exports data can also provide a measure

of competitiveness because goods are competing with those produced by other countries. Export data, however, may not clearly represent the domestic embeddedness of technology because (i) technology to produce exported goods may be provided by and contained within foreign-owned firms; and (ii) sophisticated inputs, which contribute to export value, may be imported. Despite these limitations, we first look briefly at changes in the domestic composition of production followed by a more detailed analysis of export data.

Industrial structure shows a significant shift to more high-value manufactured goods and away from agriculture.

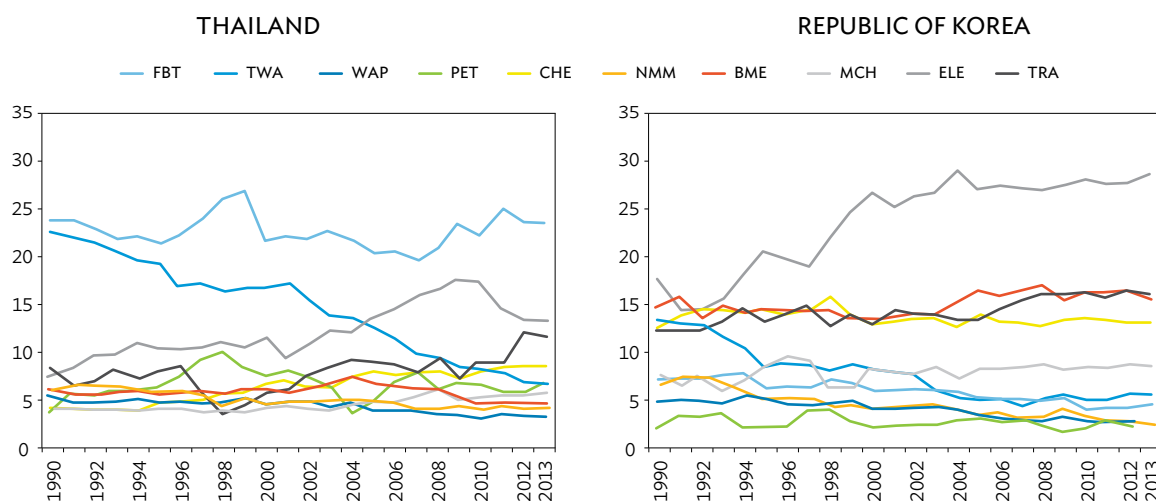
The increased sophistication of production in Thailand is confirmed in the trend of value-added composition among manufacturing sectors (Figure 2.2). The shares of labor-intensive sectors such as food and textiles have declined steadily, while those of more technologically intensive sectors such as electronics and automobiles rose. In 2013, food processing accounted for the largest proportion of value added, at about 24% of total manufacturing, followed by electronics (13%), transport (12%), chemical products

(9%), and petroleum products (around 7%). The share of labor-intensive textile and food industries peaked in the mid-1970s and continued to decline, with less than 5% currently.

Although this pattern of structural change in manufacturing is not so different from those of other countries, it is worth remarking that the Republic of Korea maintained a high share of textiles until the mid-1980s. The share of labor-intensive sectors in the Republic of Korea declined sharply afterward and was replaced by the rising share of electronics, chemical products, and transport equipment. Concurrently, Republic of Korea manufacturing in total turned from a labor-absorbing to a releasing industry. Thus, considering the high share of agricultural labor in Thailand, it may be premature for the country to shed labor-intensive manufacturing. It does appear, however, that the rise of labor-abundant countries, such as the PRC and Viet Nam, has squeezed Thailand's manufacturing into more capital-intensive production.

The significant shift to more high-value manufactured goods and away from agriculture and resource-based products is also seen in basic export data,

Figure 2.2: Value-Added Composition of Manufacturing, Thailand and the Republic of Korea, 1990–2013 (%)



BME = basic metal and metal fabrication; CHE = chemical products; ELE = electrical and electronic products; FBT = food, beverage, and tobacco; MCH = machinery; NMM = non-metallic materials; PET = petroleum and coal products; TRA = transport equipment; TWA = textile and wearing apparel; WAP = wood and paper products.

Sources: For Thailand: National Economic and Social Development Board. Gross Regional and Provincial Product Database. <http://eng.nesdb.go.th/Default.aspx?tabid=96> (accessed October 2015); for the Republic of Korea: Korean Statistical Information Service. <http://kosis.kr/eng/> (accessed September 2015).

using the Standard International Trade Classification (SITC). The share of agricultural products and raw materials (SITC 1 to 4) declined from 61.4% in 1980 to 18.2% in 2013 (Table 2.1). Compared with the Republic of Korea and Taipei,China, whose exports are already more specialized in manufactured goods and machinery, Thailand is still active in exporting agricultural products. It is noticeable, however, that the SITC 7 items (relatively more sophisticated industrial products) account for 46.8% in Thailand. As the structural change in exports of the Republic of Korea and Taipei,China shows, export development occurs through shifting major export items from light industries (SITC 6 and 8) to heavy and more sophisticated ones (SITC 7). In this respect, the current export structure of manufactured products in Thailand appears highly developed considering its income level, which corresponds to the Republic of Korea's and Taipei,China's in the early 1980s. This could be due to the growth of Thailand's export industries through the expansion of the global production network on one hand and the decline of textiles and consumer nondurables through competitive pressure from low-wage economies on the other.

This conjecture is confirmed if we trace the share of the garments, a representative labor-intensive product that usually accounts for the largest share in manufactured items at the initial stage of export development. Garments accounted for about 9.2% and was a top export category in total exports of Thailand in 1990, but its share decreased to 5.9% by 2000

(Table 2.2). However, in 10 years it lost its top place to road vehicles, office machines, and electronic products and disappeared from the list of the top 10 exports in 2013. In comparison, apparel remained the number one export item in 1970–1990 in the Republic of Korea, where labor-intensive light industries accounted for more than 50% of total exports until the mid-1980s.

Similarly, Thai exports are increasingly more sophisticated.

The trend of revealed comparative advantage (RCA) tells the same story about Thailand's export structure (Figure 2.3).⁶ The experience in East Asia shows that the typical pattern of export development from labor-intensive light industries comes with a sharp decline of agricultural products or crude materials, and then moves to more sophisticated goods. It might be noted, however, that even Japan maintained the comparative advantage in the SITC 6 and 8 items until the mid-1980s. The Republic of Korea and Taipei,China had maintained the comparative advantage of these items until the mid-1990s. Compared with these three countries, Thailand's export development in terms of RCA started in the 1980s, but skipped the period of rapid expansion of exports in SITC 6 and 8 items that these other countries went through.

Another characteristic of Thailand is the rise of SITC 7 items triggered by foreign-invested enterprises. The RCA of the 2-digit-level items in SITC 7 shows that Thailand has strong comparative advantage in office

Table 2.1: Export Shares, 1980 and 2013 (%)

SITC Description	Thailand		Republic of Korea		Taipei,China	
	1980	2013	1980	2013	1980	2013
Food, beverages, and tobacco (0,1)	44.0	11.9	7.1	1.0	9.7	0.8
Crude materials and animal oils (2,4)	17.4	6.3	2.1	1.3	2.0	1.1
Mineral fuels (3)	0.1	1.2	0.5	0.9	0.6	0.2
Chemicals (5)	1.2	10.6	3.4	12.2	3.0	10.6
Manufactured goods and miscellaneous articles (6,8)	31.4	21.3	70.3	22.5	60.4	29.4
Machinery and transport equipment (7)	5.6	46.8	15.8	60.9	23.8	63.6
Unclassified (9)	0.3	1.9	0.7	1.1	0.5	1.2

SITC = Standard International Trade Classification.

Note: The items are aggregated into 1-digit level based from the 4-digit levels of the SITC revision 2.

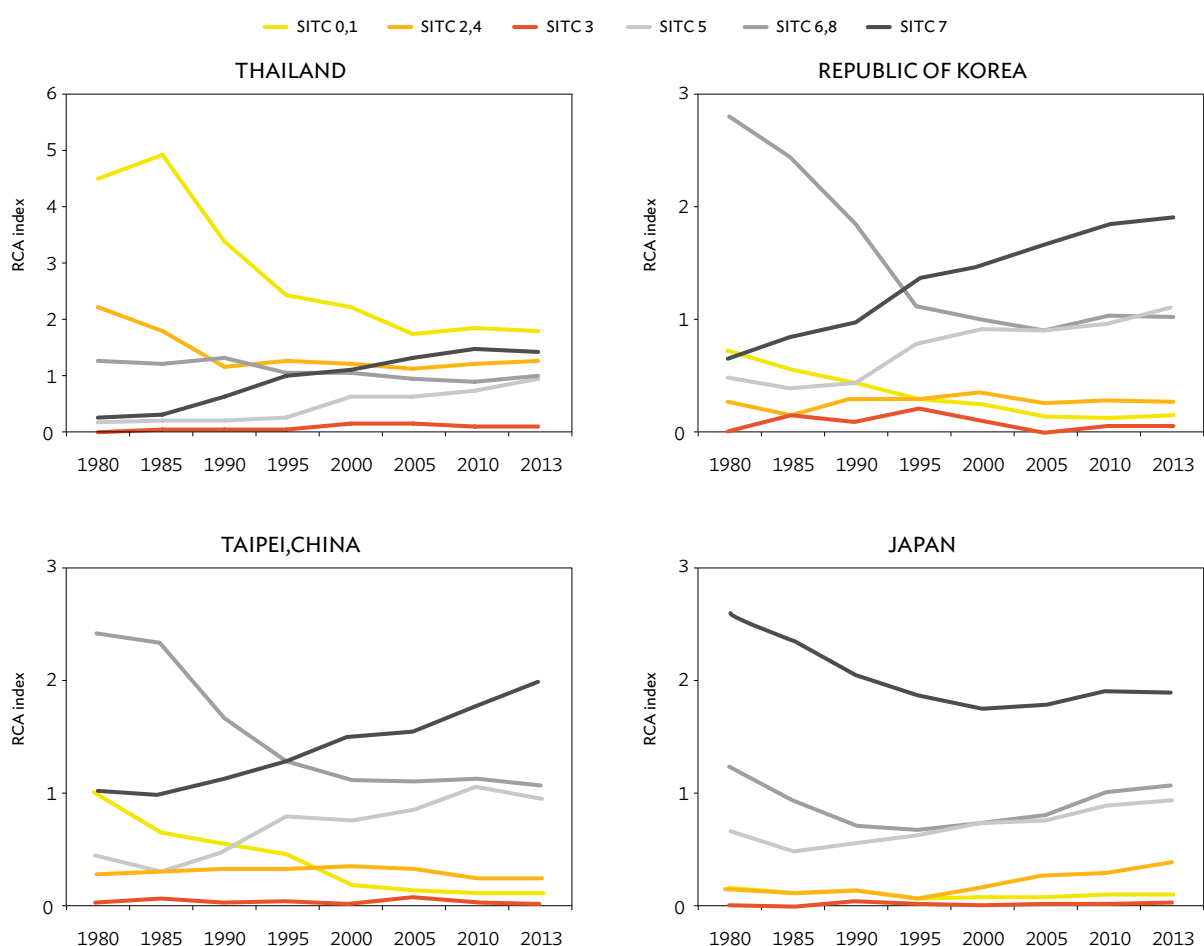
Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

⁶ RCA is calculated by dividing the export share of a commodity of a country by the export share of the commodity of total world. If RCA is greater than unity, the country is considered to have a comparative advantage in that commodity, and vice versa.

Table 2.2: Share of the Top 10 Export Items in Total Exports in Thailand, 1990, 2000, and 2013 (%)

1990		2000		2013	
Seafood	10.4	Office machines	15.1	Road vehicles	11.5
Garments	9.2	Electrical machinery	13.8	Office machines	11.4
Other manufactures	7.7	Telecommunications, etc.	6.8	Electrical machinery	10.9
Electrical machinery	7.0	Seafood	6.1	Telecommunications, etc.	5.0
Office machines	6.8	Garments	5.9	General machinery	4.9
Vegetables and fruit	6.7	Other manufactures	4.4	Artificial resins and plastic	4.7
Non-metallic minerals	5.1	Road vehicles	3.3	Crude rubber	4.0
Cereals	4.7	Non-metallic minerals	3.2	Other manufactures	3.9
Telecommunications, etc.	4.4	General machinery	3.2	Rubber products	3.3
Crude rubber	4.3	Artificial resins and plastic	3.1	Seafood	3.0

Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.3: The Trend of Revealed Comparative Advantage, Selected Economies, 1980–2013


RCA = revealed comparative advantage, SITC = Standard International Trade Classification.

Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

machines and road vehicles. Japan has comparative advantage in most of the items in SITC 7, except for office machines and other transport equipment. The Republic of Korea has strong comparative advantage in SITC 76 and 77 items due to its competitive mobile phone and household appliances industries (Table 2.3).

Among items in SITC 7 of Thailand, office machines including hard disks (SITC 75) and road vehicles including pickup trucks (SITC 78) rose rapidly in terms of RCA (Figure 2.4). It is noticeable that the RCA of general industrial machinery and equipment exports is steadily rising. The trend of export development, along with the rising income level of countries, indicates that the expansion of export volume and the diversification into new items in SITC 7 items are a natural way for

Thailand to increase the role of manufacturing in production and employment. The question is where the potential is and how to realize it.

Within the manufacturing sector, evidence shows that Thailand has upgraded from exporting parts and components to higher-value final products. Figures 2.5 and 2.6 show the evolution of parts and components vis-à-vis final goods as a share of trade in manufactured goods. In the 1990s, as Thailand was setting up its automotive and electronics assembly industries, parts and components increased as a share of exports, peaking in the early 2000s. However, the share of parts and components started to fall again in the late 2000s as the country’s manufacturing industry upgraded to higher-value final products.

Table 2.3: Revealed Comparative Advantage of SITC 7 Exports in 2013

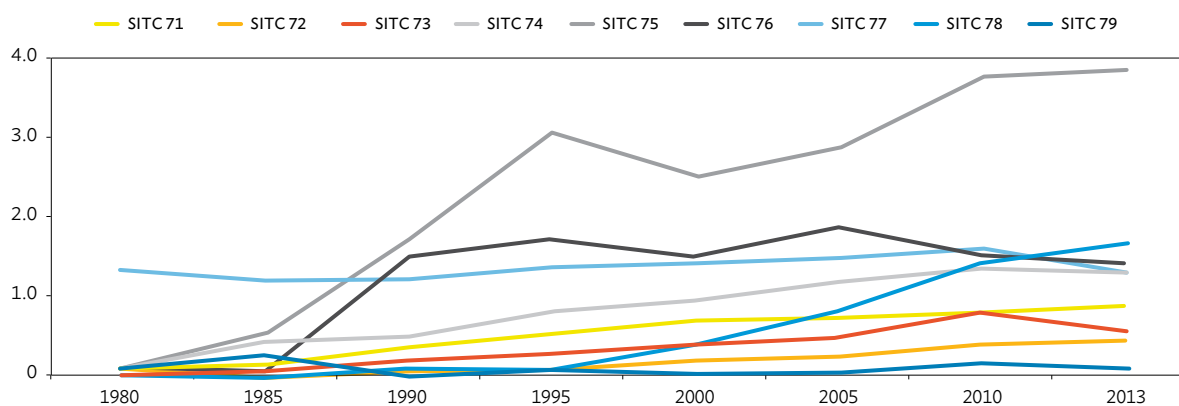
SITC Code	Commodity Classification	Thailand	Republic of Korea	Japan
71	Power-generating machinery and equipment	0.86	0.79	1.97
72	Machinery specialized for particular industries	0.39	1.38	2.85
73	Metalworking machinery	0.58	1.58	4.68
74	General industrial machinery and equipment	1.35	1.14	1.74
75	Office machines and automatic data processing equipment	3.84	0.92	0.54
76	Telecommunications, sound recording, and reproducing equipment	1.35	2.80	0.89
77	Electric machinery, apparatus, and appliances	1.29	2.88	1.74
78	Road vehicles	1.62	1.67	2.99
79	Other transport equipment	0.06	1.15	0.70

SITC = Standard International Trade Classification.

Note: The items are aggregated into 2-digit levels based from 4-digit levels in SITC revision 2.

Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.4: Trend of Thailand’s Revealed Comparative Advantage of SITC 7 Exports, 1980–2013

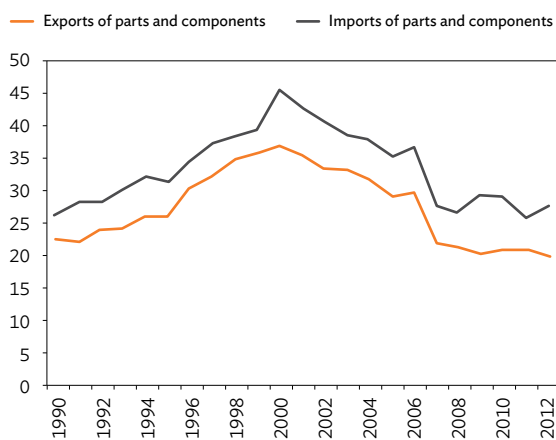


SITC = Standard International Trade Classification.

Note: Commodity classification of SITC 71–79 provided in Table 2.3.

Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.5: Share of Parts and Components in Total Manufactured Exports and Imports in Thailand, 1990-2012 (%)



Note: Parts and components using SITC Revision 3 are defined by P. Athukorala and A. Kohpaiboon. 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADB Working Paper Series No. 177*. Tokyo: Asian Development Bank Institute.
Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.6: Share of Final Manufactured in Total Manufactured Exports and Imports in Thailand, 1990-2012 (%)



Note: Final manufactured goods are computed as total manufactured goods less parts and components.
Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

The overall sophistication of an economy is not easy to measure. But recently some researchers developed techniques based on detailed export data to create

aggregate indicators that proxy for a particular country's productive capabilities. Briefly speaking, these indicators measure the sophistication of individual products based on the income level of countries that are successful in exporting them. The underlying assumption is that higher-income countries export more technically advanced and sophisticated goods. First, one can estimate a product's sophistication. The sophistication level of products (PRODY) index is the average exporting countries' gross domestic product per capita weighted by each country's revealed comparative advantage for the exported commodity. Second, one can estimate an aggregate PRODY index for the export basket of a particular country. This is the weighted sum of the PRODY values of all the products that a country exports, with the weights being the share of each commodity in the country's total exports. This aggregate sophistication score can offer insights into the country's productive capabilities. A higher score indicates that the country has acquired complex capabilities that make it easier to export sophisticated products.⁷

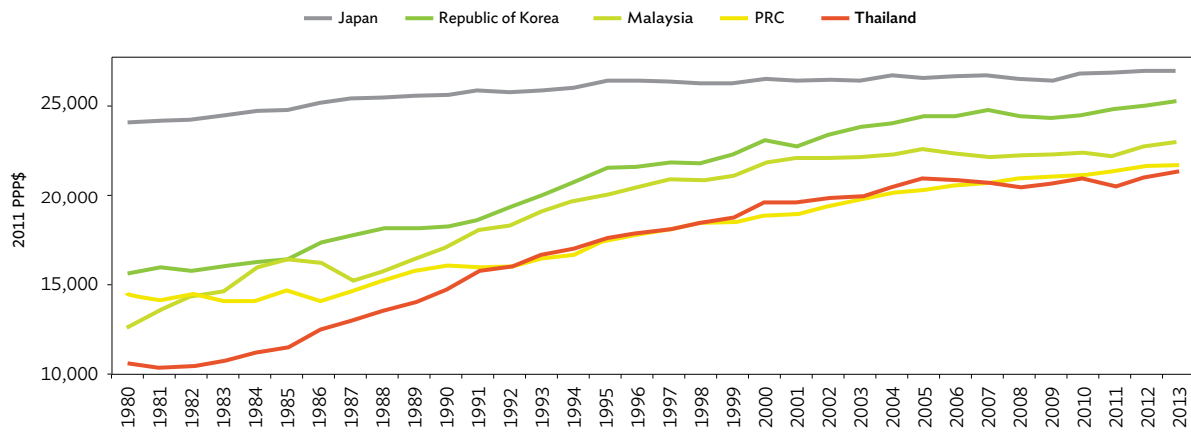
Thailand's export sophistication has been steadily increasing since the 1980s; however, in the mid-2000s, this increase started to taper off, likely due to stiffer competition from the PRC combined with a glut in demand from advanced economies due to the global financial crisis (Figure 2.7). In fact, Thailand's export sophistication started declining from 2008 onward, though from 2013 it has been very slowly catching up with the PRC's again. The PRC's sophistication nonetheless also continued to increase in the same period, indicating that Thailand may have lost some ground to that country's lower costs of production and scale economies during this period.

The majority of Thailand's exports remain technically less sophisticated than other middle- and high-income Asian economies.

