

Thailand Science Technology and Innovation Profile



2014

COMPETITIVENESS
STI BUDGET
R&D
S&T PERSONNEL
TECHNOLOGY BALANCE OF PAYMENTS
PATENTS
S&T PUBLICATIONS
ICT

FOREWORD



Science, technology and innovation (STI) are key drivers of sustainable economic growth and social development. STI indicators are important tools to measure the progress and competitiveness of Thailand in various aspects. As a secretariat of the National Committee on STI indicators, the National Science Technology and Innovation Policy Office has published “Thailand Science Technology and Innovation Profile” annually to raise public awareness on the progress of STI development.

This book comprises of eight chapters of STI indicators including competitiveness, STI budget, research and development (R&D), STI manpower, technology balance of payments, patents, science and technology publications, and information and communication technology.

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Technology and Innovation

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CHAPTER 8 Information and Communication
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Chapter 1

COMPETITIVENESS IN SCIENCE, TECHNOLOGY AND INNOVATION

Competitiveness is usually measured as a composite index and mainly used for comparing potentials and capabilities of countries. At present, several leading institutions issue reports on country competitiveness e.g. IMD and WEF

Competitiveness Ranking by IMD

In the World Competitiveness Yearbooks, International Institute for Management Development (IMD) reported the competitiveness ranking of countries in Asia and the Pacific during 2012-2013 as follows:

Rank in 2012		Rank in 2013
1	Hong Kong ↓	3
4	Singapore ↓	5
7	Taiwan ↓	11
14	Malaysia ↓	15
22	South Korea	22
23	China ↑	19
27	Japan ↑	24
30	Thailand ↑	27
43	Philippines ↑	38

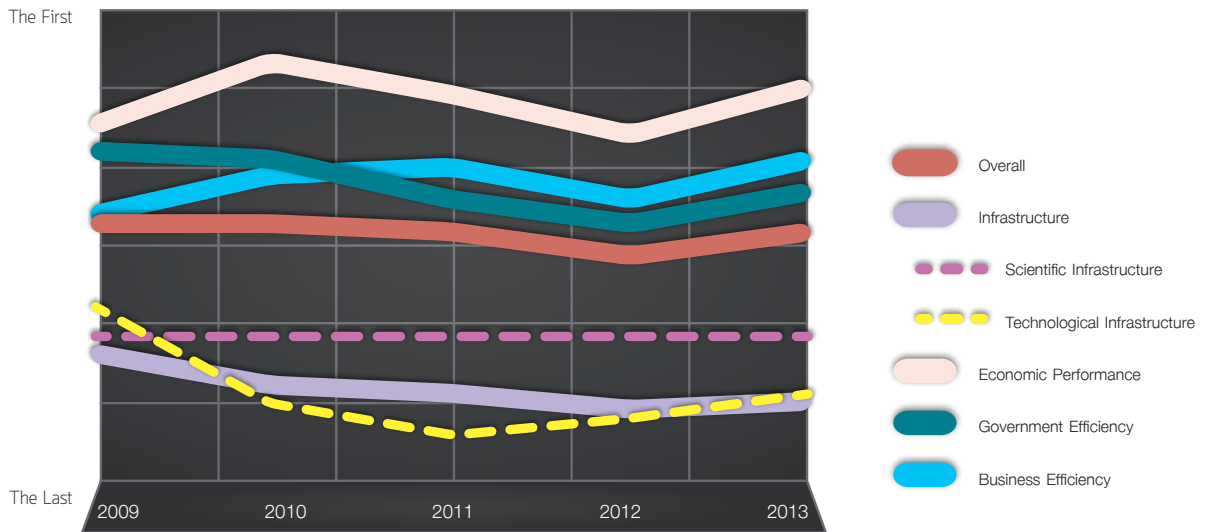
- Most Asian countries slightly decreased in rankings.
- China, Japan, the Philippines and Indonesia increase in rankings.
- South Korea remained at 22nd.
- Taiwan dropped in the ranking by 4 spots.
- Competitiveness ranking of Thailand increased to the 27th, from the 30th in 2012.

IMD

IMD is a non-profit business and management institution, located in Lausanne, Switzerland. It issues research on competitiveness ranking of countries since 1989. In 2013, there are 60 countries participated in IMD ranking.