Despite an increase in overall export sophistication, its exports are still focused on relatively less sophisticated manufactured goods. More than 60% of Thailand's exports are in groups 3, 4, and 5 of the PRODY index, similar to the PRC, but less sophisticated than Malaysia (Figure 2.8). In the case of Malaysia, 57% of its exports

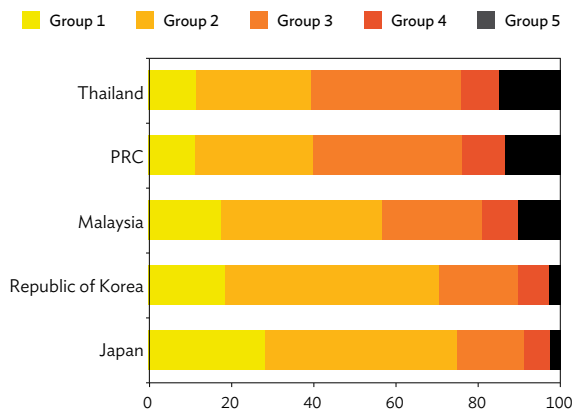
⁷ See R. Hausmann, J. Hwang, and D. Rodrik (2007)

Figure 2.7: Sophistication of Export Baskets in Selected Countries, 1980-2013



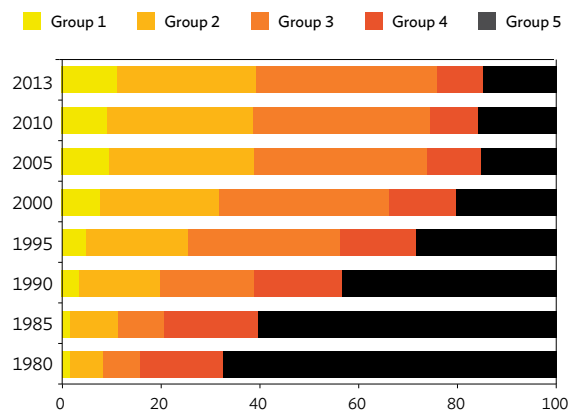
PPP = purchasing power parity, PRC = People's Republic of China.
 Note: Figures represent trends in the (PRODY) index.
 Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.8: Disaggregation of Exports by Technological Sophistication Group, Selected Economies, 2013 (% of total)



PRC = People's Republic of China.
 Note: Groups are based on quintiles of sophistication level of products (PRODY). Group 1 = PRODY \geq 28,900; Group 2 = 28,900 > PRODY \geq 23,100; Group 3 = 23,100 > PRODY \geq 17,600; Group 4 = 17,600 > PRODY \geq 10,730; and Group 5 = PRODY < 10,730.
 Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.9: Disaggregation of Exports by Technological Sophistication Group, Thailand, 1980-2013 (% of total)



Note: Groups are based on quintiles of sophistication level of products (PRODY). Group 1 = PRODY \geq 28,900; Group 2 = 28,900 > PRODY \geq 23,100; Group 3 = 23,100 > PRODY \geq 17,600; Group 4 = 17,600 > PRODY \geq 10,730; and Group 5 = PRODY < 10,730.
 Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

belong to highly sophisticated categories and fall under groups 1 and 2. Since 1980, however, Thailand's share of exports of more sophisticated goods (groups 1 and 2) has more than quadrupled (Figure 2.9). Likewise, the trade deficit in sophisticated goods has narrowed significantly (Figure 2.10). Overall, these findings

suggest Thailand has gone a long way in increasing its technological sophistication, as indicated by its exports. In fact, its pace of structural transformation in technological sophistication seems even faster than that of the Republic of Korea. However, the data also indicate that Thailand is struggling to compete with its

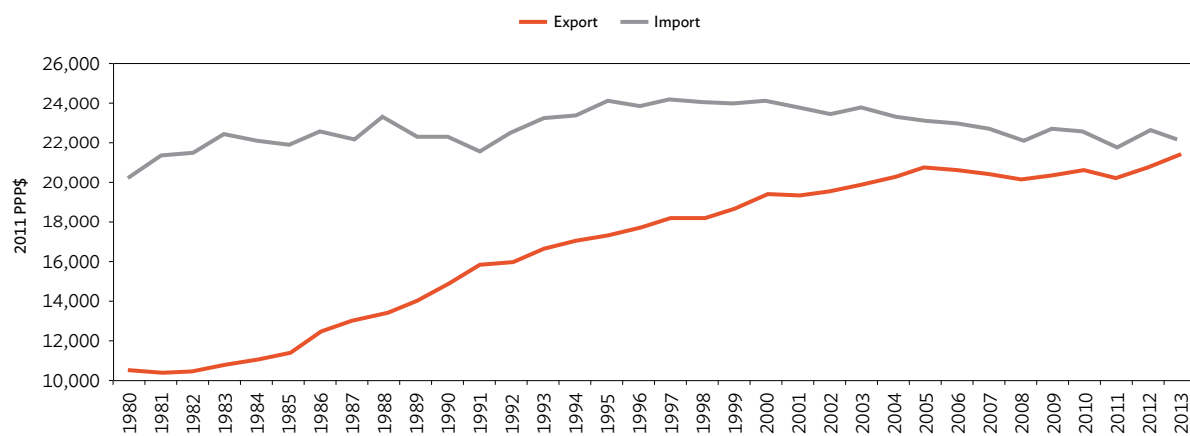
large northern neighbor, the PRC, which still has the advantage of scale.

Export diversification

Thailand has been diversifying exports since 1980, but plenty more opportunities to do so exist when compared with other East Asian countries, especially Japan and the Republic of Korea. Japan is the most

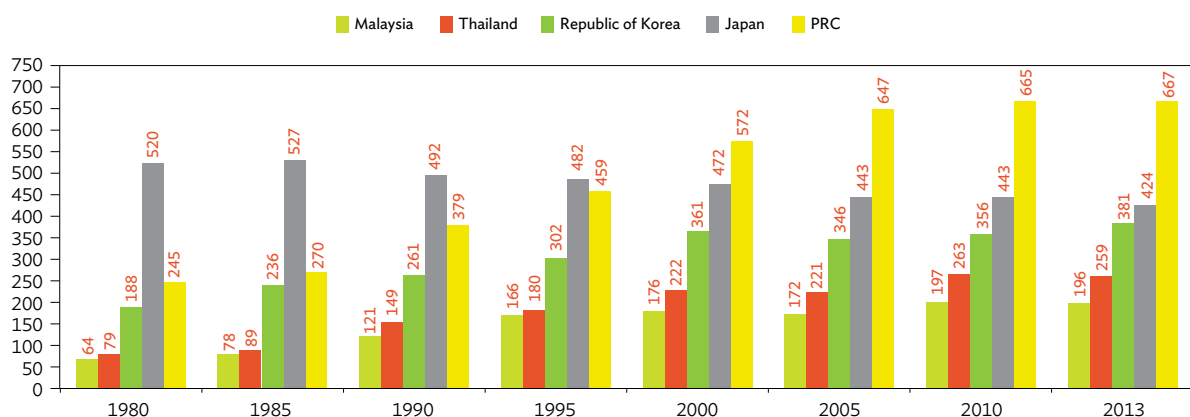
diversified among five countries in Figure 2.11.⁸ Export diversification is an indicator of technological competitiveness—a country that utilizes technology efficiently will be able to maintain its competitiveness in international trade. One measure of export diversification and competitiveness is the number of commodities with 1% of world market share, which has about tripled for Thailand since 1980, particularly rapidly between 1985 and 1995.

Figure 2.10: Technical Sophistication of Export and Import Baskets in Thailand, 1980–2013



PPP = purchasing power parity.
Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.11: Number of Commodities with More Than 1% World Market Share, Selected Economies, 1980–2013



PRC = People's Republic of China.
Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

⁸ This kind of specialization is commonly observed in countries in a mature stage of export development, as confirmed by Cadot, Carrere, and Strauss-Khan (2007). They find the pattern of inverted U-shape of export diversification that the export structure turned to concentration from diversification as income rises beyond \$20,000 per capita.

In the degree of export diversification by commodity group (Table 2.4), Thailand is most diversified in food and animals (SITC 0). But there are significant gaps between Thailand and the other two countries in the levels of diversification for manufactured materials (SITC 6) and machinery and transport equipment (SITC 7), which suggest room for Thailand to expand into newer export areas. In SITC 5 and 8 (which include commodities such as consumer goods of light industries) the country is relatively diversified, although the number of commodities in this area is still significantly smaller than for Japan and the Republic of Korea. Japan holds many export products in SITC 8

that maintain a competitive edge in the world market. In this respect, finding niches in traditional industries, such as chemicals (SITC 5) and the light industries (SITC 6 and 8), is another important part of export diversification, in addition to entering the capital-intensive and high-technology industries in SITC 7.

A more precise measure of diversification and competitiveness is the number of commodities with RCA; between 1980 and 2013, Thailand was able to increase the number of these commodities from 141 to 220 (Figure 2.12). This lags considerably behind the PRC and Japan, but is ahead of Malaysia and the

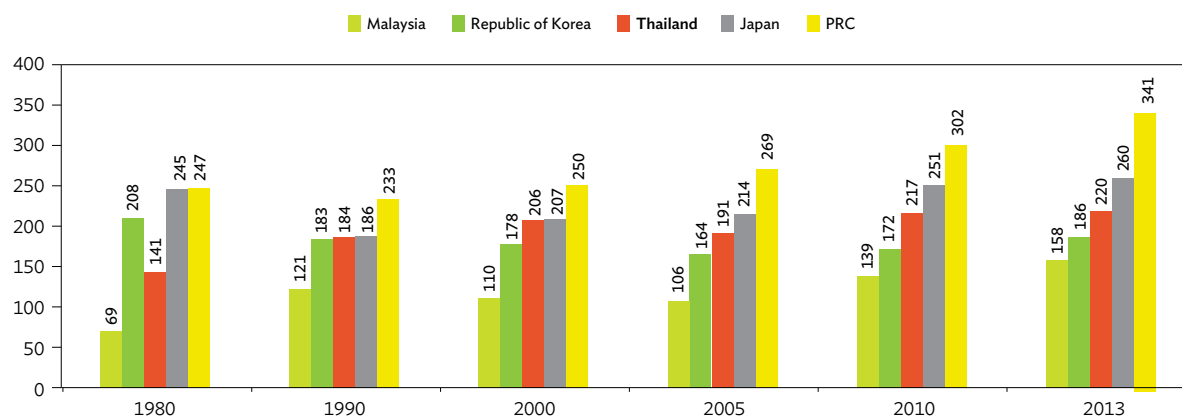
Table 2.4: Diversification of Exports by Commodity Group, Selected Economies, 2013

SITC Code	SITC Description	Number of Goods with 1% Global Market Share		
		Japan	Republic of Korea	Thailand
0	Food and animals	8	12	31
1	Beverage and tobacco	1	3	2
2	Crude materials	22	20	23
3	Mineral fuels	9	7	7
4	Animal oils and fats	3	0	5
5	Chemicals	80	63	31
6	Manufactured materials	128	126	78
7	Machinery and transport equipment	126	112	55
8	Miscellaneous manufactured articles	45	36	26
9	Unclassified	2	2	1
	Total	424	381	259

SITC = Standard International Trade Classification.
 Note: Commodities are classified at the 4-digit SITC.

Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

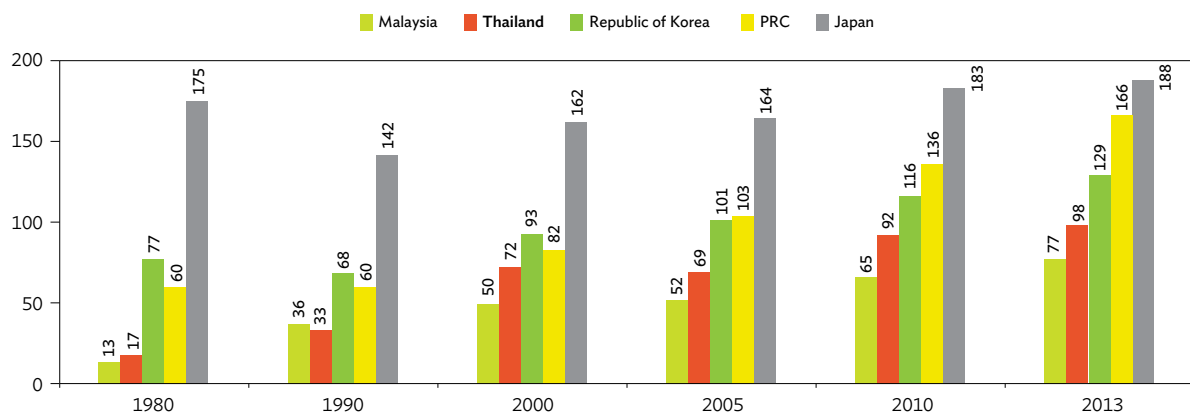
Figure 2.12: Product Diversification: Number of Commodities with Comparative Advantage (RCA ≥ 1), Selected Economies, 1980-2013



PRC = People's Republic of China, RCA = revealed comparative advantage.

Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Figure 2.13: Number of Core Products with Comparative Advantage ($RCA \geq 1$), Selected Economies, 1980-2013



PRC = People's Republic of China, RCA = revealed comparative advantage.

Notes: Core products include machinery, chemicals, and metallurgy. Most of these products have high technological sophistication.

Source: Calculations using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2015).

Republic of Korea. Thailand's RCA in core products (machinery, chemical and metallurgy) increased almost sixfold between 1980 and 2013, but remains below the PRC, Japan, and the Republic of Korea (Figure 2.13).

2.2 Technology Upgrading through Production Networks

Thailand's reliance on technology lending versus technology transfer

Multinational companies, both assemblers and component producers, have brought leading technologies into Thailand in the key areas of electronics and automobiles (see next section). But because it is acquired through FDI without substantial backward linkages, this technology does not constitute technology transfer—which in the traditional sense means the acquisition of technology by domestic firms. Instead it is “technological lending” between the parent company's headquarters and its Thai affiliate. Thailand's technological sophistication is thus related to the extent of technological lending determined by those links of the production network conducted

there. In the early years of the auto industry, not only was there no technology transfer, but technological lending was also very weak, as the import of complete-knock-down⁹ kits required only simple assembly activities with low technological requirements.

Since that early assembly stage, nonetheless, the country has made considerable progress. There is little doubt that such technological lending has helped Thailand to industrialize and become a leading exporter of high-tech goods.

But technological lending has its limitations. First is whether it creates a type of enclave industrialization in which the country possesses a few high-tech sectors, but not a high-tech economy. The second is whether the technology will be “un-lent” or “retracted” if firms decide to move to lower-cost destinations. Finally, Thailand may fail to engage in many of the higher-value research and design stages of product development. The first and third concerns are very real now. The second is starting to be realized, but probably only for the lower-value segments for the time being, as the Greater Mekong Subregion and ASEAN liberalization and integration processes have gathered pace recently.

⁹ A complete knock-down is a complete kit needed to assemble a product. Complete knock-down comprises a fully disassembled item (such as an automobile, bicycle, or a piece of furniture) that is required to be assembled by the end user or the reseller. Goods are shipped in complete-knock-down form to reduce freight charged on the basis of the space occupied by (volume of) the item. Read more at <http://www.businessdictionary.com/definition/completely-knocked-down-CKD.html#ixzz3pBMfcWYH>

The automobile sector in Thailand has several characteristics.

Thailand has 18 automobile assemblers, all foreign-owned, and no national car company (Thailand Board of Investment 2015). The Japanese automobile manufacturers account for about half of the approximately 1.5 million vehicles produced annually, and about half of production is exported, with the rest serving the large domestic market (Thailand Automotive Institute and Ministry of Industry 2012). The main niche (about 54% of units produced) is in pickup trucks (Tractus Thailand 2014).

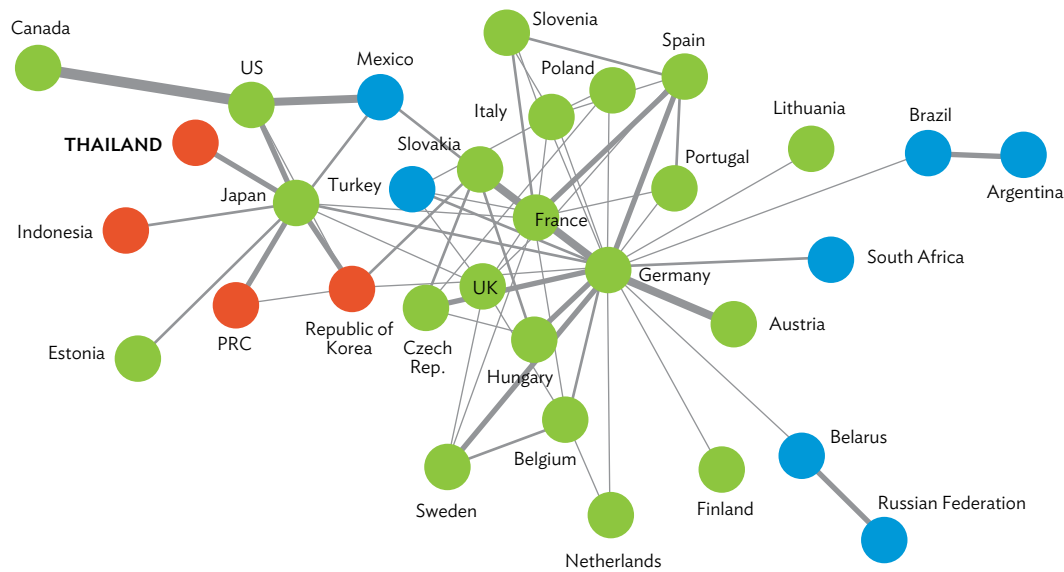
The country has also emerged as an assembling hub for the multinational global automobile companies, supported by government efforts to promote export industries and FDI. The automobile industry uses parts procured outside as well as manufactured within the country. This differs from the electrical/electronics

industry, in which Thailand is both a supplier and producer of parts and components and less of an assembler of final goods.

Figure 2.14, based on Ferrarini (2011), shows the country’s place in global and regional production networks for the automotive industries. The thickness of the lines represents the strength and extent of the relationships, with the connection to Japan clear.

As vehicles are complex, multicomponent goods, the quality and reliability of suppliers are critical for the complete product. In Thailand, the Tier 1 auto parts suppliers are predominantly foreign controlled or foreign directed (Figure 2.15). About 54% of the almost 709 suppliers are foreign-majority joint ventures, while another 23% are Thai-majority joint ventures, although in these companies the foreign partners still tend to be the source of technology, which is channeled from the parent company.¹⁰

Figure 2.14: Global Network Trade Index—Automotive Industries



PRC = People’s Republic of China, UK = United Kingdom, US = United States.
 Source: B. Ferrarini. 2011. Mapping Vertical Trade. *ADB Economics Working Paper Series* No. 263. Manila: Asian Development Bank.

¹⁰ Based on the author’s communication with Dr. John Thoburn, an expert on trade policy and export promotion, foreign investment, industrial development, and sectoral studies, particularly in Southeast and East Asia. He conducted a study on Industrial Policy and the Development of the Automotive Industry in Thailand (Natsuda and Thoburn 2013). An emeritus faculty affiliated with the School of International Development Studies of the University of East Anglia, United Kingdom.

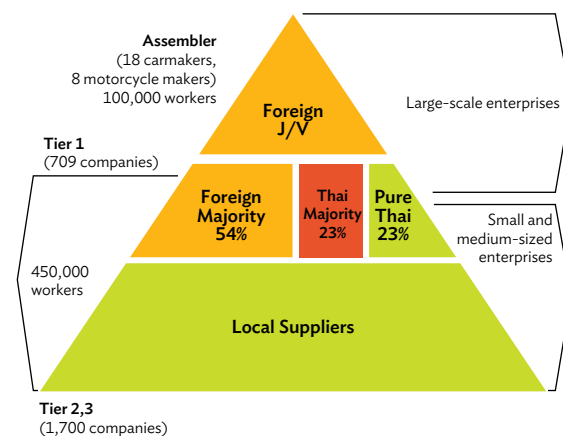
The remaining 23% are fully owned Thai firms,¹¹ some of which have been able to break through and become respected Tier 1 suppliers, such as AAPICO Hitech and the Summit Group, and have exported to other countries. The technologically less sophisticated Tier 2 companies that supply basic rough components to Tier 1 firms for further processing are all Thai-owned.

The nature of Thailand's auto industry is that assemblers prefer to link with a limited number of high-quality suppliers located in the same or near their industrial parks. Product development tends to be a top-down system in which suppliers seek to satisfy the requests for the assembler or a higher-tier supplier, resulting in relatively little joint development or within-firm innovation. The development that does take place tends to be based on parent-country designs with modification to suit the local or regional market. As a result, research and development in the sector is very limited and assemblers or higher-tier foreign firms make little attempt to share or develop the technological capacity of local firms. There is technological lending, but little technological transfer.

This lack of indigenous technological capacity is well recognized and various supplier-linkage programs have been promoted to integrate domestic firms with foreign-controlled producers. These programs were begun in the early 1990s and applied to the automobile sector, but they have generally been unsuccessful. They include the Industrial Linkages Development Program (1991), National Suppliers Development Program (1994), and 1995 Master Plan for the Development of Supporting Industries (with the Japan International Cooperation Agency).

More recently, partnerships between the sector and the Ministry of Industry established the Thailand Automotive Institute supporting human resources development and the transfer of technology to develop Thai-owned suppliers. The institute had a major role in formulating the Thailand Automotive Sector Master Plan (2007–2011), which also focused on human resources and technology transfer to domestic firms. Under its framework, the Thailand

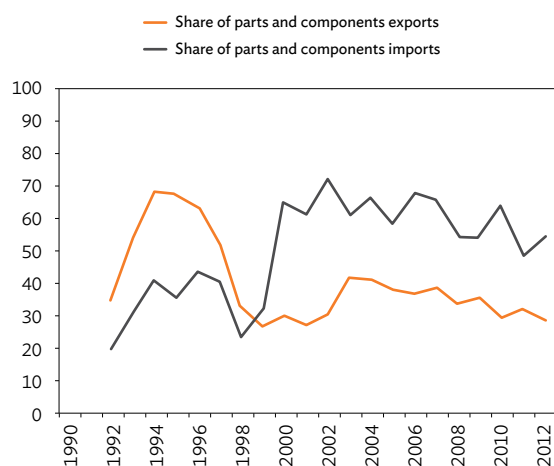
Figure 2.15: Structure of Thailand's Automobile Industry in 2014



J/V= joint venture.

Source: Thailand Board of Investment. 2015. Thailand: Global Green Automotive Production Base. <http://www.boi.go.th/upload/content/BOI-brochure%202015-automotive-20150325-70298.pdf>

Figure 2.16: Share of Parts and Components in Motor Vehicle Exports and Imports



Note: Parts and components for each manufactured product type follow P. Athukorala and A. Kohpaiboon. 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADB Working Paper Series No. 177*. Tokyo: ADB Institute.
Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2013).

¹¹ Figures are for the total number of firms, not their share of industry output or value added, which would provide a better indication of each group's importance.

Automotive Human Resources Development Program (2006–2010) was initiated with a lead role by Japanese producers Denso, Honda, Nissan, and Toyota. It aimed to improve the quality, cost, and delivery performance of Thai-owned component suppliers through human resources development, although the impacts of this program are not yet clear.¹²

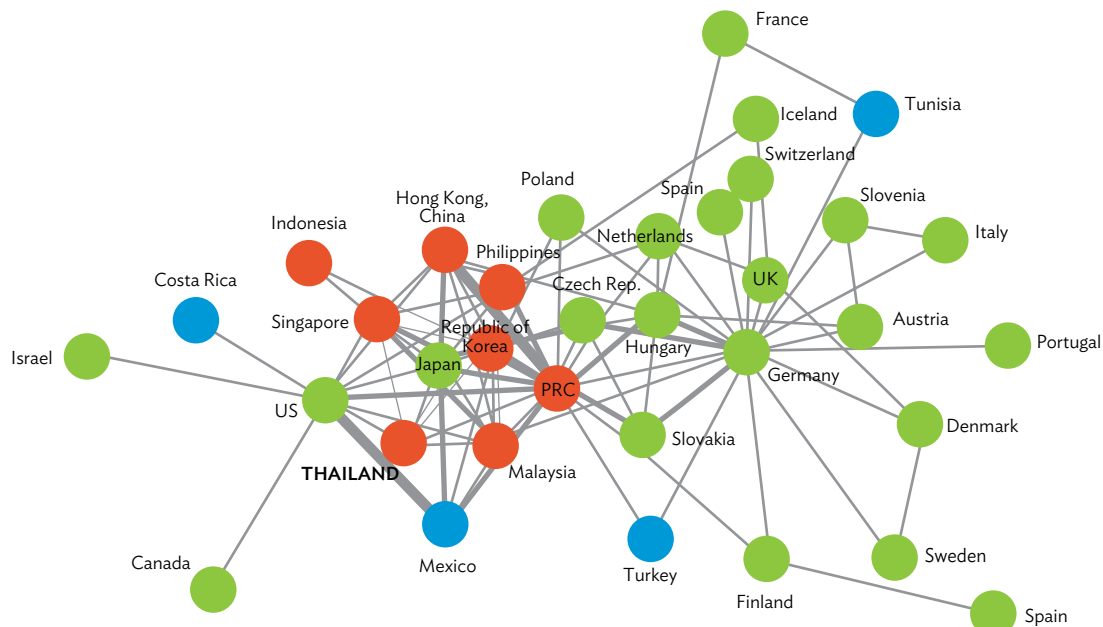
Over time, the Thai automotive industry seems to have upgraded from exporting parts and components to exporting finished goods. In the 1990s, the country was mainly exporting parts and components, suggesting a place on the relatively lower rungs of the automotive industry value chain (Figure 2.16). But in the 2000s, the share of parts and components in motor vehicle exports decreased and the share of completely built-up automobile exports increased. Likewise, the share of imports of motor vehicle parts and components increased during this period. These findings indicate that, since starting in the 2000s, Thailand has been importing motor vehicle parts and assembling them into built-up automobiles for export.

Thailand’s electronics sector has similarities to the automobile sector.

Foreign dominance in the development of the electronics industry is similar to the auto industry, in that they have provided the technology for advanced production in Thailand. Electronic products are also complex, multicomponent goods that provide considerable opportunity for structuring along regional and global production networks (Figure 2.17), as well as the inclusion of domestic component suppliers. In electronics, similar to the automotive industries, Thailand is integrated with regional production processes. This time, the linkages are clear, with the PRC and Japan, and to a lesser extent with the Republic of Korea, Malaysia, Singapore, and the United States.

Thailand has been able to increase the complexity of the tasks for electronics over the past 3 decades as more technology has been “lent” through intra-firm channels. The higher-value components of the chain are produced elsewhere and imported, however.

Figure 2.17: Global Network Trade Index—Electric/Electronics Industries



PRC = People’s Republic of China, UK = United Kingdom, US = United States.
 Source: B. Ferrarini 2011. Mapping Vertical Trade. ADB Economics Working Paper Series. No. 263. Manila: Asian Development Bank.

¹² This part of the Thai automobile section draws on Asian Development Bank (ADB) 2013.

Furthermore, like the auto sector, domestic firms are located in the low-tech tiers.

The main electronics subsector is the manufacture of hard disk drives, for which Thailand is known as a leading global production site, hosting the world's major players. The hard disk drive industry in Thailand was effectively founded when Seagate Technologies moved its labor-intensive head stack assembly operations from Singapore to Thailand in 1983 to take advantage of lower wages. With other multinational companies following suit, the number of operations grew from 5 in the mid-1980s to 74 by the mid-2000s (Kohpaiboon and Poapongsakorn 2011).

Unlike the automobile sector, the government did not attempt to apply local content requirements to the electronics sector, and gradual tariff reductions have allowed for a relatively free flow of parts and components into and out of the country. High-value components are produced elsewhere, notably in areas near Singapore (such as Johor, Malaysia), and then imported to create the completed drives, which are then exported for placement in computers and other finished products. While accurate figures are hard to come by, the value of local content is about 30%–40%.

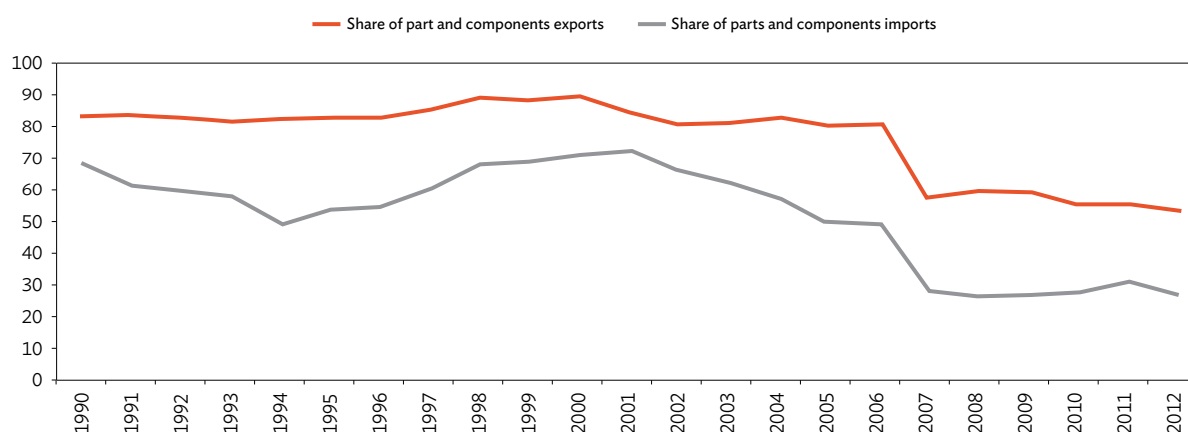
Thai producers inhabit the lower technological levels of the value chain and contribute little to innovation and design (ADB 2013).

Concern is emerging about the minor role of Thai-owned firms, and that increased participation would be beneficial, with efforts made in this regard through private sector collaboration.

The Hard Disk Drive Institute was established in 2005 and counts among its members the leading industry players. The institute works to support skill development among small- and medium-sized Thai enterprises to reach the quality standards needed for supplying large foreign firms. Yet, while there is recognized interest in fostering innovation so that Thai firms can participate fully in the hard disk drive value chain, little evidence yet shows that it is bearing fruit.

Also similar to the auto industry, the share of parts and components in information and communication technology exports has been going down since the 1990s, indicating a higher concentration on exporting finished information and technology products. Imports of related parts and components have also been declining (Figure 2.18).

Figure 2.18: Share of Parts and Components in Information and Communication Technology Exports and Imports (%)



Note: Parts and components for each manufactured product type follow P. Athukorala and A. Kohpaiboon, 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADB Working Paper Series* No. 177. Tokyo: ADB Institute.
 Source: Estimates using data from UN Comtrade Database. <http://comtrade.un.org/> (accessed June 2013).

Chapter 3

Challenges in the Transition to High-Income Status

Thailand's progression into high-income status will depend on two key factors: (i) the ability to move up the global value chain and support investment in the innovation, design, and production of more sophisticated goods and services; and (ii) the ability to expand investment and development more broadly throughout the country. As it stands, large areas, notably the North and Northeast, and to a lesser extent the South, have not gained the full benefits of Thailand's development.

The ability to innovate, adopt, and use technology is a critical aspect of growth, driving improvements in productivity and enabling the production of more sophisticated and higher-value goods and services. Technologies are embedded in and utilized by firms, and the ability to develop technologically advanced and innovative firms is a central aspect of the development process for middle-income countries.

The high-income East Asian economies of Hong Kong, China; Japan; Republic of Korea; Singapore; and Taipei, China successfully adopted increasingly complex technology through imports, adaptation, and subsequent innovation. Governments recognized the importance of technology and utilized whatever means possible to entice firms to improve their capabilities. The PRC, now in the process of its own "East Asian miracle," is also working hard not only to attract advanced technologies brought by foreign firms, but also to leverage strategic partnerships with these firms and to develop technology and innovation

by domestic firms, in collaboration with research institutes and other public bodies.

Thailand is growing in a different environment from the earlier crop of high-growth economies. Asia is a more integrated economy with production chains on a regional scale driven by large multinational firms from within and outside of the region. These firms have moved production—and with it technology—to countries in Southeast Asia to take advantage of low wages and other production cost advantages, as well as to be closer to growing consumer markets. From the late 1980s, parts of Thailand's economy have become firmly embedded in and benefited from the rise of "Factory Asia." To maintain its place and draw the benefits from an integrating Asia, Thailand needs to keep pace with advancing technology and innovation.

3.1 Research and Development

While foreign investment will remain important to provide advanced technology and innovation, this needs to be supplemented with domestic efforts to ensure that technology infuses the sectors of the economy and is not isolated in a few specific, albeit key, subsectors.

Thailand's research and innovation capacity remains weak, however, stemming from the lack of interest and investment and the reliance on foreign investment for its key technological inputs. Thailand ranks 55th out

of 141 countries in the Global Innovation Index 2015 (Cornell University, INSEAD, and WIPO 2015) put out by the World Intellectual Property Organization. Adequate research infrastructure and activity needs to emerge to provide new breakthrough and improvements on products and production processes.

Evidence of insufficient innovation capacity is seen in the standard measures. In terms of R&D expenditure, Thailand lags behind a number of middle-income countries and behind the now high-income countries. While its R&D is higher than Indonesia's and the Philippines', it falls considerably below Malaysia's, the average level of middle-income countries, and the PRC's, which was at the same per capita income level

in 2014, when both countries graduated to upper-middle-income status (Figure 3.1).

Thailand spends a quarter of 1% of GDP on R&D, even lower than India, which also spend less than 1% of GDP on research (Table 3.1). In comparison, the Republic of Korea spends more than 4%; Japan, about 3.4%; and the PRC almost 2%. Private sector spending on research in Thailand is the second lowest in the sample group after India.

Deliberate R&D is an important driver of technological change. The phenomenon of science and technology takeoff is one characterized by abrupt increases in national R&D intensity, as it approaches 1% of GDP,

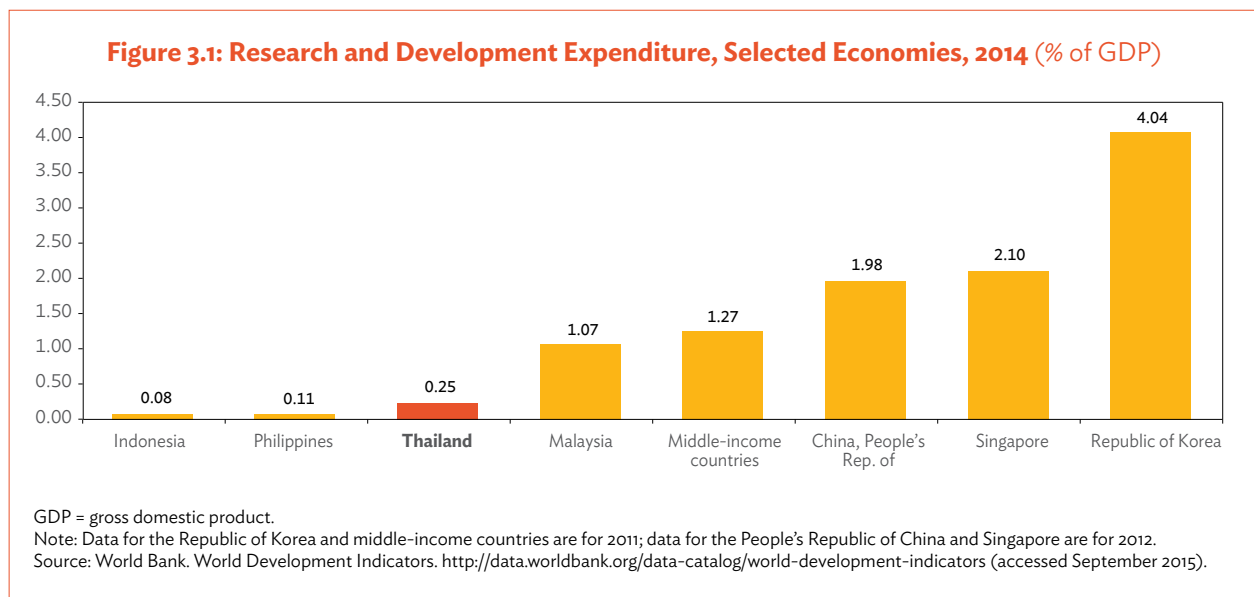


Table 3.1: Expenditure on Research and Development by Source (% of GDP)

Economy	Total Research and Development Expenditure	By Business Enterprises	By Government	By Higher Education	By Private Nonprofit Organizations
PRC	1.980	1.509	0.323	0.150	...
India	0.810	0.288	0.490	0.033	...
Republic of Korea	4.040	3.091	0.473	0.408	0.065
Malaysia	1.070	0.607	0.154	0.309	...
Thailand	0.250	0.103	0.082	0.062	0.003
Germany	2.920	1.953	0.432	0.534	...
Japan	3.390	2.610	0.285	0.447	0.051
United States	2.790	1.947	0.343	0.385	0.112

... = data not available, PRC = People's Republic of China, GDP = gross domestic product.

Note: Data for Thailand are for 2009; India, the Republic of Korea, Malaysia, and Japan are for 2011; and the PRC, Germany, and the United States are for 2012. Some numbers do not add up because of rounding.

Source: UNESCO Institute for Statistics. Data Centre. <http://www.uis.unesco.org/datacentre/pages/default.aspx> (accessed September 2015).

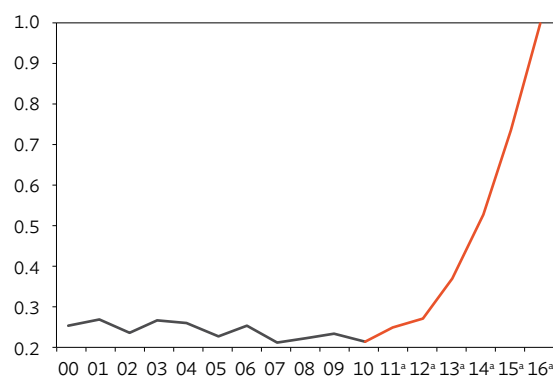
and accelerates abruptly to the vicinity of 2%, before leveling off in the range of 2% to 3% of GDP, based on historical data during 1987–1997 in the PRC (Jefferson and Su 2006). The average ratio for 23 Organisation for Economic Co-operation and Development (OECD) countries stood at 2.0%, while that for non-OECD countries was a very low 0.7%. The seven largest OECD countries in the sample have average R&D intensity equivalent to 2.4%, while the average for 16 small OECD countries is 1.8%.

R&D spending has been low and stable over the past decade in Thailand. Thailand’s 11th National Economic and Social Development Plan targets R&D spending of 1% of GDP by 2016, suggesting that the government recognizes that technology and innovation are too low to support a higher growth process. Whether it can be achieved remains in question, given that spending has hovered near 0.25% for more than a decade (Figure 3.2). It should be noted that even the PRC, which has recognized the importance of technology and innovation as vital to moving beyond the middle-income stage, tried to raise R&D spending to 2% by the end of the 10th Five-Year Plan, but failed to do so. The country raised the target further in its 12th Plan to 2.2%.

R&D targets are difficult to achieve because they represent a combination of public and private sector activity. Governments can allocate more funds to research, but private firms need to play their part. The Thailand government hopes that the share of private sector R&D will rise to 70% by 2016, a considerable increase from its current level of about 40%–45%.

The National Research Council of Thailand’s 2010 Science, Technology and Innovation Survey estimates that only 24.9% of firms actually had a budget for innovation activities, of which 15.8% see no change in budget in the next 5 years, 8.9% see an increase, and 0.2% see a decrease (NRCT 2011). Among companies with a budget for innovation, the majority of it is spent on R&D done by the company itself, while about a fifth of the budget is spent on the acquisition of equipment (Table 3.2). However, spending on innovative activities is estimated to total B9.8 billion in 2010, just 0.10% of GDP. This figure is down from the estimated B13.2 billion spent on innovation in 2009, or 0.15% of GDP.

Figure 3.2: Research and Development Expenditure in Thailand, 2000–2016
(% of GDP)



^a Ministry of Science and Technology targets.
Source: Oxford Business Group (OBG). 2011. *The Report: Thailand 2014*. London: OBG.

Table 3.2: Allocation of Budget for Innovation Activities (%)

Innovation Activities	2009	2010
Intramural research and development	57.5	51.6
Extramural research and development	5.0	9.8
Acquisition of machinery and equipment (including computer hardware) for product or process innovation	20.2	18.1
Acquisition of other external knowledge such as licenses to use intellectual property or specialized services (such as consultants)	0.6	0.5
Training	5.4	6.0
Marketing of innovations	3.5	3.7
Design and other preparations	2.5	3.0
Marketing of improved services (market research and launch advertising)	4.9	3.7
Others	0.5	0.4

Source: National Research Council of Thailand (NRCT). 2011a. Innovation Survey: Business Sector (Summary). Presentation at the UNESCO Institute of Statistics Statistical Capacity Building Workshop 2011. [http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop_Documents/ST_Workshop_dox/Vietnam_2011/Thailand_Innovation_Survey_\(2\).pptx](http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop_Documents/ST_Workshop_dox/Vietnam_2011/Thailand_Innovation_Survey_(2).pptx).