Competitiveness Ranking of Thailand by IMD 2009-2013

Competitiveness ranking of Thailand by IMD during 2009-2013



Source: IMD, World Competitiveness Yearbook 2009-2013

Key improving and Declining indicators between 2012-2013

Scientific Infrastructure Criteria

Improving indicator

- Number of domestic filing patent per capita increased to the 48th from the 53th in 2012.

Declining indicators

- Number of domestic patent filing decreased to the 39th from the 33th in 2012.
- Standard of scientific research decreased to the 44th from the 38th in 2012.

Technological Infrastructure Criteria

Improving indicators

- Fixed telephone tariffs increased to the 36th from the 56th in 2012.
- Number of mobile phone users per 1,000 population increased to the 37th from the 44th in 2012.

Declining indicators

- Service rate of high-speed internet decreased to the 21th from the 16th in 2012.
- Ratio of high tech and industrial exported goods decreased to the 14th from the 11th in 2012.

Competitiveness Ranking by WEF

Competitiveness of a nation may reflect the level of development. In the Global Competitiveness Reports, published by World Economic Forum (WEF) the Global Competitiveness Index (GCI) demonstrates that highly developed countries with high per capita income tend to have high level of competitiveness.

WEF

WEF is a non-profit organization located in Geneva, Switzerland. Annually, WEF organizes the meeting in Davos to announce the country competitiveness ranking based on GCI. The 2013-2014 WEF Annual Report provides the ranking of 148 countries.

Thailand in Global Competitiveness Index



GCI composes of 3 sub-indices, including Basic Requirements, Efficiency Enhancer and Innovation and Sophistication factors. These sub-indices are calculated using several factors. The key STI factors include Technological Readiness and Innovation.

Basic Requirements sub-index:	
Efficiency Enhancer sub-index:	Technological Readiness
Innovation and Sophistication Factors sub-index:	Innovation

RANKING

2012-2013	2013-2014
45	49
47	40
84	78
55	52
68	66

The Innovation and Sophistication factors remained the weakness for Thailand although the overall ranking has risen 3 spots between 2012-2013 and 2013-2014.

For Thailand, certain factors are in low ranking among 148 countries.

- Share of internet user in the population

1st Iceland
internet user
96%



97th Thailand
internet user
26.5%



- Innovation performance

1st Switzerland
score 8.54



81st



81st Thailand
score 3.36

Innovativeness Ranking by Cornell University / INSEAD / WIPO

Cornell University, Institut Europeen d' Administration des Affaires (INSEAD) and World Intellectual Property Organization (WIPO) have developed and published the **Global Innovation Index (GII)** since 2007. The 2013 report presents the ranking of 142 countries / economies. The following table shows the ranking of Thailand during 2011-2013.

	2011	2012	2013
Global Innovation Index (GII)	48	57	57
Innovation Efficiency Ratio	56	61	76
Innovation Input sub-index	48	59	57
Innovation Output sub-index	46	56	61

Source: The Global Innovation Index 2011-2013

The **GII** is calculated as the simple average of its Input and Output sub-indices:

1 **Innovation Input sub-index** captures 5 elements of the national economy that enable innovative activities including (1) institution, (2) human capital and research, (3) infrastructure, (4) market sophistication, and (5) business sophistication.

2 **Innovation Output sub-index** are the results of innovative activities within the economy comprising of (1) knowledge and technology outputs and (2) creative outputs.

In addition, the **Innovation Efficiency Ratio** is calculated as the ratio of the Output over the Input sub-indices. The ratio demonstrates how much innovation inputs of a given country can generate its outputs.

Thailand's GI snapshot amount 142 countries

Factors that still did not support creation and development of innovation:

- Regulatory environment
ranked 121st
- Political environment
ranked 94st
- Creative outputs: Intangible assets
ranked 95st
- Online creativity
ranked 81st

Factors that Thailand ranked relatively well :

- Market sophistication
ranked 37st
- Human capital and research **ranked 46th**, moving up from 101st due to the improvement of tertiary education and R&D factor

Conclusion

Low investment of science, technology and innovation (STI) in Thailand, especially research and development, has resulted in the low STI rankings by IMD, WEF and Cornell University-INSEAD-WIPO. To improve the overall competitiveness, Thailand's STI needs to be upgraded.