Thailand also has a lot of catching up to do in recruiting and training more researchers. Currently, only 0.57 researchers are available for each 1,000 members of the labor force (Table 3.3). In comparison, there are 1.75 researchers per 1,000 workers in the PRC, more than 10 in the Republic of Korea, and 3.8 in Malaysia.

Allocation of R&D is also highly interesting, in that there is relatively little private R&D in the prominent manufacturing sectors of automobiles and electronics, which account for 8.4% and 2.0%, respectively, of total private sector R&D. Indeed, R&D in electronics is only slightly ahead of textiles, at 1.9% (Figure 3.3). This may reflect the heavy influence of foreign producers in these sectors, for which research work is done in the home country. In Thailand, the three sectors that account for just over half (52%) of all private research are petroleum, food, and chemicals, which are also areas that government has encouraged.

Strategic collaboration between institutions of higher education and the manufacturing sector are not enough to foster indigenous innovation. Few joint, integrated research projects are found for innovative product and process development. Universities seldom engage in basic research, which is not always of good quality, and offer few ideas for business to turn into commercially viable innovation.

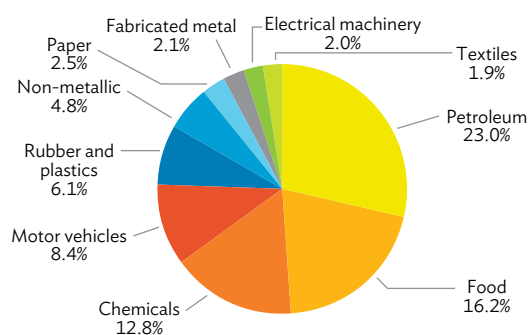
Table 3.3: Number of Researchers

Economy	Researchers per Thousand Labor Force	Researchers per Thousand Total Employment
China, People's Republic of	1.75	1.83
India	0.41	0.43
Republic of Korea	11.64	12.04
Malaysia	3.80	3.93
Thailand	0.57	0.58
Germany	7.97	8.44
Japan	10.06	10.54
United States	7.87	8.65

Note: Data refer to full-time equivalent number of researchers from various fields. Data for Thailand are for 2009; for India 2010; for Republic of Korea, Japan, and the United States 2011; and for the People's Republic of China and Germany 2012.

Source: UNESCO Institute for Statistics. Data Centre. <http://www.uis.unesco.org/datacentre/pages/default.aspx> (accessed September 2012).

Figure 3.3: Private Investment in Research and Development, Thailand, 2009



Source: Oxford Business Group (OBG). 2011. *The Report: Thailand 2014*. London: OBG.

Patents

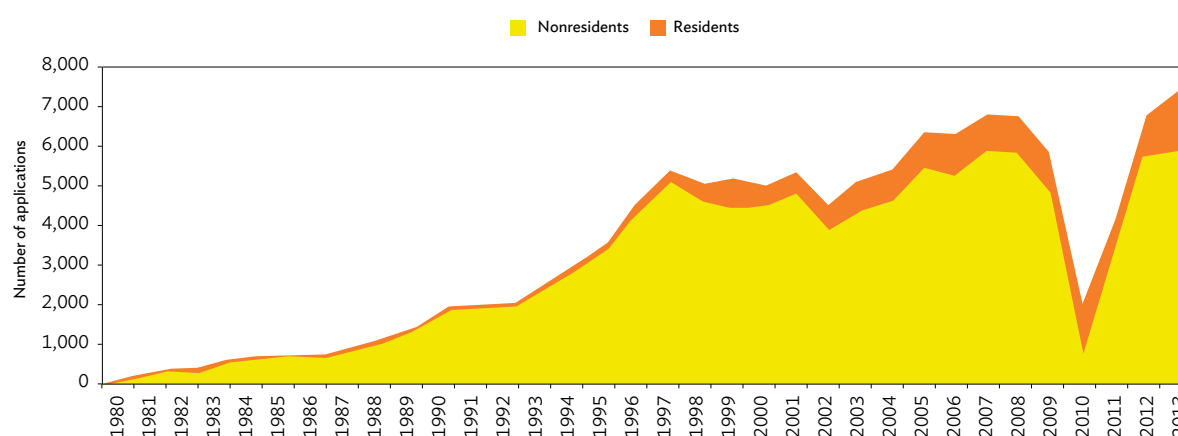
A key output of innovation activity is the number of patents produced by a country. It is a rough measure, in part because some patents may be only improvements on past patents and because many of them may not result in commercially viable products or processes. Nonetheless, Thailand's patent outputs are modest, better than some ASEAN countries, such as the Philippines or Viet Nam, but considerably below those of the PRC and high-income Asian countries such as Japan, the Republic of Korea, and Singapore. On a per capita basis, the situation is similar: Thailand registers 110 patents per million people, with the PRC at 608, and Malaysia at 245 (Table 3.4).

The bulk of patent registrations are made by nonresidents, but there has been an increase of residents' applications to more than 21% in 2013 (Figure 3.4), higher than Singapore, which has attracted considerable nonresidents, including researchers, to work in its high-tech economy. The precipitous decline in patent applications by both residents and nonresidents in 2010 may reflect the effect of Bangkok's accession to the Patent Cooperation Treaty, which allows patents filed in other signatory countries to be recognized in Thailand (World Intellectual Property Organization 2009).

Table 3.4: Patent Applications, Selected Economies, 2014

Economy	Total	% Share by Residents	Applications per Million Population
China, People's Republic of	825,136	85.4	607.9
Japan	328,436	82.7	2,579.2
Republic of Korea	204,589	78.2	4,073.9
Malaysia	7,205	16.6	244.5
Philippines	3,285	6.7	33.7
Singapore	9,722	11.8	1,800.6
Thailand	7,404	21.2	109.8
Viet Nam	3,995	11.1	44.5

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

Figure 3.4: Patent Applications in Thailand, 1980–2013


Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

Intellectual property rights protection

A stronger regime protects the discoveries of innovators, allowing them to reap the rewards of their discoveries. A weak regime reduces the incentive to engage in research. The international property rights in Thailand are considerably weaker than the high-income countries in the region, registering a score of 5.3 out of 10, compared with Singapore's 8.2 and Malaysia's 6.5 among ASEAN member countries (Table 3.5). It also trails high-income, knowledge economies in East Asian economies such as Taipei, China and the Republic of Korea, which both score above 6.0 on the scale.

Table 3.5: International Property Rights Index, 2012

Economy	Overall	Legal	Physical	Intellectual
Singapore	8.2	8.4	8.2	7.9
Taipei, China	6.9	6.7	7.0	7.1
Malaysia	6.5	5.8	7.5	6.3
Republic of Korea	6.2	5.9	6.0	6.8
Brunei Darussalam	5.7	6.9	5.7	4.5
Thailand	5.3	4.3	6.9	4.6
Indonesia	5.0	4.2	6.6	4.2
Philippines	4.7	3.4	5.8	4.9
Viet Nam	4.8	4.6	5.6	4.3

Note: For a description of the index see The International Property Rights Index 2015. <http://www.internationalpropertyrightsindex.org/data> The index for the Republic of Korea, Brunei Darussalam and the Philippines is for 2012. Source: Americans for Tax Reform Foundation/Property Rights Alliance. 2014. International Property Rights Index. Washington, DC.

Government priorities and institutional support

Thailand has established a set of government institutions in an effort to promote innovation and expedite technological progress to a level similar to those of high-income countries. However, the government's lack of coordinated leadership continues to hamper the fostering of an innovation culture or society. Rather, the effort remains passive by relying on foreign firms for technology upgrading.

In the 1990s, various government agencies in Thailand used the Thai Research Fund to increase public R&D expenditures. The government allowed tariff-free importation of new equipment and established a series of new industry and technology institutions to foster technology and innovation useful for domestic firms. But these were not successful for a variety of reasons, including, simply, the lack of personnel in the R&D sector (Doner 2009).

At the highest levels of government, policy is set by the Science Technology and Innovation Committee, which was reformed in 2008 and is chaired by the Prime Minister, with members holding the rank of ministers. It is supported by the National Science, Technology and Innovation Policy Office, which was created as its secretariat.¹³ The National Research Council of Thailand also assists with national policy and strategy, reporting directly to the Prime Minister and providing advice to the cabinet. Along with its policy and planning role, the research council allocates research funding, mostly to research institutes and universities. To help commercialize research findings, the National Innovation Agency exists to find and entice investors for research ideas that are close to the market.

In addition to these policy and funding institutions, research and development is coordinated by two large agencies, the National Science and Technology Development Agency and the Ministry of Science and Technology (MOST). As a ministry, MOST is coordinating the policy and strategic plan for science, technology, and innovation. It is also seeing to its effective and substantive implementation, both in research and development and creating cooperative

mechanisms between all sectors of society. It is responsible for 16 important supporting agencies, which are divided on an organizational basis, including 4 government agencies, 3 autonomous agencies, 2 state enterprises, and 7 public organizations.

Established in 1991, the National Science and Technology Development Agency focuses on key R&D activities including research, technology transfer, human resources development, and infrastructure development for science and technology. It also promotes public-private partnerships in R&D. The agency is composed of five national R&D centers: the National Center for Genetic Engineering and Biotechnology, the National Metal and Materials Technology Center, the National Nanotechnology Center, the National Electronics and Computer Technology Center, and the National Technology and Management Center. It also manages the Thailand Science Park and the Software Park Thailand.

Recently the government more strongly recognized the need to encourage innovation. A National Science, Technology and Innovation Master Plan, 2012–2021 was completed in early 2012 and indicates government attention to the issue, but it is too early to evaluate its impacts.

3.2 Education Quality and Skills Mismatch

World Bank (2012b) finds that investing in higher education by developing the right skills and research is critical to greater productivity growth and technological development.

Thailand understands the importance of high-quality human capital for growth and technology advances and has prioritized education (World Bank 2009). But more needs to be done, especially on higher education. The government has undertaken numerous reforms in the educational system since it shifted to a constitutional monarchy in the 1930s. The National Education Act 1999 and the 2002–2016 National Education Plan raised compulsory education from 6 to 9 years, resulting in near universal primary

¹³ Enabled under the National Science, Technology and Innovation Act, 2008.

education. And government efforts to expand access to secondary education have produced remarkable growth in enrollment since the 1990s. In 2001, 62% of the labor force had only reached elementary education, while only 19% had secondary education, and 12% higher education. By 2014, 45% had primary education, 28% secondary, and 20% tertiary.

While significantly improved, Thailand's educational performance falls behind East Asia's high-income economies and OECD countries. The next steps in advancing quality and greater workforce skills require better understanding of how access, quality, equity, and efficiency play out in the local context.

Educational attainment in the workforce is low.

About 10% of Thailand's labor force had higher education in the mid- to late-1990s (Paitonpoong 2002), which slightly improved to 12.5% by 2011 (Table 3.6). Even so, a large portion (54.1%) had only primary education. The bright side seems to be that the 18–25 age group, the future of the labor force, has more secondary and higher education, at 70.7% and 15.7%, respectively.

Table 3.7 shows the educational attainment of selected high- and middle-income countries for which data are available.¹⁴ That Thailand has the lowest portion of the labor force with secondary education is quite alarming. This means that the majority of the labor force still has only primary education, as Table 3.6 illustrates. Secondary education provides the pool of the more trainable and skilled workers for an economy. The knowledge and skills gained in secondary education makes workers more employable and able to respond

Table 3.6: Educational Attainment of Labor Force in Thailand, 18–65 years old, 2011 (%)

Educational Attainment	18–25	26–45	46–65	All
Primary	13.3	44.7	77.1	54.1
Secondary	70.7	39.1	15.1	33.2
Higher level	15.7	16.1	7.7	12.5
Other non-degree	0.4	0.1	0.1	0.1

Sources: National Statistics Office. 2011a. The Labor Force Survey Whole Kingdom. Bangkok, Thailand; and ADB estimates.

to the demands of an increasingly modern industrial and service economy. It also allows them to proceed to higher education.

Thailand's labor force with tertiary education compares more favorably with high-income countries, but still lags behind some peers at similar levels of economic development.

The skills mismatch places constraints on business.

Skills shortages and gaps in Thailand's labor market are validated by a 2014 World Economic Forum survey on global competitiveness. Among the factors identified as the most problematic for doing business in Thailand, two relate to education—an inadequately educated workforce and insufficient capacity to innovate. These

Table 3.7: Labor Force with Secondary and Tertiary Education in Selected Countries

	Year Became High Income	Labor Force with Secondary Education (% of total)	Labor Force with Tertiary Education (% of total)
Recent High-Income Countries (average of 10 years before reaching high income)			
Argentina	2015	37.7	29.7
Chile	2013	50.9	24.0
Croatia	2007	60.7	17.5
Czech Republic	2005	78.3	11.6
Greece	1996	30.6	15.6
Hungary	2007	65.1	17.3
Republic of Korea	1994	41.1	16.2
Poland	2009	70.3	16.7
Slovak Republic	2005	69.8	18.3
Middle-Income Countries (latest available year)			
Brazil		36.4	17.2
India		22.3	7.1
Indonesia		55.8	24.4
Malaysia		39.2	28.0
Philippines		36.4	17.2
Thailand (latest)		14.5	17.1

Note: The earliest educational statistics for these countries begin in 1970. Data for some countries may be less than 10 years depending on availability. Data for Indonesia and the Philippines are for 2008, India for 2010, Brazil for 2011, and Malaysia and Thailand for 2012.

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

¹⁴ The educational attainment of the portion of the labor force with secondary and tertiary education was averaged for the 10 years prior to the country reaching high income. This is comparable to Thailand currently, which aims for high-income status over the next 10 to 15 years.

were ranked after four governance issues: government instability, corruption, policy instability, and an inefficient bureaucracy (Figure 3.5).

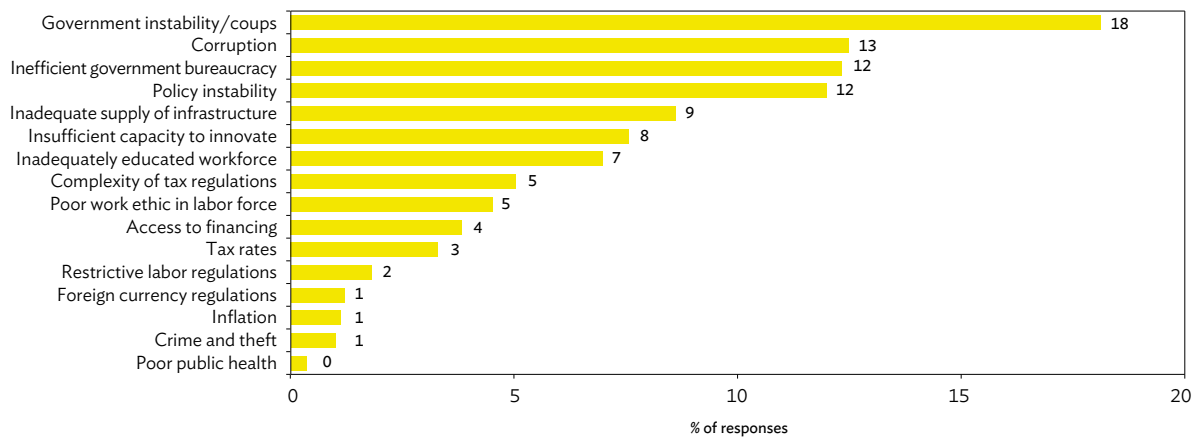
Although Thailand’s universities produce enough graduates to work in various sectors of the economy, a World Bank (2008) study points to the difficulty in identifying applicants with appropriate basic and technical skills as one of the main reasons for job vacancies. More than 43% of the country’s firms identified insufficient basic and technical skills as major causes for vacancies, while only 13% pointed to a lack of applicants as a major factor (Figure 3.6). This indicates an imbalance between the quantity and

the quality of higher education graduates; thus making employers willing to pay a significant premium for high-skilled workers.

Student choices on what discipline to specialize in matter. Thai students tend to favor disciplines out of sync with the needs of the market and a more advanced economy. Fifty-four percent of tertiary enrollment is in social science, business, and law, compared with 20%–30% in Japan, the Republic of Korea, the United Kingdom, and the United States (Figure 3.7).

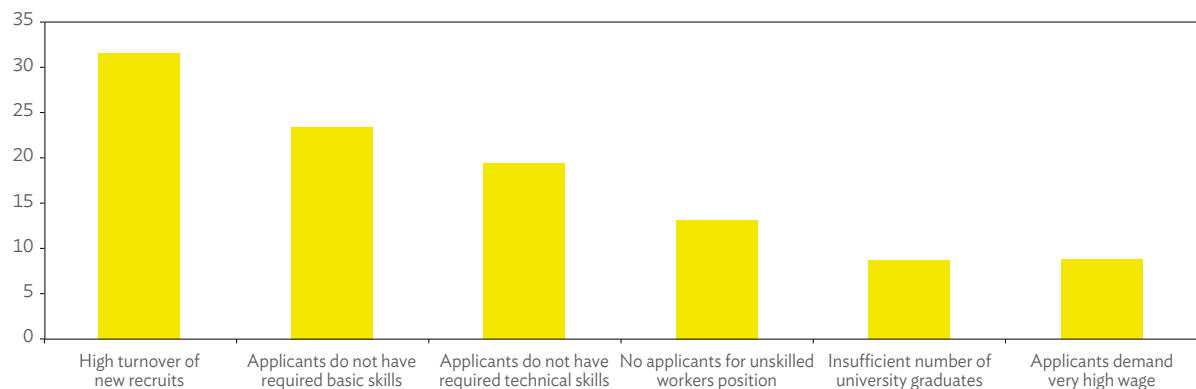
On the other hand, the total enrollment share in science and engineering is 18%, compared with 33%–

Figure 3.5: Most Problematic Factors for Doing Business in Thailand, 2014



Source: World Economic Forum (WEF). 2015. *The Global Competitiveness Report 2015–2016*. Geneva: WEF.

Figure 3.6: Main Causes of Job Vacancies in Thailand (% of firms)



Source: World Bank. 2008. *Thailand Investment Climate Assessment Update*. Report No. 44248-TH, Washington.

40% in the Republic of Korea, Malaysia, and Singapore. The result is a shortage of the engineering and science graduates crucial for innovation and greater productivity, thus reinforcing the mismatch between what Thai universities produce and what employers want. Moreover, the shortage of qualified engineers and skilled labor undermines the country’s ability to attract new foreign direct investment (Russel 2007).

Science and engineering courses are less popular among students, despite their higher returns, while the social sciences and related fields may be perceived as relatively easy, hence their popularity. This has implications for students’ knowledge foundations in math and science, which leaves them less confident to specialize in disciplines involving these subjects. The Thai government has been consciously trying to strengthen science and technology education to address this gap, yet more needs to be done. As discussed later, the quality of math and science education in Thailand has deteriorated since the late 1990s, as illustrated by the recent results of Times International Mathematics and Science Study 2011.

Thai students’ foreign language skills (notably English) are also inadequate to support advanced economic links and global integration. The Thailand Productivity and Investment Climate Study rated English

language skills poor in 2004 and very poor in 2007 (Figure 3.8). But Thai workers need to improve proficiency in English, considering that the country is promoting tourism as a major source of growth.

Concerns about the shortage of skilled labor suggest that Thailand’s educational strategy needs to be better linked to development strategies in agriculture, industry, and services. Specialized skills must be built on a solid base of foundational skills and aptitudes (such as in math and science). This is so that workers can be flexibly redeployed as the nature of Thailand’s participation in global production networks and supply chains changes.

Labor productivity is rising, but needs to improve further.

Labor productivity growth—computed as GDP (constant 2005 \$) over the number of workers employed—improved in all sectors during 2001–2012, by 1.2% in agriculture, 3.2% in industry, and 1.6% in services (Figure 3.9). The ratio of average productivity in industry to agriculture in 2012 was high, at nearly 9 to 1. This means that it would take the average industrial worker only 1 month to produce the same value as the average agricultural worker would produce in 9 months. This ratio was around 7 in 2001 and 2005.

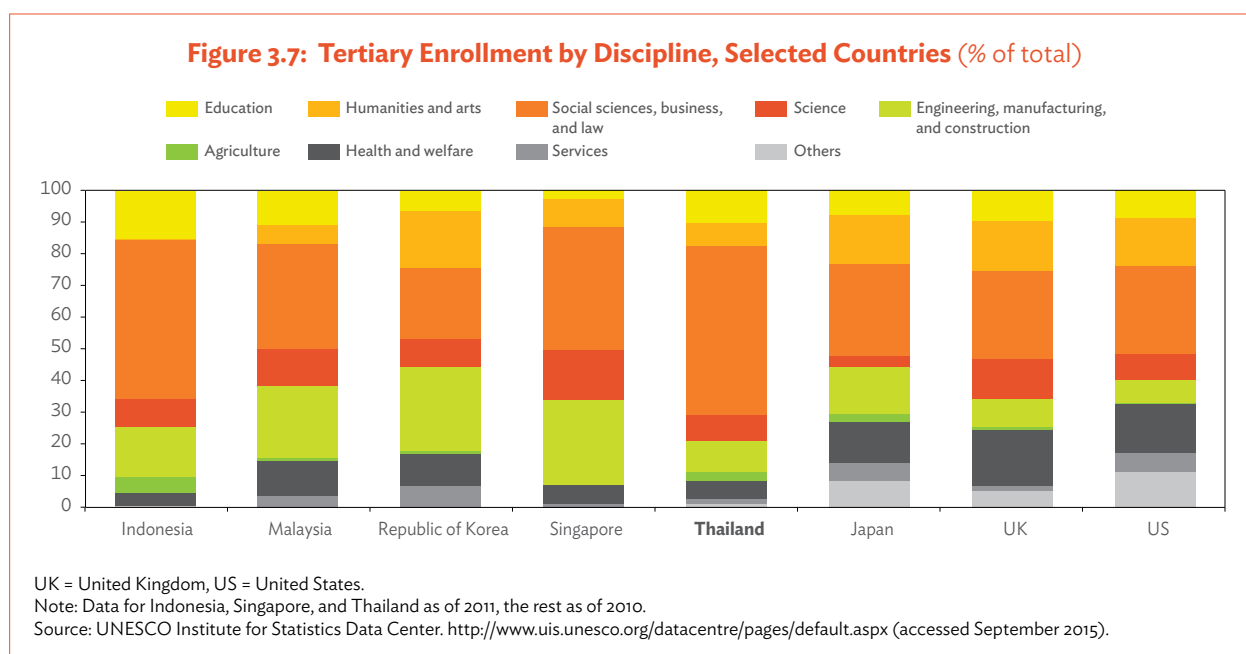
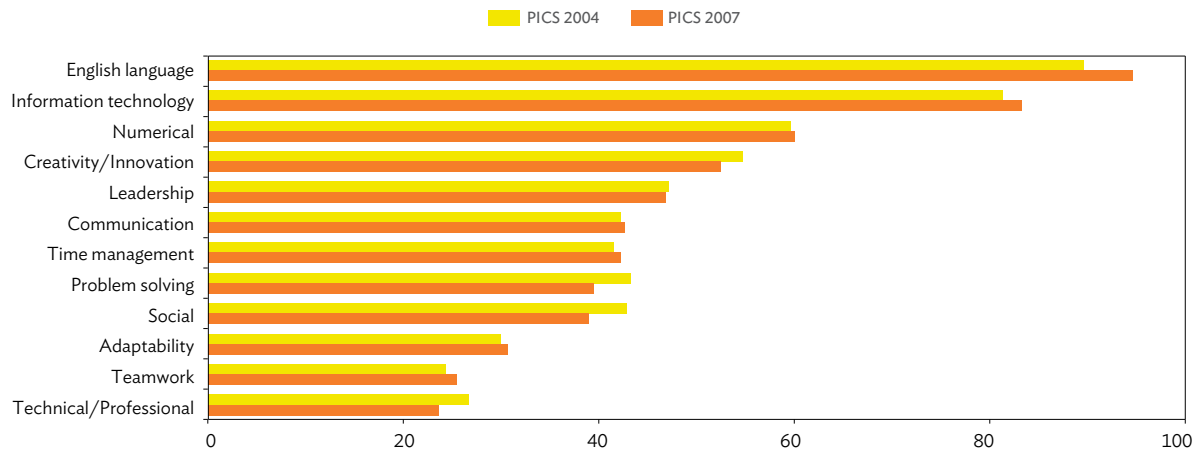
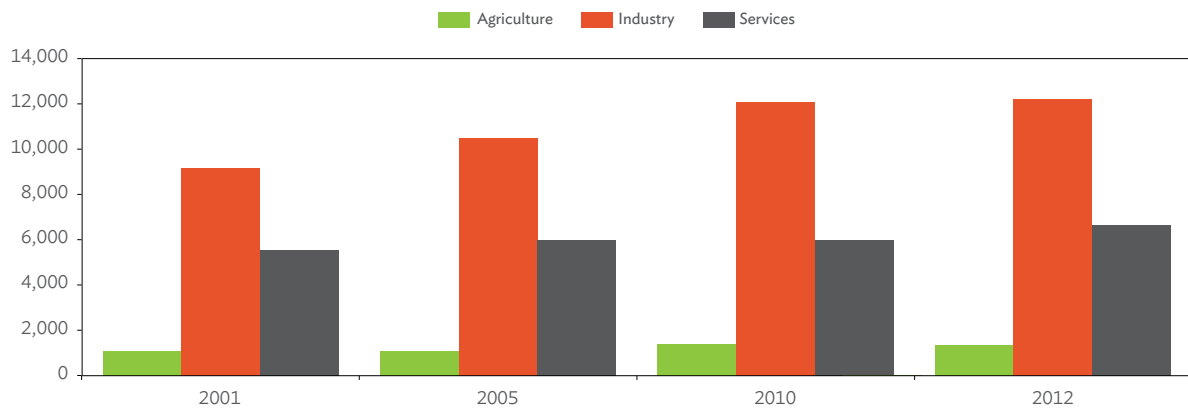


Figure 3.8: Firms Rating Certain Skills as Poor or Very Poor, 2004 and 2007 (%)



PICS = Productivity and Investment Climate Study.
 Source: World Bank. 2008. *Thailand Investment Climate Assessment Update*. Report No. 44248-TH, Washington.

Figure 3.9: Labor Productivity in Thailand, 2001-2012 (\$ per worker)



Sources: For GDP by sector, constant 2005 \$: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015); for employment by sector, Ministry of Information and Communication Technology. National Statistical Office. <http://web.nso.go.th/> (accessed September 2015).

Thailand’s industrial annual productivity growth was comparable with countries at its income level during 2000–2011; however, in terms of its annual productivity level, it is far lower than high-income Asian economies such as Japan, the Republic of Korea, and Singapore (Figure 3.10). The efficiency of Thailand’s production processes needs enhancing to the level of these economies. This requires building an educated and skilled labor force to improve productivity in low-productive sectors. The country’s labor force should also match the technological skills and sophistication

of expatriate workers who currently populate firms producing higher-technology products, with the aim of transforming the country into a “headquarter economy.” These firms employ skilled expatriates more than Thai workers, who are as yet incapable of performing the skilled tasks required in the production of high-value products.

Measures were initiated in the late 1980s and early 1990s to improve the technological skills and sophistication of workers, with the focus largely on

universities. But the effort was unsuccessful because universities were unable to address the technological absorption and diffusion needs of local and foreign firms. In contrast, Singapore institutionalized technical education and training programs that led to the promotion of indigenous suppliers and the development of new products (Doner 2009).

Becoming part of regional or global supply chains provides productive employment for all types of workers. As Thai workers become more skilled and move up the value chain, opportunities for less skilled workers in lower value-chain segments also rise, and can be taken up by the masses of labor in the agriculture sector.

Increasing the quantity and quality of education.

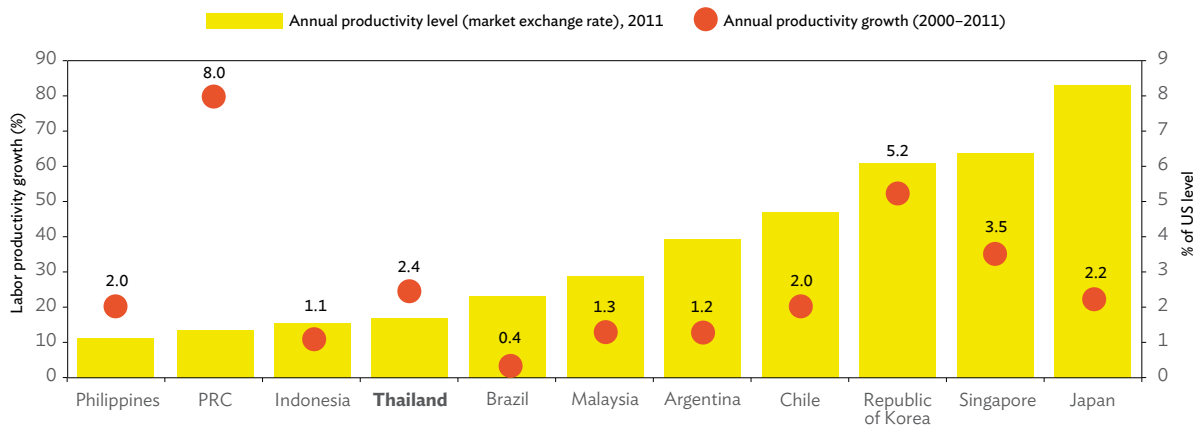
Table 3.8 shows steady and substantial increases in student participation at all levels of education since the early 1970s—and this may have been the result of explicit policies and practices adopted by the government. The National Educational Act 1999, for example, set national goals for achieving universal lower secondary education by 2006 and universal upper secondary education by 2015 (World Bank 2009). However, resource mobilization for education under the act has not been fully implemented

(Lekagul 2009), indicating possible room for even higher increases in student participation at all levels of education. The gross enrollment ratio for the secondary level more than tripled from 28.5% in 1990 to 85.9% in 2013. Gains in tertiary-level enrollment are also significant, with the gross enrollment ratio tripling from 15.9% in 1990 to 51.2% in 2013.

An economy’s pool of talent has to come from secondary and tertiary education. Enrollments in these levels are also closely related to each other. For tertiary education to have more enrollees, it follows that enrollment in secondary education has to increase. In Thailand’s case, the level of secondary enrollment, however, does not appear to be a constraint on having a wider source of talent. Nevertheless, compared with other countries, Thailand’s school enrollment rates show room for further improvement, particularly at the primary level. Most of its Asian peers and high-income economies (that is, 10 years prior to becoming high-income) had almost 100% primary enrollment (Table 3.9).

Disparities in access to and the quality of high education across Thailand’s regions are large, and reducing inequality in this respect is important for inclusive growth. Table 3.10 shows that the highest share of labor force, with tertiary and graduate degrees,

Figure 3.10: Industrial Labor Productivity, Selected Economies, 2000–2011



PRC = People’s Republic of China, US = United States.
 Sources: Estimates based on World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators>; Asian Productivity Organization. Productivity Measurement. <http://www.apo-tokyo.org/wedo/measurement>; The Conference Board. Total Economy Database. <https://www.conference-board.org/data/economydatabase/> (all accessed October 2015).

Table 3.8: Gross Enrollment Ratio in Thailand, 1971–2013 (%)

Level	1971	1975	1980	1985	1990	1995	2000	2005	2010	2013
Primary	82.4	84.1	96.0	96.3	98.8	95.3	97.7	98.1	94.9	95.8
Secondary	18.0	23.4	27.7	30.7	28.5	48.0	62.7 ^a	71.4	83.5	85.9
Tertiary	2.9	3.6	10.3	20.6	15.9	20.1	35.1	44.2	50.0	51.2

^a 2001 data.

Source: World Bank. Data. EdStats: Education Statistics. <http://datatopics.worldbank.org/education/> (accessed October 2015).

Table 3.9: School Enrollment, Selected Economies

	Year Became High Income	School Enrollment, Primary (% gross)	School Enrollment, Secondary (% gross)	School Enrollment, Tertiary (% gross)
Recent high-income economies (average of 10 years prior to becoming high income)				
Argentina	2015	117.2	89.8	71.4
Chile	2013	103.2	89.3	55.6
Croatia	2007	95.0	88.0	35.9
Czech Republic	2005	102.1	92.0	29.0
Greece	1996	98.1	93.2	30.9
Hong Kong, China	1977	115.6	41.6	8.1
Hungary	2007	100.0	96.5	45.4
Republic of Korea	1994	103.9	92.2	35.8
Macau, China	1994	108.1	66.4	26.5
Poland	2009	97.8	100.0	59.5
Portugal	1989	122.6	57.3	12.6
Slovak Republic	2005	100.3	88.5	27.1
Spain	1973	114.0	56.6	18.3
Middle-income countries (latest year available)				
Philippines		107.0	85.3	33.4
People's Republic of China		126.4	92.4	29.9
Malaysia		101.4	70.8	37.2
Indonesia		108.5	83.1	31.5
India		108.5	71.5	24.7
Thailand (latest)		95.8	85.9	51.2

Note: Earliest education statistics begin in 1970 for these countries. Figures for some countries may be less than 10 years depending on data availability. Data for gross primary enrollment for Malaysia are for 2005; Indonesia and India for 2012; and the People's Republic of China, the Philippines, and Thailand for 2013. Data for gross secondary enrollment for Malaysia and India are for 2012; the People's Republic of China, India, Indonesia, the Philippines, and Thailand for 2013. Data for tertiary gross enrollment for Malaysia and Indonesia are for 2012; the People's Republic of China, India, the Philippines, and Thailand for 2013.

Source: World Bank. Data. EdStats: Education Statistics. <http://datatopics.worldbank.org/education/> (accessed October 2015).

Table 3.10: Educational Attainment of Labor Force by Region, 18–65 years old, 2011 (%)

Educational Attainment	Thailand	Bangkok	Central	South	North	Northeast
Primary	54.1	30.1	49.6	49.8	60.7	63.6
Secondary	33.2	38.2	38.4	38.4	29.5	27.7
Higher level	12.5	31.6	11.9	11.6	9.6	8.6
Other non-degree	0.1	0.2	0.0	0.2	0.3	0.0

Source: ADB estimates using data from the National Statistics Office. 2011b. Thailand Socio-Economic Survey 2011. <http://web.nso.go.th/en/survey/>

is concentrated in Bangkok (31.6%), which may impact on the quality of growth between regions. Economic growth and development occur mostly in the capital, where knowledge-intensive jobs are concentrated. For

this reason, “good” universities are also concentrated in Bangkok, perpetuating the problem of equity and access to top universities.

Because the quantity of education, or school enrollment, is now reaching nearly 100% at the primary level, and secondary enrollment is steadily increasing, the *quality* of education needs greater attention. Several indicators suggest overall quality needs considerable improvement for Thailand to rank alongside its higher-income neighbors and advanced countries. Based on Programme for International Student Assessment (PISA) results—a standard benchmark for reading, mathematics, and science for lower secondary school students—Thailand is well behind the more developed countries in the region and below the average for OECD countries in all three subjects (Table 3.11).¹⁵

Thailand also scores below Asia’s average in all three subjects, despite some improvement from 2003 to 2012 (Table 3.12).

Thai students also performed relatively poorly in the 2011 Times International Mathematics and Science Study (TIMSS), with eighth graders achieving an average scale score of 427, lower than the 1999 and 2007 TIMSS results for Thailand (Figure 3.11). This result placed Thailand 28th out of the 45 countries

Table 3.11: PISA Scores, Selected Economies, 2012

Economy	Science	Mathematics	Reading
Shanghai, PRC	613	570	580
Hong Kong, China	561	545	555
Singapore	573	542	551
Japan	536	538	547
Republic of Korea	554	536	538
Taipei, China	560	523	523
Thailand	427	441	444
Kazakhstan	432	393	425
Indonesia	375	396	382
Asia average	613	570	580
OECD average	561	545	555

PRC = People’s Republic of China, OECD = Organisation for Economic Co-operation and Development, PISA = Programme for International Student Assessment.

Note: Asian economies covered by PISA 2012 are the PRC (Shanghai; Macau, China; and Hong Kong, China); Indonesia; Israel; Japan; Jordan; Kazakhstan; Republic of Korea; Malaysia; Qatar; Singapore; Taipei, China; Thailand; Turkey; United Arab Emirates; and Viet Nam.

Source: Organisation for Economic Co-operation and Development. 2014. PISA 2012 Results in Focus: What 15-Year-Olds Know and What They Can Do with What They Know. <http://www.oecd.org/pisa/keyfindings/>

¹⁵ Results are much better in Bangkok than other parts of the country, underlining regional disparities in educational investment and outcomes.

¹⁶ The description on secondary education in Thailand draws heavily from Moenjak and Worswick (2003).

Table 3.12: Thailand’s PISA Scores

Subject	2003	2006	2009	2012
Reading	420	417	421	441
Math	417	417	419	427
Science	429	421	425	444

PISA = Programme for International Student Assessment.

Note: The score is the average of all student scores in Thailand. Organisation for Economic Cooperation and Development (OECD) country average score is 500, with standard deviation of 100.

Source: OECD. 2014. PISA 2012 Results in Focus: What 15-Year-Olds Know and What They Can Do with What They Know. <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf>

participating in the 2011 math assessment, and below the scale center point of 500. High-income East and Southeast Asian economies were in the top five of the 2011 study, led by the Republic of Korea (with an average score of 613), Singapore (611), Taipei, China (609), Hong Kong, China (586), and Japan (570). Malaysia ranked 26th and Indonesia 38th. The math assessment measures overall achievement in the subject, as well as in its major components (algebra, geometry, and so on).

In science, Thailand, with an average scale score of 451, ranked 27th out of 45 countries in the 2011 TIMSS study. As in mathematics, its average scores in science showed a decreasing trend (Figure 3.11). But it is worth noting that Malaysia and Indonesia, ranking 32nd and 40th, respectively, attained scores that were also below the scale center point of 500. High-income East and Southeast Asian economies were again in the top four: Singapore (with an average scale score of 590), Taipei, China (564), the Republic of Korea (560), and Japan (558). Hong Kong, China (535) placed eighth. The science assessment measures the students overall performance in science, as well as in its major components (biology, physics, and so on), which they are expected to master as they progress through primary and lower secondary school.

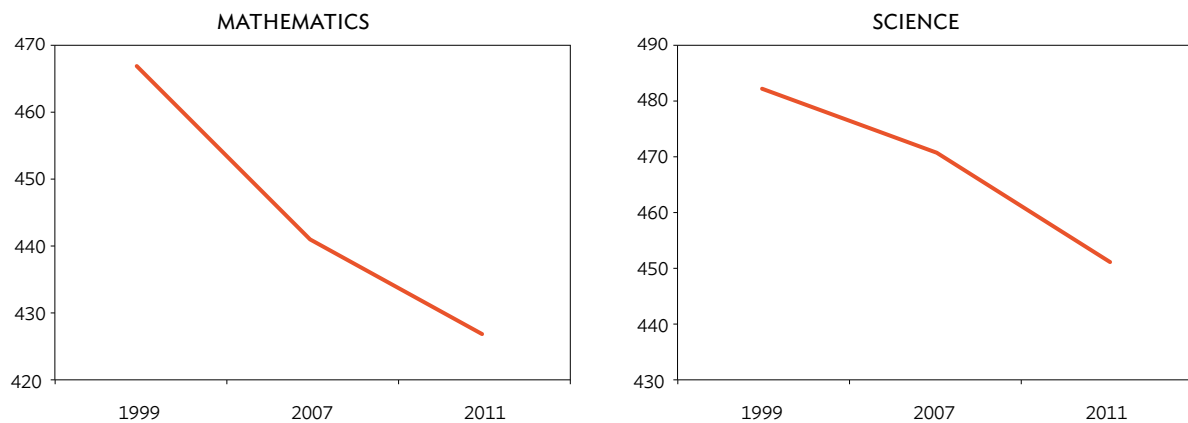
More vocational education graduates are needed.

Thailand’s system of technical and vocational education and training (TVET) is open to those finishing lower secondary education.¹⁶ Alongside the general (or academic) stream, TVET is one of two

streams of upper secondary education. Access to both is fairly open, they have similar admission criteria, and both prepare students for higher studies. The general stream aims to equip students with basic skills for nonmanual jobs (such as office); the vocational stream with skills for jobs that require specialized skills, such as electricians and mechanics, as well as business skills such as bookkeeping. Some vocational schools offer agricultural studies.