Chapter 2

SCIENCE, TECHNOLOGY AND INNOVATION BUDGET

STI budget allocation is strategy important for the building of National Competitiveness in long term STI budget statistics therefore, are key indicators for monitoring and evaluating STI development.

Definition of Science, Technology and Innovation Budget



Remarks: R&D = Research and Development; STET = Scientific and Technological Education and Training
STS = Scientific and Technological Services; STA = Scientific and Technological Activities

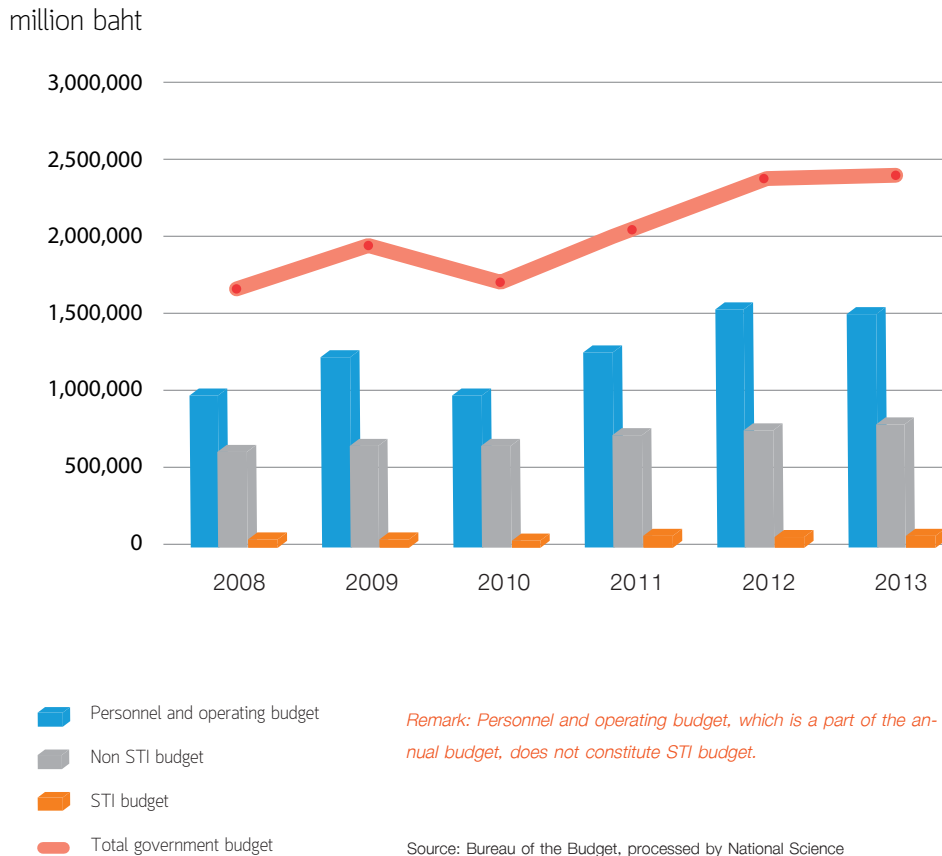
Sources: 1. United Nations Educational, Scientific and Cultural Organization: UNESCO
2. Organisation for Economic Co-operation and Development: OECD

United Nations Educational, Scientific and Cultural Organization (UNESCO) defines the term Scientific and Technological Activities (STA) as follows

“ All systematic activities which are closely concerned with the generation, advancement, dissemination, and application of scientific and technical knowledge in all fields of science and technology, that is the natural sciences, engineering and technology, the medical and the agricultural science (NS), as well as the social sciences and humanities (SSH). ”