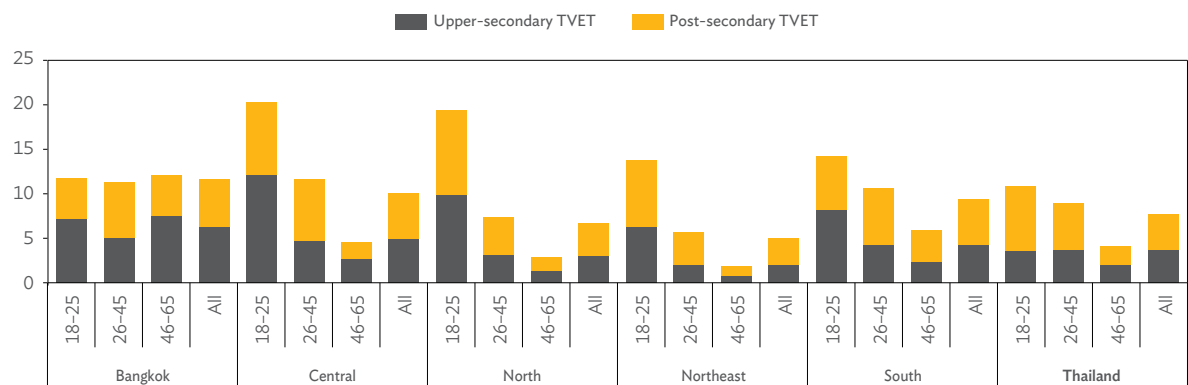
Because TVET teaches highly specialized skills, developing it to respond to the demands of the economy’s major sectors would help Thailand better position itself to compete globally. Take-up of TVET in the country is low at 7.8% (Figure 3.12), although higher in the 18–25 age group—possibly reflecting that TVET is already getting more attention. Overall enrollment in TVET is highest in Bangkok, closely followed by the Central and the South region, which

Figure 3.11: Trends in Mathematics and Science Achievement of Thai Students (8th Grade), 1995–2011



Note: Thailand did not participate in the 1995 and 2003 Times International Mathematics and Science Study.
Sources: I. Mullis, M. Martin, and A. Arora. 2012. *TIMSS 2011 International Results in Mathematics*. International Association for the Evaluation of Educational Achievement. Chestnut Hill, MA: TIMSS & PIRLS International Study Center and Amsterdam: International Association for the Evaluation of Educational Achievement (IEA); M. Martin, I. Mullis, P. Foy, and G. Stanco. 2012. *TIMSS 2011 International Results in Science*. Amsterdam: IEA.

Figure 3.12: TVET Take-Up in Thailand, 2011 (% of Population Aged 18-65)



TVET = technical and vocational education and training.
Source: ADB estimates using data from National Statistics Office. 2011a. *The Labor Force Survey Whole Kingdom*. Bangkok.

again suggests regional disparities in access to TVET opportunities. Outside Bangkok attendance is highest among the 18–25 age group, reflecting that younger people there choose to enter the job market after secondary education, rather than pursuing higher education (Table 3.10).

3.3 Constrained Competition in Services

The importance of the services sector increases as a country moves through the middle-income stage of development. In high-income economies in Asia and the Pacific, services account for about 70% of GDP, including for manufacturing powerhouses, such as Japan and Taipei, China, as well as for agriculture and natural resource producers such as Australia and New Zealand. As an economy grows and income per capita rises, the services sector caters to a growing middle class with increased purchasing power for hospitality, entertainment, tourism, health, education, and personal services. Equally important are services that support other businesses (manufacturing and agriculture, for example) and other service subsectors. Logistics, finance, engineering, and business services play key roles in enhancing efficiency, productivity, and innovation throughout the economy.

Thailand, like many emerging economies, has focused on the manufacturing sector, which is seen as fundamental to creating a modern industrial economy. However, its services and utilities sectors are constrained by greater regulation and less competition. Typical in this regard are public services, such as electricity, gas, water, and so on, which the government tends to dominate because of high fixed costs of these facilities and operations, and because these services for the public may be underprovided if left to the market alone. In many cases, these subsectors exhibit—or have been thought to exhibit—the characteristics of natural monopolies and are best provided through a single state-owned enterprise. However, alternative contracting mechanisms that allow a separation in functions (for example, track and operations in railways, and networks, and subscriber services in telecommunications) have widened the

opportunities for greater private sector participation to promote greater competition.

Thailand's services sector comprises an array of commercial activities. Competition is healthy in most service areas and, even in the area of public services, the principles of choice and competition are increasingly recognized as key elements for successful reforms to improve quality and efficiency across a range of public services. Competition is increasingly encouraged and promoted in key services sectors, such as transport (as a regional travel hub), hospitality and tourism, and related personal services such as therapeutic and spa treatments. The country has also developed a burgeoning medical services industry that generates services exports through medical tourism. Overall, however, services have lost ground to industry, and productivity has been stagnant.

The share of services in output is declining and productivity is stagnant.

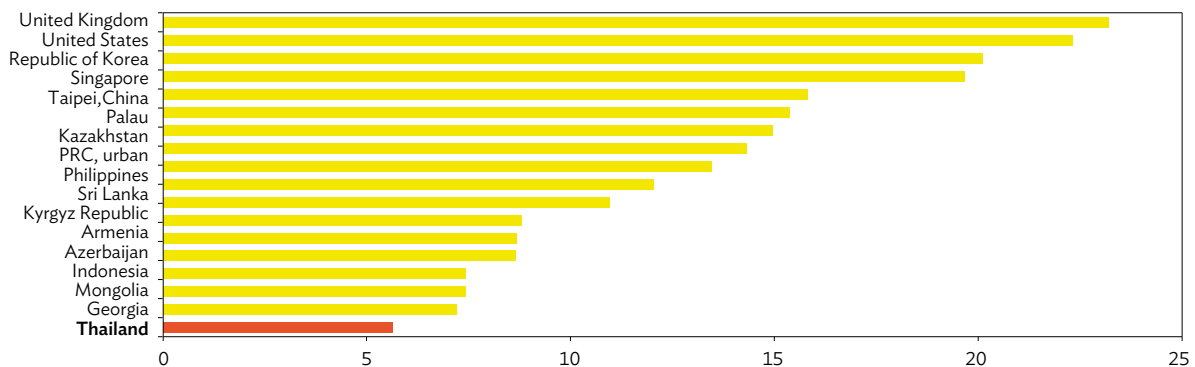
From 1990 to 2010, the share of services in output fell. This decline occurred through the following subsectors: trade; hotels and restaurants; transport and storage; real estate and dwellings; and communications, finance, and business services. This is quite surprising—and worrying—since transport and hospitality are key sectors of the economy, and given the country's increasing role as a transport, logistics, and tourism hub for the region. As a result of this decline and output increases in other countries, Thailand's services subsectors now make up a smaller share of value added than in most comparator countries, the exception being hotels and restaurants. Thailand is falling behind, particularly in the critical area of communication, finance, and business services, where value-added share has fallen 3.6 percentage points since 1990; indeed, it is now below the nine middle- and high-income Asian economies in Table 3.13, which shows country shares in value added. Business services—critical for productivity and innovation across the economy—play a small role in Thailand, accounting for about 6% of total employment, the lowest among 17 Asian countries for which comparable data are available (Figure 3.13).¹⁷

¹⁷ The figures are for 2007, the latest comparable data available.

Table 3.13: Share of Services in Value Added, Selected Economies, 1990 and 2010 (%)

Economy	Total Services		Trade		Hotels and Restaurants		Transport and Storage		Real Estate and Dwellings		Public Administration, Community, Personal, and Other Services		Communication, Finance, and Business Services	
	1990	2010	1990	2010	1990	2010	1990	2010	1990	2010	1990	2010	1990	2010
Developing Asia														
PRC	31.5	43.4	6.8	8.5	1.6	2.1	3.8	4.9	2.1	7.3	7.9	11.2	9.4	9.4
Hong Kong, China	87.2	92.2	21.8	24.0	3.0	3.3	7.7	8.1	5.1	5.2	30.3	27.9	19.4	24.4
India	46.1	54.7	11.8	15.1	1.0	1.4	6.4	6.4	5.0	6.1	13.3	14.5	8.8	11.2
Indonesia	42.4	37.7	13.5	10.9	3.2	2.8	6.1	3.4	2.9	2.6	10.1	10.2	6.5	7.8
Republic of Korea	51.5	58.5	11.8	8.6	2.4	2.3	4.7	4.2	6.5	7.2	14.8	20.1	11.2	16.1
Malaysia	44.9	46.0	10.9	11.9	2.2	2.3	3.8	3.3	5.4	4.1	8.3	9.7	14.4	14.6
Philippines	50.8	55.1	14.7	17.4	...	...	3.2	3.9	5.8	6.5	15.7	13.4	11.5	13.9
Singapore	67.8	71.7	13.1	16.5	3.5	2.2	11.4	8.6	3.6	4.1	9.6	10.7	26.6	29.6
Taipei, China	55.0	66.2	13.4	18.8	1.7	2.0	4.6	3.3	6.4	8.9	17.5	20.8	11.4	12.4
Thailand	50.9	43.0	17.8	13.1	5.4	4.7	4.5	4.1	2.2	1.4	9.7	12.0	11.3	7.7
OECD														
France	69.2	79.7	11.7	10.6	2.3	2.6	4.6	5.0	9.8	13.4	21.7	26.1	18.9	22.0
Japan	59.8	72.6	12.8	12.3	...	...	4.9	4.5	9.4	13.0	19.1	25.7	13.6	17.2
United States	73.4	80.2	12.9	11.6	3.4	3.8	3.0	2.8	12.1	12.2	23.0	24.8	18.9	25.1
Latin America														
Chile	49.8	53.9	14.7	9.4	...	...	5.0	5.9	4.9	4.4	12.7	16.2	12.5	17.9
Mexico	61.1	64.2	15.7	11.5	2.2	3.3	6.9	5.7	8.8	10.0	14.9	20.4	12.4	13.1

... = data not available or combined with other services, PRC = People's Republic of China, OECD = Organisation for Economic Co-operation and Development.
 Source: Asian Development Bank. 2012. *Asian Development Outlook 2012 Update: Services and Asia's Future Growth*. Manila.

Figure 3.13: Share of Business Services in Total Employment, 2007 (%)


PRC = People's Republic of China.

Source: Asian Development Bank. 2012. *Asian Development Outlook 2012 Update: Services and Asia's Future Growth*. Manila.

Services sector productivity is rising in Asia.

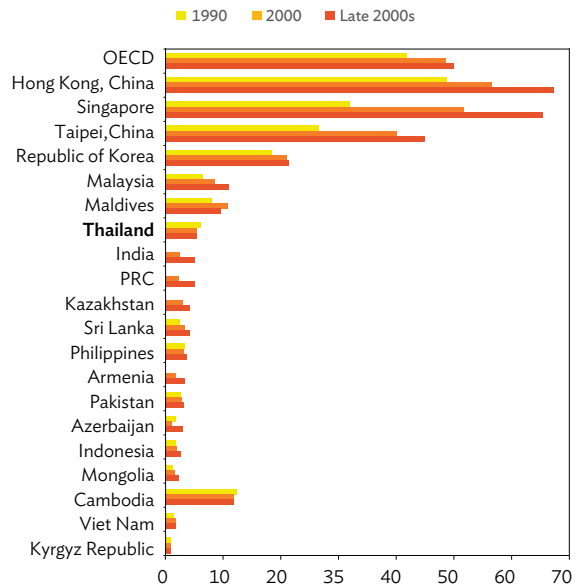
Across developing Asia, labor productivity in the services sector has risen since the early 1990s, an encouraging and probably expected trend as Asia's economies become more developed and their

income levels rise. But in Thailand, the case is quite different: productivity is now lower than in 1990, and only marginally improved between 2000 and the late 2000s (Figure 3.14). In 2000–2010, annual labor productivity growth was 0.08%, whereas in Malaysia it was 2.1% and in India a hefty 7.0%. For 12 Asian

countries, the average was 3.0%.¹⁸ In the PRC, which graduated to upper-middle income at about the same time as Thailand and has seen a rapid expansion of its manufacturing base, services sector productivity grew 8% per year during that decade.

Labor productivity in Thailand’s services sector was well below high-income Asian economies and OECD countries from 1990 to the late 2000s, when Thailand experienced a marginal decline in labor productivity in its services sector (Figure 3.14). Several countries in Eastern Europe that recently graduated from middle-to high-income got a significant boost from a “sectoral rebalancing” toward services. These countries were “over-industrialized” under the system of central planning, and included a small but highly productive services sector (World Bank 2008). A reduction in policy emphasis on industry and the freeing of market forces in these countries allowed their services sectors to rapidly increase output and employment shares. Box 3.1 summarizes this experience.

Figure 3.14: Labor Productivity in Services
(2000 constant \$ ‘000)



PRC = People’s Republic of China, OECD = Organisation for Economic Co-operation and Development.
Source: Asian Development Bank. 2012. *Asian Development Outlook 2012*
Update: *Services and Asia’s Future Growth*. Manila.

Box 3.1: Achieving High-Growth and High-Income Status through Services Market Expansion

Economic studies often demonstrate that high growth and achieving high-income status tend to be associated with the increased production, sophistication, and export of goods. However, the services sector also plays an important role in the process, as witnessed by countries in Eastern Europe.

Fourteen non-small, non-OPEC countries graduated to high-income status in 1965–2010. As well as Asia’s five tigers, five of the 14 were countries in Eastern Europe: Croatia, the Czech Republic, Hungary, Poland, and Slovenia. Through solid but not spectacular growth rates, they managed to move beyond the middle-income phase and are now among the most recent group of high-income countries.

An interesting characteristic of their growth process was that labor productivity in the services sector was higher than in manufacturing and agriculture. This was attributable, in part, to the fact that these countries were “over-industrialized” due to an emphasis on manufacturing and related subsectors in government policies. Enterprises were overstaffed and productivity low. But after central planning was abandoned, these countries underwent a sectoral rebalancing through the decline of policy direction and the development of market forces. As a result, labor and other factors shifted to the services sector.

The services sector’s share of economy-wide value added increased dramatically in a short period: from 40% in 1999 to 60% in 2005 among EU-10 countries, a group of Eastern European transitional economies that includes four of the five countries mentioned above. In addition, the employment share in services rose 16 percentage points. Since services have higher productivity, this boosted economic growth—aided by the shedding of manufacturing labor, which raised labor productivity in that sector as well.

EU = European Union, OPEC = Organization of the Petroleum Exporting Countries.
Sources: World Bank. 2008. *Thailand Investment Climate Assessment Update*. Report No. 44248-TH. Washington, DC; J. Zhuang, P. Vandenberg, and Y. Huang. 2011. *Growing Beyond the Low-Cost Advantage: How the People’s Republic of China Can Avoid the Middle-Income Trap*. Manila: Asian Development Bank.

¹⁸ The 12 Asian economies are the PRC; Hong Kong, China; India; Indonesia; the Republic of Korea; Malaysia; Pakistan; the Philippines; Singapore; Taipei, China; and Viet Nam

There are several constraints to competition and fostering competition.

Lagging productivity may reflect limited competition in a sector. Fostering a competitive sector requires (i) low barriers to entry to a given subsector; (ii) that state enterprises are not given unfair advantages over private firms; (iii) that firms do not engage in collusive behavior (for example, price fixing); (iv) that large firms do not abuse their market power; and (v) that firms do not gain an advantage from political connections. These conditions help ensure a level playing field. Even in subsectors that bear the conditions of natural monopolies, there should be an element of contestability that allows potential investors and firms to challenge and possibly unseat the incumbent firm. To promote the conditions to foster competitive sectors, it is important that a well-defined, enforceable, and an enforced competition policy is in place, with appropriate legal and institutional structures, and a knowledgeable and competent staff. In Thailand, however, weaknesses in a number of these conditions have resulted in reduced competition.

One of the constraints to competition is a barrier to increased foreign investment in the services sector. Manufacturing has benefited greatly from the foreign ownership that has brought in capital, technology, advanced management practices, and

access to foreign marketing opportunities. In Thailand, foreign investment is allowed in services, but has been constrained through the Foreign Business Act 1999. This restricts foreign equity ownership to 49% in several areas, notably in a number of services subsectors: media (newspapers, radio, and television); wholesale and retail trade; and land trading; along with a number of rural activities such as rice farming, animal husbandry, fishing, and mining. Furthermore, the law includes a catch-all reference to “all service businesses.”

While there are legal limits on foreign equity holdings in the services sector, provisions exist under specific statutes and agreements for equity participation to be higher than the general levels set out in the Foreign Business Act. These are included in the Investment Promotion Act 1977, the Industrial Estate Authority of Thailand Act 1979, the Treaty of Amity and Economic Relations between Thailand and the United States, and free trade agreements that address this issue.

External forces are also at work to change this situation on foreign ownership. The planned ASEAN Economic Community requires Thailand to amend laws to allow much higher equity stakes in various subsectors, including services. The country missed ASEAN’s 2010 target for equity participation to reach at least 70% in services sectors (Table 3.14). Other countries in the

Table 3.14: Legal Limits on Foreign Equity in the Services Sector in Selected ASEAN Economies

Service Sector	Target	Thailand	Malaysia	Singapore	Philippines	Indonesia	Brunei Darussalam
E-ASEAN							
Mobile phone	>=70	49	51	74	40	49	...
Online data and database	>=70	49	51	100	...	51	100
Consultancy services on HW installation	>=70	100	100	51	40	...	...
Health Care							
Hospital services	>=70	49	51	100	40	49	100
Medical services	>=70	49	51	100	...	49	100
Dental services	>=70	49	51	100	...	49	...
Tourism							
Hotels	>=70	49	51	100	100	100 (east) 51 (0)	...
Catering	>=70	49	51	100	100	51 (east)	...
Tour agents	>=70	49	51	100	60	49	...
Construction	>=70	49	51	100	40	55	55

... = not available, ASEAN = Association of Southeast Asian Nations, HW = hardware.

Source: B. S. Das, J. Menon, R. Severino, and O. L. Shrestha, ed. 2013. *The ASEAN Economic Community: A Work in Progress*. Singapore: Oxford Graphic Printers.

grouping also missed this target, except Singapore, which allows 100% ownership in almost all services sectors.

For domestic competition, laws have been in place since the late 1970s to ensure fairness (Box 3.2). Indeed, Thailand was an early mover in this area among ASEAN. The Price Control and Anti-Monopoly Act 1979 was an early attempt to ensure price competition and defuse monopolies. During the boom of the 1980s and the 1990s there were concerns that the law was inadequate in dealing with the rise of monopolists and oligopolists, and needed to be revised (Kohpaiboon et al. 2010). Some 20 years after its enactment, the Thailand Trade Competition Act (TTCA) 1999 and the Price Determination Act 1999 replaced the act

to deal specifically with price-setting and fixing. The former applies to industry and services sectors, but not to agricultural goods—and, importantly, it does not apply to state-owned enterprises or government procurement.

Concerns have been raised over the TTCA almost since its inception. Although a law for fair competition was put in place, the institutional framework needed to make it effective was not. The TTCA has also been subject to political influence. Another major concern is that some sections are vague and its implementation rules are still not in place. Terms used in the law such as “unreasonable” and “without justifiable reasons” were highly subjective in defining unfair practices and market dominance that can provide grounds

Box 3.2: Testing Competition Policy: Four Key Cases in the Services Sector

The Thailand Trade Competition Act (TTCA) was enacted in 1999 to ensure adequate competition in the economy. Over the next decade, four major cases have come up for resolution under the act. They highlight the types of anticompetitive practices that are an ongoing concern in Thailand, but they also reveal the weaknesses of the act and its implementation. All four cases involve the services sector, three of them in the area of trade.

Tied whiskey-beer sales. A merger in 1986 resulted in a monopoly in the domestic liquor market by the Sang Som group (a later name). In 1994, Sang Som started using its presence in the liquor market, particularly its popular white whiskey, to force its way into the beer market, then dominated by the Singha brand. Retailers were compelled to sell Sang Som’s Chiang beer if they wanted to continue to sell its whiskey. Chiang’s share of the beer market rose from zero to 75% in 2004. The Trade Competition Commission investigated and ruled that Sang Som infringed the TTCA, but could not enforce its ruling because the government failed to define what constituted market “dominance” under article 25 of the act.

Honda’s motorcycle. Honda, a popular brand with about an 80% share of the market, threatened retailers that it would stop supplying them and open nearby rival stores if they did not become exclusive agents for Honda products. The Trade Competition Commission ruled against Honda under article 29 of the act on unfair trade practices. The case went to the Attorney General’s Office; it found that the TTCA’s procedures were not followed. But Honda discontinued the practice before a decision was delivered, and the complainants (the other motorcycle companies) dropped the suit.

Large foreign retailers and wholesale suppliers. Following the Asian crisis in 1997–1998, foreign firms increased their presence in the retail sector, notably in discount stores. These firms pursued aggressive practices with suppliers, such as charging service fees and giving favored treatment to house brands. The Trade Competition Commission investigated but did not rule on the case; instead, it published a Retail Industry Code of Ethics.

Cable television monopoly and price setting. Two firms merged in 1998 to create a single cable television company, the United Broadcasting Corporation. It raised the price on its standard package by 22.5% and did not offer a cheaper package with fewer channels. A Trade Competition Commission subcommittee ruled that the merger eliminated the often fierce competition that had existed in the industry prior to the merger. However, the Trade Competition Commission was unable to determine that the pricing was excessive, because that required an expert industry assessment. Instead, it transferred the case to the Mass Communication Organization of Thailand, later named as MCOT Public Company Limited, the state organization that at that time issued broadcasting licenses. In the end, United Broadcasting Corporation did not reduce the price on its standard cable package, but it did offer an alternative one at a lower cost.

Sources: D. Nikomborirak. 2005. Contract Design: Providing Incentives for Private Sector Participation in Infrastructure Development: The Case of Thailand. *TDR Quarterly Review*. 20 (3). pp. 3–13; A. Kohpaiboon, P. Kulthanavit, P. Vijninoparat, and N. Soonthornchawakan. 2010. Global Recession, Labour Market Adjustment and International Production Networks: Evidence from the Thai Automotive Industry. *ASEAN Economic Bulletin Special Issue*. 27 (1).

for prosecution. There are also concerns over lack of funding and inadequate human resources for administering the law, thereby making its full and effective implementation difficult. In addition, a lack of transparent procedures and inappropriate legal sanctions has affected the TTCA's usefulness.¹⁹

3.4 Infrastructure Gaps for a Modernizing Economy

Infrastructure is crucial to rapid growth and broader social inclusion. A modern, competitive economy requires systems to move people, goods, information, and energy quickly, cheaply, and continuously to all corners of the country and across borders. The need for efficient infrastructure is even more critical for a country like Thailand, which is increasingly integrated within the region and globally, and requires continued integration to grow and develop into a high-income country.

Thailand has developed transport, telecommunications, and energy infrastructure that is commensurate with its level of development since the mid-1970s. On most measures of infrastructure capacity and coverage, Thailand ranks above its less developed ASEAN counterparts, but trails behind the region's two leading economies, Singapore and Malaysia (Table 3.15). The Executive Opinion Survey of the World Economic Forum (2015) found that only 4.7% of business leaders considered inadequate infrastructure as one of the top-five most problematic factors for doing business in Thailand. These results are also consistent with investor feedback from the Thailand Investment Climate Assessment (World Bank 2008), which signaled infrastructure constraints as of little concern.

Even so, the country's overall quality of infrastructure lags behind—often considerably—Asia's high-income economies, such as the Republic of Korea and Taipei,China (Figure 3.15). Thailand ranked 71st among 140 countries in the World Economic

Forum's *Global Competitiveness Report 2015–2016* in quality of overall infrastructure, compared with the Republic of Korea (20th), Malaysia (16th), Singapore (4th), and Taipei,China (21st). Thailand's infrastructure ranking was even lower than its overall global competitiveness rank (32nd), placing between the lower-income economies in Southeast Asia and the higher-income economies in Asia. Particular concerns are telecommunications—critical for the high-tech economy that Thailand seeks to develop—and a railway sector that is rapidly losing relevance. Investment in infrastructure as a share of GDP has been falling, and is now about less than 1% (or about 4% of total government expenditure).²⁰ That said, the government recently committed itself to a massive investment program in infrastructure, notably for transport.

Thailand requires infrastructure that is high-tech, integrated, inter-modal, efficient, and inclusive. Current major infrastructure development programs aim to address regional connectivity through transport investments in economic corridors, a transport modal shift from roads to rail and water through gateway improvement, and developing an internal transport network, including a mass transit system. These will require financing of about \$66 billion, which may

Table 3.15: Basic Infrastructure in High- and Middle-Income Countries in Asia

Country	Electricity Consumption, 2012 (kWh per capita)	Telephone Lines, 2014 (per 100 people)	Improved Water Source, 2015 (% of population with access)
Middle income	1,778	10.2	91.4
Indonesia	730	11.7	87.4
Republic of Korea	10,346	59.5	97.6 ^a
Malaysia	4,345	14.6	98.2
Philippines	672	3.1	91.8
Singapore	8,690	35.5	100.0
Thailand	2,465	8.5	97.8
Viet Nam	1,272	6.0	97.6

kWh = kilowatt-hour.

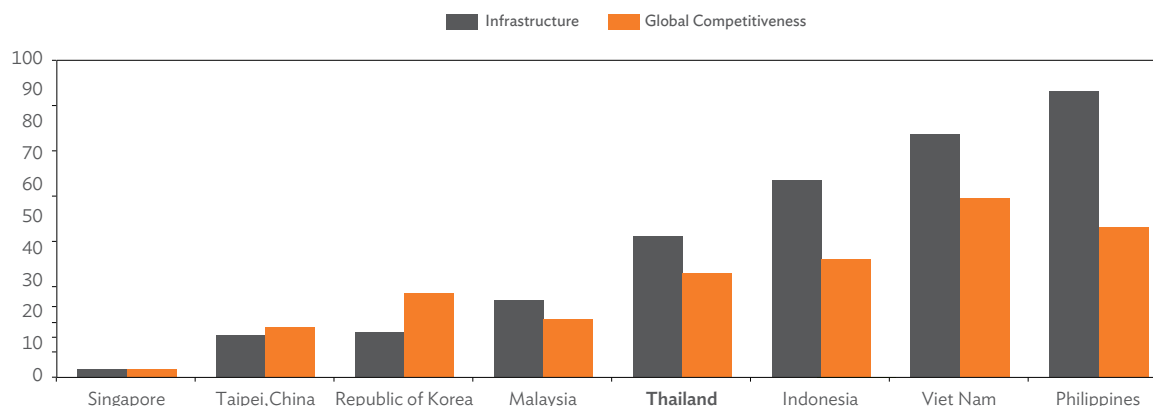
^a Latest available data.

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

¹⁹ See Nikomborirak (2005) for greater detail on the concerns expressed over the TTCA.

²⁰ Government expenditure in infrastructure (electricity, gas, water, and transport and communications) in 2014 was only B113.84 billion, about 0.89% of the country's current GDP and 4.36% of total government expenditure (ADB Statistical Database System Online [accessed October 2015]).

Figure 3.15: Infrastructure and Global Competitiveness, Selected Economies, 2015



Note: Rankings are for 144 economies. Lower ranking (closer to 1) implies better infrastructure quality and higher global competitiveness.
 Source: World Economic Forum (WEF). 2015. *The Global Competitiveness Report 2015–2016*. Geneva: WEF.

call for greater private sector participation in these programs.²¹ Improvements are required not only in hard infrastructure, but also in the soft systems that make infrastructure work and integrated—such as document processing, ticketing, and cross-border transfers—that require the latest information and communication technology.

Telecommunications

Advanced telecommunications are vital for developing an efficient and high-tech economy, allowing people and business to share information rapidly, to provide real-time logistics and supply chain management, to transact regionally and globally, and to send and share complex data. Design and innovation, both within a country and with firms abroad, are facilitated by an efficient, rapid, and high-quality telecommunications infrastructure. Asia’s high-growth, high-income countries have pushed the development of the supporting infrastructure for these services.

Thailand’s telecommunications sector has developed considerably over the past 2 decades, but much remains to be done. The population, for one thing, is not as “connected” as it might be given the country’s stage of economic development. Fixed-line

telecommunications density is quite low, at eight lines per 100 people, less than Indonesia and Malaysia, and only about a quarter of the rate for Singapore, a high-income country (Table 3.16). Mobile phone density is much higher, albeit still lower than comparator countries in the region; for example, there are 144 mobile phone subscriptions for every 100 people. Internet use, broadband internet subscribers, and the number of secure servers are all much lower in Thailand than in the Republic of Korea, Malaysia, and Singapore. In 2014, 81% of households in the Republic of Korea had computers, compared with 29% in Thailand. The share of homes with internet access was even greater in the Republic of Korea at 98% compared with 23% in Thailand (Table 3.17).

Regulatory failures that have constrained competition have hindered the development of Thailand’s telecommunications sector (Box 3.3). A “networked” service requires an adequate regulatory framework to allow competitors to link with existing infrastructure and for subscribers to reach the networks of rival companies. That framework is weak in Thailand and has kept out new players. The country introduced internet services in the mid-1990s and a plan was drawn up to expand to 3G services in the early 2000s. But this was slow off the mark and allowed less-developed countries

²¹ According to Sittipunt (2013), the \$66 billion infrastructure development program includes \$9.2 billion for road networks, \$13.4 billion for rail network, \$26 billion for high-speed trains, \$15.7 billion for mass rapid transit, \$0.9 billion for inland waterways and coastal transport, and \$0.9 billion for multimodal transport and border trade facilities.

Table 3.16: Telecommunications Indicators, Selected Economies, 2014 (per 100 people)

Economy	Telephone Lines	Mobile Cellular Subscriptions	Internet Users	Fixed Broadband Internet Subscribers	Secure Internet Servers (per 1 million people)
Republic of Korea	60	116	84	39	2,178
Singapore	36	158	82	28	822
Malaysia	15	149	68	10	89
Thailand	8	144	35	8	23
Viet Nam	6	147	48	6	12
Philippines	3	111	40	23	11
Indonesia	12	126	17	1	6

Source: World Bank. World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed September 2015).

Table 3.17: Access to Computer and Internet, Selected Economies, 2013 (% of total households)

Economy	Households with Computer	Households with Internet Access
Republic of Korea	80.6	98.1
Singapore	86.0	86.0
Malaysia	65.1	64.7
Philippines	18.7	22.9
Viet Nam	19.0	17.1
Thailand	28.7	22.7
Indonesia	15.6	5.7

Source: International Telecommunication Union (ITU). 2014. *Measuring the Information Society Report 2014*. Geneva: ITU.

in the region, notably Cambodia and the Lao People's Democratic Republic, to introduce 3G services before Thailand. More advanced countries, such as Japan, have had 3G services for more than a decade and are now moving ahead with 4G. Thailand's tardiness was the result of political and regulatory issues involving disputes about which agency had the right to sell 3G licenses. It was only in 2012 that a revised regulatory structure was finally in place to allow the sale of 3G licenses, with nine sold to the three leading operators.

More effort is needed for transport and logistics.

A renewed effort is needed to accelerate the development of Thailand's transport infrastructure and logistics industry for the country to compete effectively in global markets. The deficiencies of the transport system lie not in coverage and the extent of the network, or, for that matter, in the share of paved road. Instead, it needs to be better integrated; for example, between urban and intercity rail, and between the various systems of urban transport (urban rail and bus). The sector has enormous potential—and need—for public-private partnerships, but only

modest progress has been made in leveraging private finance. In addition, transport infrastructure has not paid enough attention to trade, transit, and transport facilitation with neighboring countries, constraining Thailand's role as a regional hub. Furthermore, the use of information and communication technology in the sector is still at an early stage.

Competitive and efficient logistics are critical to national competitiveness, especially for staying competitive in global production chains. Thailand ranked 35th among 160 countries in overall logistics competitiveness in the World Bank's 2014 Logistics Performance Index. This compares favorably with other lower-middle-income countries in the region such as Indonesia and Viet Nam, but is below Singapore and Malaysia (Table 3.18).

Thailand has the region's largest railroad network, spanning more than 4,400 kilometers (not counting Bangkok's urban transit lines). Unfortunately, rail transport has suffered from underinvestment and poor management, and was recently described as "aging and decrepit" (ADB 2011). The railway's share

Box 3.3: Competition in Telecommunications

Thailand's telecommunications market was controlled for many years by two state monopolies: the Telephone Organization of Thailand (TOT), which controlled domestic fixed-line services, and the Communications Authority of Thailand (CAT), which controlled the international phone gateway. In the 1990s, an effort was made to instill greater competition to inject needed private investment into the sector. Competition has increased in some telecommunications subsectors, but is nevertheless constrained by powerful state enterprises operating in telecommunications. TOT was corporatized in the early 2000s with a plan for privatization, but this plan was abandoned following the coup of 2006.

In the fixed-line market, concessions were offered to private operations with a distinction made between the Bangkok area and the rest of the country. There is one private operator in each area, but they both compete with TOT, which operates in both areas, resulting in two duopolies. Bangkok has seen increased competition, as TOT has lost market share to private operator Telecom Asia. Today, each firm's share of subscribers is more or less equal. As a result, the Herfindahl-Hirschman index (HHI) fell in that market segment from 2003 to 2010 (Nikomborirak and Rueanthip 2011).^a

The rural market, on the other hand, shows the opposite trend, with TOT gaining a larger market share at the expense of Thai Telephone and Telecommunication, a private operator that lacked capital for increased investment. The HHI rose in that market segment as a result.^b New licenses were issued by the National Telecommunications Commission, but these have not resulted in additional fixed-line services because tariffs are fixed at a very low level, making new investment less profitable.

The mobile telephone market, composed entirely of private firms, is now more competitive, with six players as of early 2011. But of these, three account for 98% of subscribers. Competition expanded from 2001 with the entry of TRUE, which increased the number of large competitors from two to three.^c

The difficulties of the telecommunications market go somewhat beyond the figures, and indicate the difficulty of entering the market. The case of Hutch (Hutchinson Whampoa Group of Hong Kong, China) highlights this concern. Hutch was granted a "marketing contract" (not a concession) with CAT and secured a valued 3G license in 2005. But Hutch had difficulty resolving interconnection difficulties with TRUE, a much larger operator. Hutch eventually gave up and sold out and CAT made the unprecedented move of handing over Hutch's operation to TRUE, including the valuable 3G license—and doing so without a competitive bid. At the time, the sale of 3G licenses was being held up by a regulatory dispute and the license provided a big bonus to TRUE, which gained an unfair advantage over rivals and other firms that might have wanted to enter the sector.

As noted, the auction of 3G services to Thailand was much delayed, with other lower-income countries in the region moving more quickly in establishing 3G services. The auction itself was criticized for not being competitive. The National Broadcasting and Telecommunications Commission sold nine licenses to three major players at or very close to the minimum auction price, which was considerably below market value and what bidders might have been willing to pay.^d

^a From 5,137 to 5,047.

^b HHI rose from 5,100 to over 6,100.

^c HHI fell from a peak of 5,421 in 2001 to 3,373 in 2010.

^d AFP. 2012. Thailand raises \$1.4 bln in 3G mobile auction. *Bangkok Post*. 17 October. <http://www.bangkokpost.com/tech/world-updates/317371/thailand-raises-1-4-bln-in-3g-mobile-auction>

Source: ADB Study Team.

Table 3.18: Logistics Performance Index Rankings, Selected Economies, 2014

Economy	Rank	Overall LPI	Customs	Infrastructure	International Shipments	Logistics Competence	Tracking and Tracing	Timeliness
Singapore	5	4.00	4.01	4.28	3.70	3.97	3.90	4.25
Malaysia	25	3.59	3.37	3.56	3.64	3.47	3.58	3.92
Thailand	35	3.43	3.21	3.40	3.30	3.29	3.45	3.96
Viet Nam	48	3.15	2.81	3.11	3.22	3.09	3.19	3.49
Indonesia	53	3.08	2.87	2.92	2.87	3.21	3.11	3.53

LPI = Logistics Performance Index.

Note: 5 = highest; 1 = lowest.

Source: World Bank. Logistics Performance Index. <http://lpi.worldbank.org/> (accessed September 2015).

of the freight market fell from 9.0% in 2000 to 2.5% currently, with an inter-modal balance shift to road haulage. Indeed, the poor condition of the railways means more heavy goods being transported by road, resulting in considerable road damage. The poor record of the rail system, the shift to road, and other factors have resulted in the cost of inland transport being considerably higher in Thailand than in other countries. The cost of moving goods to port is some 60% of the overall shipping cost, about twice the share for the PRC and Malaysia.

Urban motor vehicle transport is a particular concern, causing costly delays for people and business, notably in Bangkok. The environment has also suffered from a dependence on fossil fuels in vehicle traffic. Thailand had 13 million registered passenger cars and 20 million registered motorcycles as of 2013. Road passenger-kilometer was 677.8 billion in 2013, while freight-kilometer was 183.9 million. Traffic accidents totaled 61,000 in 2013, causing more than 7,000 deaths and almost 20,000 injuries (ADB 2011 and ASEAN–Japan Transport Partnership, AJTP Information Center)

Thailand has 17 ports, the largest being Laem Chabang in eastern Thailand, on the Gulf of Thailand, with a total peak throughput of about 4.5 million twenty-foot equivalent units. It is the fourth busiest port in ASEAN after Singapore and two in Malaysia. The country's other major ports are also in the Gulf of Thailand, but no major ports are on the western coast between Myanmar and Malaysia, denying a vital trade route to the Andaman Sea, Bay of Bengal, and the Indian subcontinent. Once completed, the planned construction of a large deep sea port and industrial zone at Dawei in Myanmar should improve the situation. The joint project of the two governments will be supported by a highway connecting the Dawei port to Bangkok and the Central region. The new port will relieve westbound ships from routing around the Malay Peninsula.

Import and export processes are relatively easy in Thailand, with a maximum 14 days required for the entire process, an improvement of 10 days from 2006 (Table 3.19). While existing ports can handle current

shipment levels, the costs are considerably higher than in major nearby ports in other countries. The export cost to ship a container from Thailand is more than 13% and 29% higher than from ports in Malaysia and Singapore, respectively (Figure 3.16).²²

The difference for import costs is even greater—at 25% higher compared with Malaysia, and 73% for Singapore (Figure 3.17). Indeed, import costs

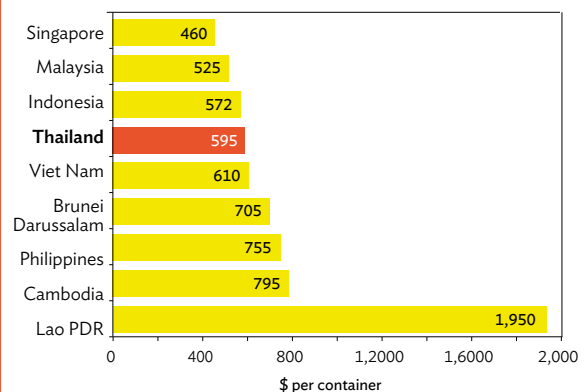
Table 3.19: Days to Export and Import in Thailand, Trading across Borders, 2006–2015

Year	Time to Export (days)	Time to Import (days)
2006	24	22
2007	24	22
2008	17	14
2009	14	13
2010	14	13
2011	14	13
2012	14	13
2013	14	13
2014	14	13
2015	14	13

Note: Time to export and import (days) include obtaining, filling out and submitting all the documents, inland transport and handling, customs clearance and inspection, and port and terminal handling; it does not include sea transport time.

Source: World Bank. 2014. *Doing Business 2015. Going Beyond Efficiency*. Washington, DC: World Bank.

Figure 3.16: Cost to Export, Selected Economies, 2014



Lao PDR = Lao People's Democratic Republic.

Source: World Bank. 2014. *Doing Business 2015. Going Beyond Efficiency*. Washington, DC: World Bank.

²² The cost in Thailand is associated with all procedures required to import or export goods. This includes document and administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges, and inland transport.

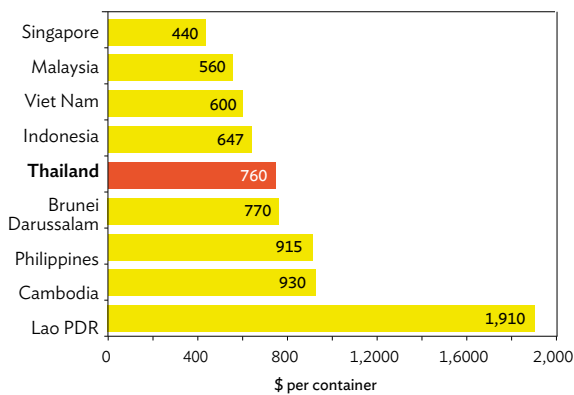
in Thailand are the fifth highest in Asia, lower only than Brunei Darussalam, the Philippines, Cambodia and landlocked Lao People’s Democratic Republic. High inland transport and handling costs drive up export costs, while more than a third of import costs come from customs clearance and technical control processes (World Bank 2014).

Expanding Thailand’s port system could help develop Laem Chabang further, as it has many of the required

advantages, such as connection to major markets and land transport routes, supportive industrial complexes, and feeder networks for transshipment. The port benefits from favorable weather conditions (limited exposure to fog and typhoons), resulting in fewer closure days. It also has service advantages from investments in information and communication technology used at the port. Indeed, Laem Chabang has sought to modernize through the e-port project, which includes the Automatic Ship Identification System, Container Traffic Management System, and Economic Value Management System (ADB 2011), all of which are designed to improve traffic management and speed up loading coordination.

As well as higher export and import costs, Thailand’s global shipping networks do not compare well with its neighboring economies, with its Liner Shipping Connectivity Index ranking much lower than the Republic of Korea, Malaysia, and Singapore (Figure 3.18).