Science, Technology and Innovation Budget Allocation

Structure of government budget allocation in 2008-2013



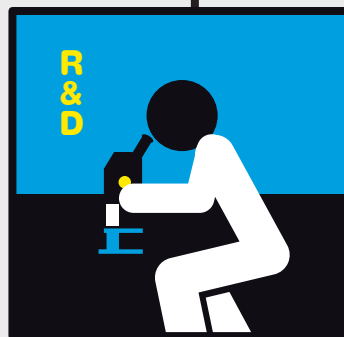
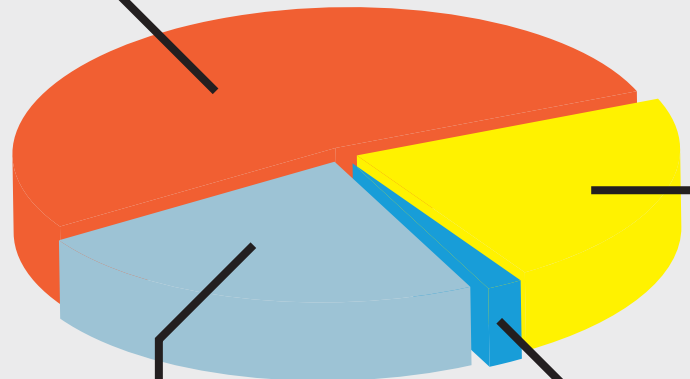
The structure of government budget allocation during 2008-2013 showed that 95 percent of the annual budget was personnel and operating budget and non-STI budget. The STI budget has been constant at 3 percent of the total budget each year.

STI Budget Classified by Types of STI Activities in 2013

Based on UNESCO and OECD definitions, The highest share of STI budget is scientific and technological education and training (53 percent). The share of research and development budget and scientific and technological services (STS) budget are quite comparable around 23 and 22 percents respectively, while the share of innovation budget is rather small (2 percent).

Percentage of STI budget classified by types of activities
(defined by UNESCO and OECD) in 2013

53% Scientific and Technological
Education and Training (STET)



23% Research and Development
(R&D)

22% Scientific and Technological Services (STS)



2% Innovation



Conclusion

This chapter shows that Thailand's STI budget has been stagnated at 3% of total government budget. In order to transform Thailand towards knowledge-based economy, Thailand has to make stronger commitment by allocating more budget on important STI activities such as strengthening R&D commercialization program.

Chapter 3

RESEARCH AND DEVELOPMENT

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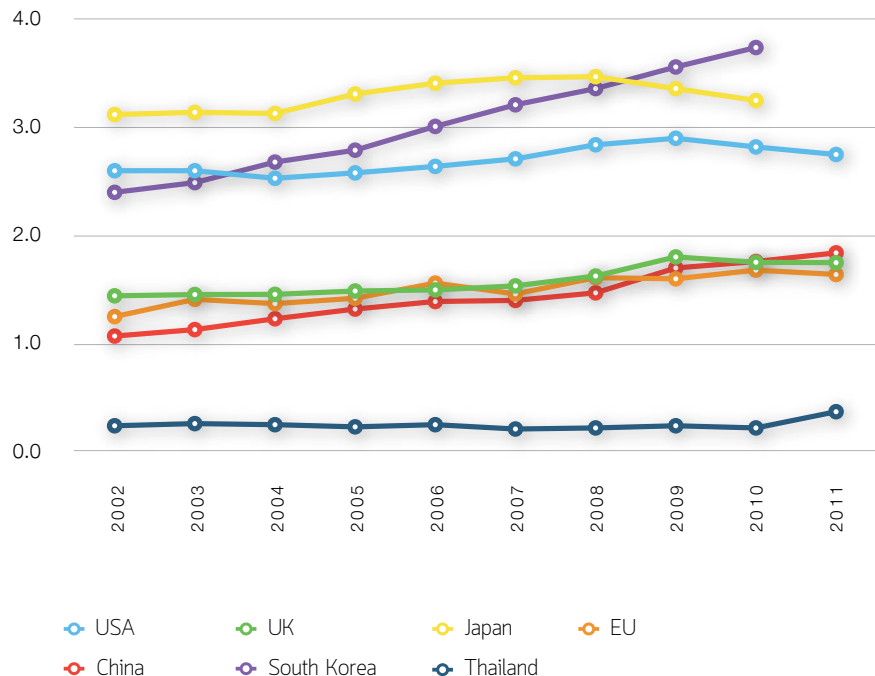
International competition among countries have been intensified these days. For a country to be more resilient and able to adapt to impacts from globalization, it is crucial to transition into a knowledge-based economy and society. To achieve that target, STI has become the main drivers and R&D investment has to increase.

World R&D Investment Trends.