Figure 3.17: Cost to Import, Selected Economies, 2014

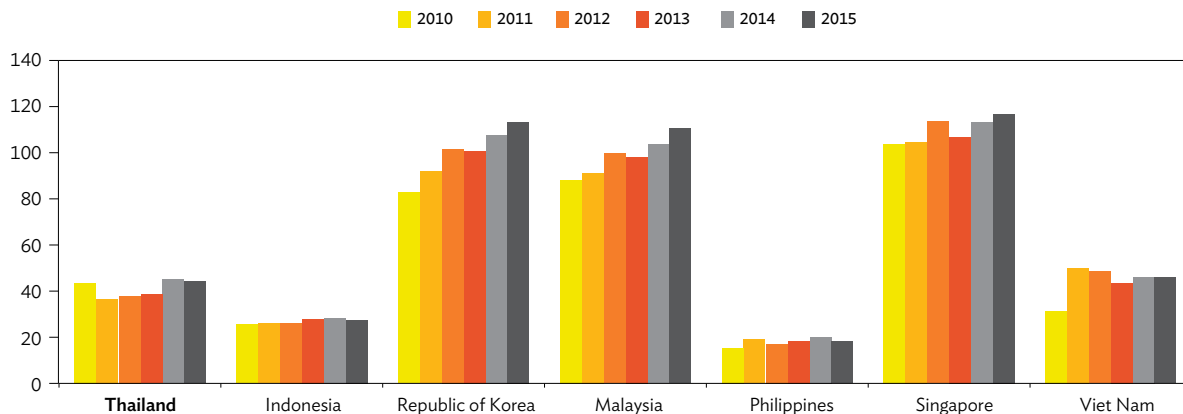


Lao PDR = Lao People’s Democratic Republic.
 Source: World Bank 2014. *Doing Business 2015. Going Beyond Efficiency.* Washington, DC: World Bank.

3.5 Small and Medium-Sized Enterprises and the Missing Middle

As Thailand seeks to take that important step from an upper-middle to a high-income economy, it is

Figure 3.18: Liner Shipping Connectivity Index, 2010–2015



Note: The Liner Shipping Connectivity Index captures how well countries are connected to global shipping networks. It is computed by the United Nations Conference on Trade and Development (UNCTAD) based on five components of vessel size, number of services, and number of companies that deploy container ships in a country’s port. For each component, a country’s value is divided by the maximum value of each component in 2004, the five components are averaged for each country, and the average is divided by the maximum average for 2004 and multiplied by 100. The index generates a value of 100 for the country with the highest average index in 2004. The underlying data come from Containerisation International Online.
 Source: UNCTAD. UNCTADSTAT. <http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=92> (accessed October 2015).

necessary not only that the larger firms make the transition in innovation and technology, but also small and medium-sized enterprises (SMEs). Thailand has a high density of SMEs, but they are concentrated in the “small” category, with a much thinner layer of medium-sized enterprises. Building a more solid stratum of medium-sized firms is important for deepening and thickening the private sector. Furthermore, the small firms that are large in number need to be built up and strengthened in their share of production as well.

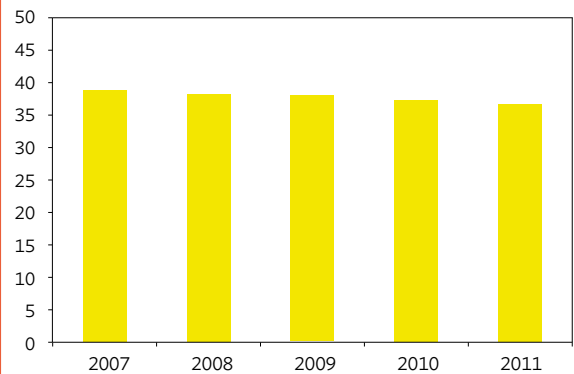
In numbers, SMEs are the dominant enterprise size category, accounting for all but about 1% of enterprises in Thailand. The most recent available figures from 2008 suggest that there are only 4,158 larger enterprises; medium-sized firms are relatively few as well, numbering 12,073 (OECD 2011). The remaining 99.3% of enterprises are classified as small and there are 2.8 million of them.

However, SMEs’ contribution to output and employment is much weaker relative to their huge numbers, accounting for just over 36% of GDP in 2011 (Figure 3.19). This was less than large enterprises (46%), but more than agricultural enterprises (13%) and other enterprise forms (5%). The SME share of output has also fallen marginally—but persistently—in recent years, from 39% in 2007. Sector breakdown of SME output are as shown in Figure 3.20.

SMEs are an important employer and therefore critical for inclusive growth. Some 65% of enterprise-based employment occurs in small enterprises with medium-sized firms making up an additional 11.6%. That leaves large firms with only 23% of employment.

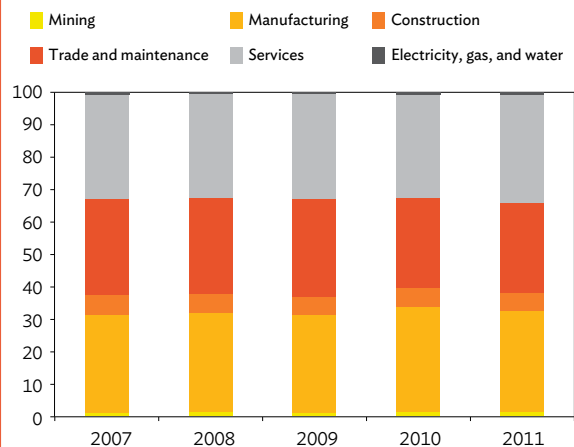
Thailand has a “missing middle” in its enterprise size distribution, although this is not unique and occurs in many other developing countries (Entrepreneurial Finance Lab Research Initiative, Center for International Development at Harvard University). As earlier noted, the country has many SMEs, but a stratum of medium-sized firms is neither large in number nor significant in output and employment. Because these companies tend to be domestically owned, the absence of a thick “middle” says something about the vibrancy of the country’s entrepreneurial class, especially when the larger firms tend to be dominated by foreigners,

Figure 3.19: Small and Medium-Sized Enterprises’ Share of GDP, 2007–2011 (%)



GDP = gross domestic product.
Source: Organisation for Economic Co-operation and Development (OECD). 2011. *OECD Studies on SMEs and Entrepreneurship: Thailand Key Issues and Policies*. Paris: OECD Publishing.

Figure 3.20: Sector Breakdown of Small and Medium-Sized Enterprises’ Output, 2007–2011 (%)



Source: Organisation for Economic Co-operation and Development (OECD). 2011. *OECD Studies on SMEs and Entrepreneurship: Thailand Key Issues and Policies*. Paris: OECD Publishing.

state enterprises, and domestic oligopolies that have benefited, to a greater or lesser extent, from barriers to entry and concessions from the government.

While comparative cross-country data are often difficult to obtain, the most recent figures suggest that the more advanced countries in Asia and elsewhere

have a much thicker stratum of medium-sized firms. In Thailand, only 0.4% of firms are medium-sized, which is slightly below the shares for comparable middle-income countries such as Turkey (0.5%) and Mexico (0.6%). By contrast, 6.4% of firms in the Republic of Korea are medium-sized, 10.2% in Japan, 2.4% in Germany, and 2.0% in the United States (OECD 2011).

A variety of factors cause a missing middle and one of the common major constraints is limited access to finance. Medium-sized firms—and small firms seeking to become medium-sized firms—find it difficult to secure the financing needed to grow. Micro firms, by contrast, often have access to microfinance and larger firms of course have a variety of finance options.

SMEs face difficulties in accessing financing because of (i) lack of proper accounting systems to demonstrate financial performance; (ii) inability to put together credible investment proposals; (iii) lack of collateral assets or institutions that support the registry or disposal of collateral; and (iv) the small size of loans requested, which makes risk assessment by the bank more costly.

The various institutions established by governments that seek to overcome or underwrite the cost of these barriers to finance include credit guarantees, specialized SME banks, policy direction, collateral registries, and financial regulations. But these may be inadequate for the task, including in Thailand, where the many mechanisms in place are insufficient to meet the broad demand for access to finance from SMEs.

Credit is an important aspect of finance, but it is not the only one. As firms grow to and through the medium-size stage, and seek to become large firms, equity financing becomes critical. Thus, an economy requires mechanisms for accessing private equity investment, including through business angels and venture capital, and then, ultimately, sourcing finance publicly through stock markets. Thailand has these non-credit financing mechanisms in place. But the extent to which they support high-growth, innovative firms, and can help to fill the missing middle, appears to be limited.

Micro, small, and medium-sized enterprises also lack technological capacity due to insufficient R&D spending, limited access to technology, and talent shortages. The Industrial Technology Assistance Program is designed to support technology development and the capacity of SMEs in the manufacturing sector. With technical support from nine universities and related institutes, the program provides grants to pay 100% of the cost of technical problem diagnosis and 50% of fees for exports and consultants, along with other expenses, such as testing fees, materials, and equipment, subject to a ceiling of B500,000 per project. However, the scope and funding size of the program is too small to deliver effective outcomes.

Chapter 4

Policy Recommendations: Addressing the Challenges

This report has identified the following five areas where Thailand needs to invest more to make the successful transition to an innovative, high-value, high-tech economy:

- (i) R&D and international technology transfers;
- (ii) education quality and skills mismatch;
- (iii) competition in the services sector;
- (iv) transport and logistics infrastructure for a modernizing economy; and
- (v) the missing middle in the business sector.

It should be noted that these challenges are highly interrelated and mutually reinforcing. For example, moving up the technological ladder and encouraging greater innovation requires a more skilled workforce and more efficient infrastructure. This section summarizes the policy suggestions to improve competitiveness, generate higher returns from economic activity, and seek more regionally balanced growth and development.

4.1 Closing the Technology Gap

The emphasis on innovation and building productive capabilities is the basis for a successful transition to a modern industrialized economy. Thailand needs to move into the higher-value segments of global production networks, build stronger strategic linkages with foreign firms, and raise innovation in domestic firms to lift its growth potential and create decent jobs.

- **Raise R&D spending.** As a share of GDP, from 0.25% currently to 0.75% by 2015 and further to 1.0% by 2020 and 1.5% by 2025. Target a gradual increase in private sector share of such spending, from 40%–45% currently to 80% by 2025. Increasing public procurement from high-tech industries may positively influence private sector R&D (Box 4.1).
- **Facilitate technology transfer through FDI.** Encourage more foreign firms to establish innovation, design, and testing centers and activities in Thailand, and expand the scope of companies that already have them. This will require pursuing greater openness to FDI, deepening trade integration, creating world-class infrastructure, and developing a highly skilled and educated workforce.
- **Provide support for science and technology research.** Especially at universities and institutes of higher learning, provide incentives for research that closely allies with the private sector and emphasizes the commercialization of this research. Public universities, in collaboration with the private sector, can play a stronger role in initiating applied research programs to foster innovation. Science and technology policy should target, in particular, activities with the greatest public externalities rather than those that benefit only individual firms.

Box 4.1: Encouraging Research and Development through Public Procurement

To increase private sector research and development (R&D) expenditure, government could increase procurement from high-tech industries, which increases the rewards for innovation, thereby stimulating private sector R&D and inducing individuals to acquire more technical skills.

A recent study by Slavtchev and Wiederhold (2012) demonstrates how the technological intensity of government procurement (that is, the technological content of the goods and services bought by government) affected innovative behavior in the corporate sector in 1997–2009. Their indicator for the technological content of government procurement is the share of federal non-R&D procurement in high-tech industries to total federal non-R&D procurement in a state and year. They use this rather than federal procurement of R&D because they want to measure the effect of demand created by government procurement on R&D decisions of private firms, rather than capturing the R&D of firms done on order from the government.

Expected profits for successful innovators in high-tech industries rise when government procures more from such industries. Because of diminishing marginal productivity in the R&D sector, and after the increased technological intensity of government purchases, a greater research effort is needed by firms in the private sector to innovate. The study finds that public procurement can indeed be used as a tool for innovation. Increasing the share of public procurement in high-tech industries stimulates private sector R&D economy-wide. In fact, a one-standard deviation increase in the share of federal government procurement in high-tech industries is associated with an increase of about 81,000 weekly working hours in R&D occupations in the private sector, an amount equivalent to 1,800 full-time R&D workers.

Source: V. Slavtchev and S. Wiederhold. 2012. Technological Intensity of Government Demand and Innovation. *IFO Working Papers*. No. 135. Munich: Institute for Economic Research, University of Munich.

- **Streamline the lengthy patent approval process and improve the enforcement of intellectual property rights.** The latter is currently enshrined in seven different laws, which has created a more secure legal environment for innovation and the ability to reap the rewards of research. But more needs to be done to enhance foreign investors' perception of the intellectual property rights regime and the security of intellectual property transferred to and initiated in Thailand.
- **Support innovative start-ups and successful SMEs.** Notably those in high-tech sectors, through fiscal incentives and assistance in attracting venture capital and equity finance. But there has to be an element of competition in any schemes of policy incentives and support to start-ups and SMEs.
- **Provide a platform of information sharing and collaboration between government and domestic firms in key subsectors dominated by foreign firms, such as automobiles and electronics.** This can help generate and share information on the quality, technology, and delivery standards of parts and components in these sectors. The aim is to increase the capacity of domestic firms to act as Tier 1 suppliers in Thailand and export to finished goods assemblers in other countries.
- **Raise education expenditure to at least 5% of GDP and review the education budget for its efficiency.** It is important to ensure that

4.2 Upgrading Skills, Managing the Workforce

Upgrading productive capabilities requires an educated and skilled workforce. This is needed to attract and support foreign investment in high-tech segments of regional and global value chains, as well as for domestic firms in industry, services, and even agriculture. The quality of education determines the quality of a workforce—and improving the latter requires upgrading the former.

increased funding leads to improved learning outcomes. This requires a careful assessment of the current education budget and making more balanced allocation of education budgets between basic education and high and technical education. For example, TVET and university education may be underfunded given their spending needs for upgrading facilities and training equipment. Overall, education planning should be better aligned with national economic and investment planning. Ensure the even distribution of expenditure across regions and consider “affirmation expenditure action” for areas where spending has historically been particularly lacking.

- **Raise teacher salaries.** This is needed to attract well-qualified people into teaching and to retain them, and as an incentive to high quality teaching. Continue with efforts to improve teacher training both for aspiring teachers and through in-service training.
- **Improve the link between tertiary education and industry.** Support and strengthen recent initiatives by the Commission for Higher Education to increase the industry relevance of higher-level education. Encourage public universities to develop applied research programs jointly with industry. Also encourage industry representation and involvement with training institutions through advisory panels, sector skills councils, and related arrangements. Engage industry in setting national skills competency standards.
- **Increase the quality of research undertaken by universities.** This is needed to further motivate firms to engage in collaborative research. Revisit the structure of promotion and tenure of university faculty as part of a linked process to produce quality research (and noting that research is often funded through grants). This would reduce the tendency for individual researchers to engage in narrow, direct consultancies with firms.
- **Increase the availability of and access to high-level vocational education and training.** In doing so, ensure that course types and content are more practical and systematically aligned with the evolving needs of industry. This would

require improving the teaching techniques and strengthening the link between education and jobs. Put in place the institutional mechanism to allow students to move easily between vocational and academic/professional tracks in the education system.

- **Improve the quality of teaching in math and science at secondary schools.** This is needed to strengthen the foundations for learning in higher education.
- **Monitor education outcomes by district, and target underperforming areas and specific institutions.** Determine whether it is the quality of teaching, administration, or other factors that are limiting outcomes. Encourage greater parent involvement in the management of schools through school councils to help with the recruitment, selection, and the retention of quality teachers.

4.3 Fostering Competition in Services

Fostering competition in service areas can contribute to overall productivity growth and productive employment generation. As an economy grows and income per capita rises, the share of services in national output increases. The employment potential of high-skill services is even greater. Therefore, higher productivity in the services sector will boost economic growth and employment generation.

- **Allow greater competition in the services sectors.** This could be done by reducing restrictions on foreign investment in key subsectors. Also, monitor the concentration of ownership structure of major services sectors to ensure adequate competition. Problems of anti-competitive behavior tend to be high in sectors dominated by Thai conglomerates rather than foreign companies, such as in manufacturing.
- **Level the playing field between private and state-owned enterprises, and ensure the latter do not have unfair advantages.** Areas to address include access to government-controlled

resources, permits, and so on. Continue efforts to reform state-owned enterprises, including large firms in utilities and services sectors.

- **Review the implementation of the Thailand Trade Competition Act.** Ensure there is adequate legal infrastructure to carry out the act, that the Trade Competition Commission is more independent of and shielded from political influence, and that penalties under the act are a deterrent.
- **Improve investor protection and extent of disclosure.** This is needed to make the investment process more transparent and thus increase investment in publicly traded firms.

4.4 Creating Integrated Networks for Moving Goods, People, and Information

In March 2015, the government approved an 8-year investment plan amounting to B1.9 trillion (\$53 billion)²³ to upgrade the country's major transport systems and reduce logistics costs. Improvements in transport and other infrastructure can support a more even distribution of industry across the country, thus raising the income level of non-Central regions.

- **Plan and structure infrastructure investment to ensure inter-modal connectivity.** This is needed for better movement of both people and goods. Ensure the development of the required information and communication technology infrastructure to facilitate the efficient, low-cost movement of data and information, and the application of information and communication technologies throughout business and society.
- **Facilitate the greater use of public-private partnerships.** This is needed in investments in transport as well as other sectors to meet increased funding needs. While PPP represents one of many promising channels for shoring up funding for infrastructure, developing a successful PPP program is a considerable challenge and

entails a number of important tasks for developing countries. At the very basic level, they need to ensure that PPP projects are integrated into the national development strategy to underpin investor confidence. Adequate legal and regulatory frameworks must be in place to provide investor protection with clear obligations for all parties involved in the PPP projects. Also ensure that procedures and approaches are clear and streamlined and build a base of successful PPPs.

- **Reduce the heavy tariff subsidization of rail passengers.** This is needed to ensure that funds for investment in and maintenance of railways are adequate, and the financial viability of the State Railway of Thailand is improved.
- **Formulate a railway transport policy to guide reform and the future direction of the railway's consolidation and development.** A time-bound implementation plan for reforming the railways is also needed.
- **Ensure the financial viability of the State Railway of Thailand.** Debt relief is needed to reduce the burden on the company's finances. Its pension obligations must be more effectively managed by the government. A separation of infrastructure from operations would be helpful; this would require a new infrastructure organization, either within the Ministry of Transport or as a separate entity.
- **Finalize and implement the infrastructure master plan and provide implementation guidelines.**
- **Capitalize on the opening up of Thailand through the development of infrastructure links.** This should include an effective connection of the Thailand components of the east-west and north-south highway and rail corridors within the Greater Mekong Subregion. Improve connectivity at border points to allow for easy and low-cost movement of goods and people in and out of the country and within the region.

²³ Estimated based on the foreign exchange rate of \$1.00 = B35.81.

4.5 Promoting Regionally Balanced and Inclusive Growth

Thailand needs to spread investment and development throughout the country. Development is currently concentrated in the central areas in and around Bangkok and the industrial areas to the southeast near the port of Laem Chabang. Thailand's other regions have higher levels of poverty, lower levels of private and public investment, and less access to decent nonfarm employment. Figures on national output and income per capita mask the substantial differences between regions. These regional disparities are a brake on growth and cause political tension, and they are best addressed through a balanced public investment and policy.

- **Ensure regionally balanced allocation of public expenditure for, among other things, education, health, infrastructure, and municipal services.** In addition, provide affirmative action to make up for lower spending in the past where needed. Poverty, location, gender, ethnicity, and other accidents of birth should not be determinants of access to quality basic services.
- **Improve the quality of secondary education in non-Central regions.** This will improve the employability of students from these regions and their chances of obtaining access to higher education.
- **Improve access to finance and technology to micro, small, and medium-sized enterprises and the socially excluded.** Accelerate finance sector development and continue reforms for financial deregulation and liberalization. Further improve financial inclusion for rural households by exploring the use of new technology and innovative approaches such as mobile banking technology. Explore microfinance lending schemes, including associations, community and village banking, and cooperatives to broaden the reach of microcredit facilities.

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Thailand: Industrialization and Economic Catch-Up

Thailand's economic and social transformation of the last 50 years has placed it in the ranks of upper-middle-income countries and made it an integral part of global value chains. It has also established itself as a regional hub for key transport and logistics, with a world-class airport. Yet, growth has concentrated on greater Bangkok. As wages rise, productivity needs to keep pace for the economy to stay competitive. While it has diversified its economic base into tourism, health care, and other services, the bulk of the workforce remains in low-productivity activities—with the agriculture sector still employing almost 40% of workers. To continue its rise, therefore, Thailand needs to move into the higher-value segments of economic activity and create high-quality jobs that are regionally broader based. This report identifies the major constraints to accomplishing these goals and analyzes the main challenges. Among them, the country must (i) enhance research and development and international technology transfers; (ii) elevate worker skills and their industrial relevance; (iii) address structural impediments to competition, notably in services; (iv) provide advanced transport and logistics infrastructure; and (v) improve access to finance and technology for micro, small, and medium-sized enterprises.

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