Countries that have shown significant economic growth such as China and South Korea have consistently increased their investment in R&D. Thailand's R&D expenditure as percentage of GDP had remained constant during 2002-2012, at around 0.20-0.25 percent . However, R&D expenditure in Thailand increased significantly to 0.37 percent of GDP in 2011.

Gross domestic expenditure on R&D (GERD) to GDP (2002–2011)

GERD/GDP (%)



R&D Index

Widely used Indicators for measuring the level of R&D resource allocation in countries include the followings.

1. Gross domestic expenditure on R&D (GERD)
2. The Ratio of GERD to GDP

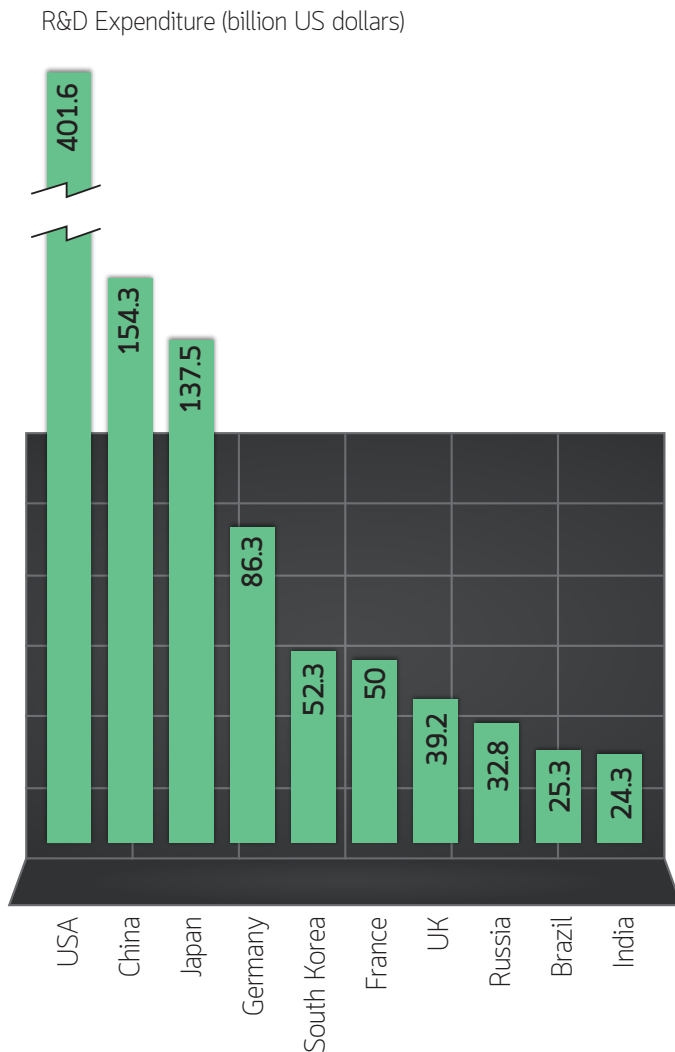
Source: 1. International Institute for Management Development (IMD). World Competitiveness Yearbook 2013.
2. National Science Foundation. Science and Engineering Indicators 2012.

Regional Trends

- **North America:** GERDs are around 2.0-3.0 percent of GDP
- **Europe:** GERDs are ranging from 0.5-3.9 percent of GDP
- **Oceania:** GERDs are between 1.0-2.0 percent of GDP
- **South America:** GERDs are around 0.3-1.0 percent of GDP with exception for Brazil's (1.2 percent)
- **South Africa:** GERDs are lower than 0.5 percent of GDP with exception for South Africa's (0.9 percent)
- **Middle East and South Asia:** GERDs are between 0.2 to 4.4 percent of GDP. Israel has the highest percent of GERD/GDP in the world at 4.4 percent
- **East Asia:** GERDs are around 2-3 percent of GDP. South Korea has the highest GERD/GDP at 3.7 percent
- **ASEAN:** GERDs are around 0.3-2.2 percent of GDP. Singapore has the highest GERD/GDP at 2.2 percent

Source: Information from UNESCO in UNESCO Science Report (2012)

Top 10 Countries in R&D Expenditure

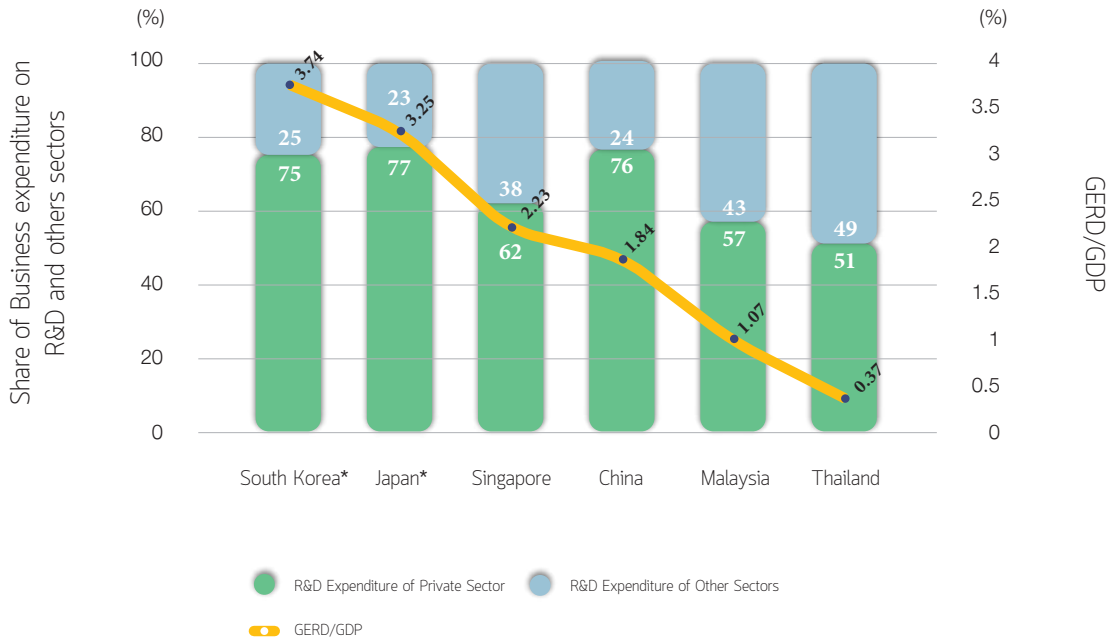


Remark: Data from 2010

Source: UNESCO, UNESCO Institute for Statistics, October 2012

R&D in Asia and the Pacific

GERD/GDP and share of business expenditure on R&D in 2011 (BERD)

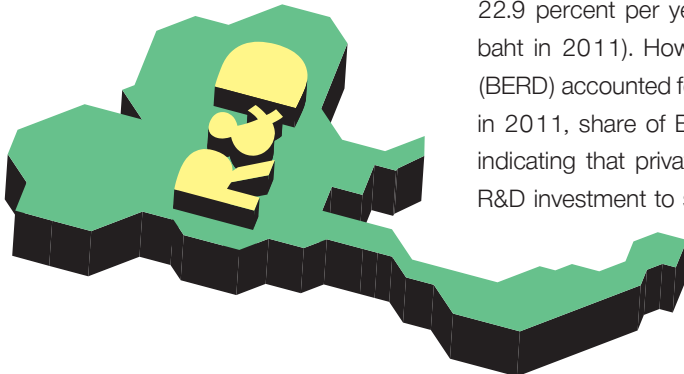


Remark: *Data from 2010

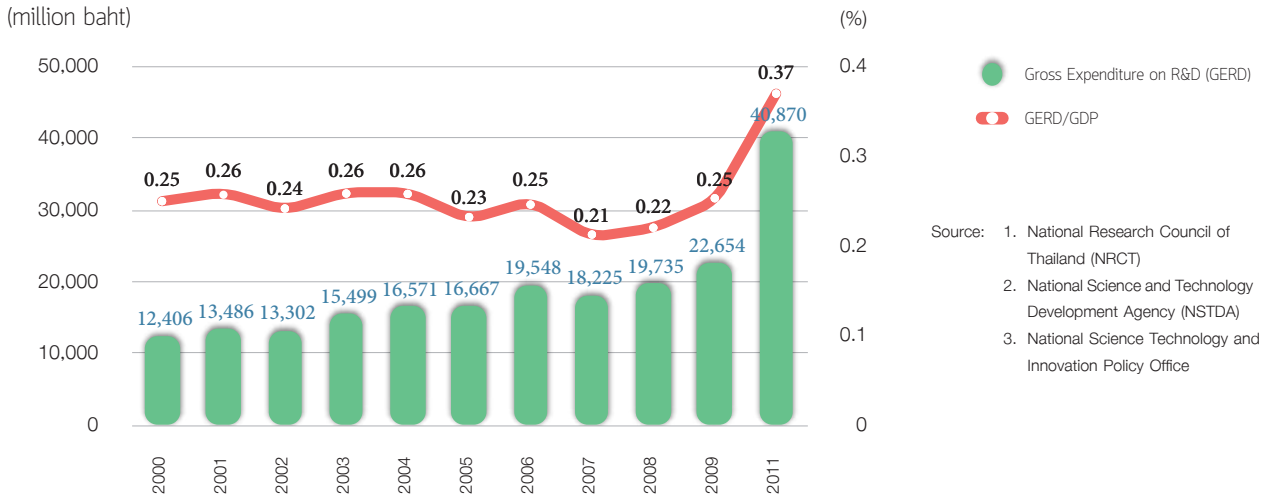
Source: International Institute for Management Development (IMD), World Competitiveness Yearbook 2013

R&D Expenditure in Thailand

During 2000-2011, R&D expenditure in Thailand increased on average 22.9 percent per year (from 12,406 million baht in 2000 to 40,870 million baht in 2011). However, during 2000-2009, business expenditure on R&D (BERD) accounted for less than 50 percent of Gross R&D investment. However, in 2011, share of BERD increased to 51 percent of gross R&D expenditure indicating that private sector has a greater awareness on the importance of R&D investment to sustain competitiveness.

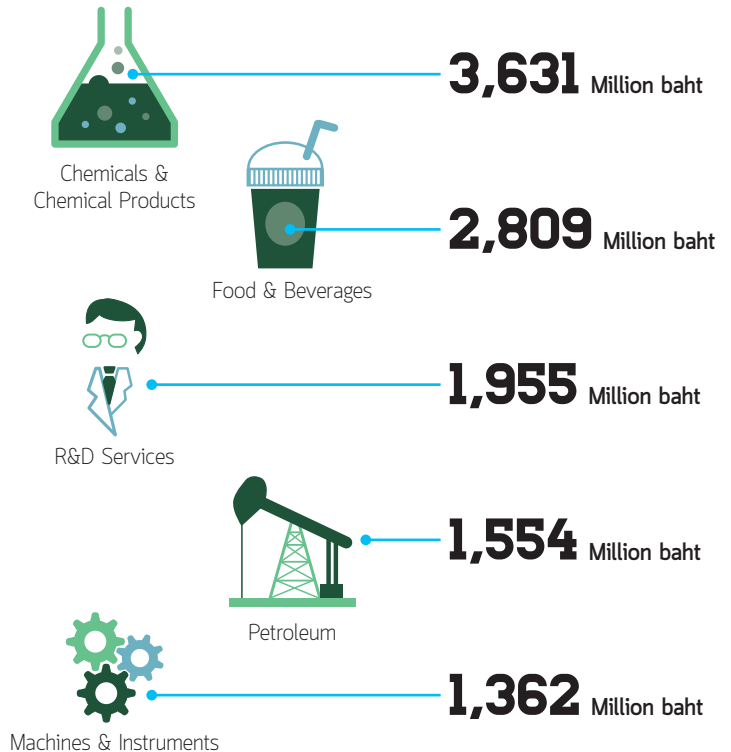


Gross Expenditure on R&D in Thailand (2000-2011)



Source: 1. National Research Council of Thailand (NRCT)
 2. National Science and Technology Development Agency (NSTDA)
 3. National Science Technology and Innovation Policy Office

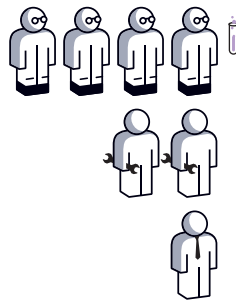
Top 5 industries in R&D investment (2011)



R&D Personnel in Thailand

The number of R&D personnel (head count) in Thailand doubled from 55,748 persons in 2001 to 91,473 persons in 2011.

In 2011, the number of R&D personnel (head count) is 91,437 persons, composing of the following positions.

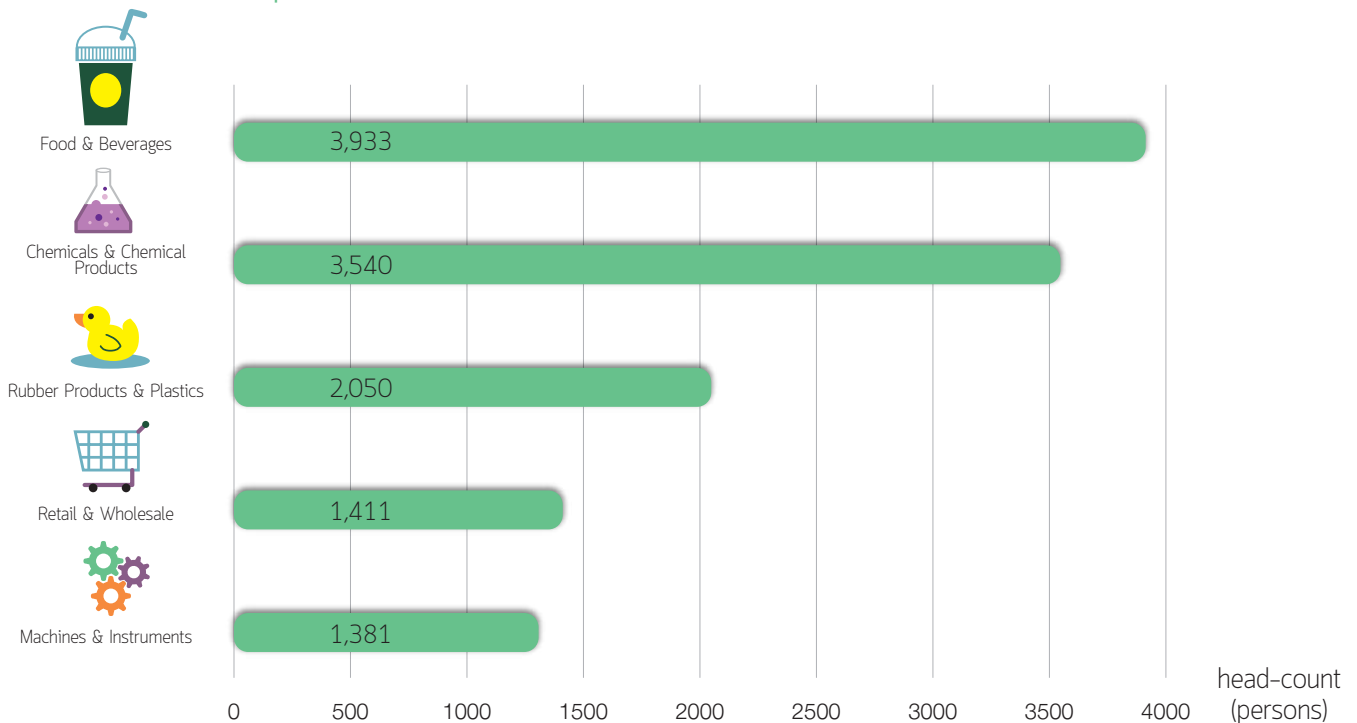


Researchers 51,178 persons

Technicians 27,040 persons

**Supporting
staffs** 12,752 persons

Top 5 Industries in Number of R&D Personnel (2011)



Researcher by sector



In 2011, the total number of researchers (head count) is 51,178 persons, but only less than 30 percent of researcher reside in private sector

- Private sector: 14,256 persons
- Public sector including other sectors: 36,922 persons

Conclusion

From 2000 to 2011, Thailand still has low level of R&D expenditure to GDP, despite a significant increase in investment between 2009 to 2011 by 48 percent. R&D worldwide has risen exponentially during 1996-2007 as a result of the global economic growth.

In Asian region, countries actively expand R&D activities are South Korea, Japan, Taiwan, and China. The majority of R&D expenditure (more than 70 percent) in these countries comes from private sector.

In 2011, it was the first time in Thailand that the share of business expenditure on R&D was greater than the share of R&D expenditure from government sector and other sectors.

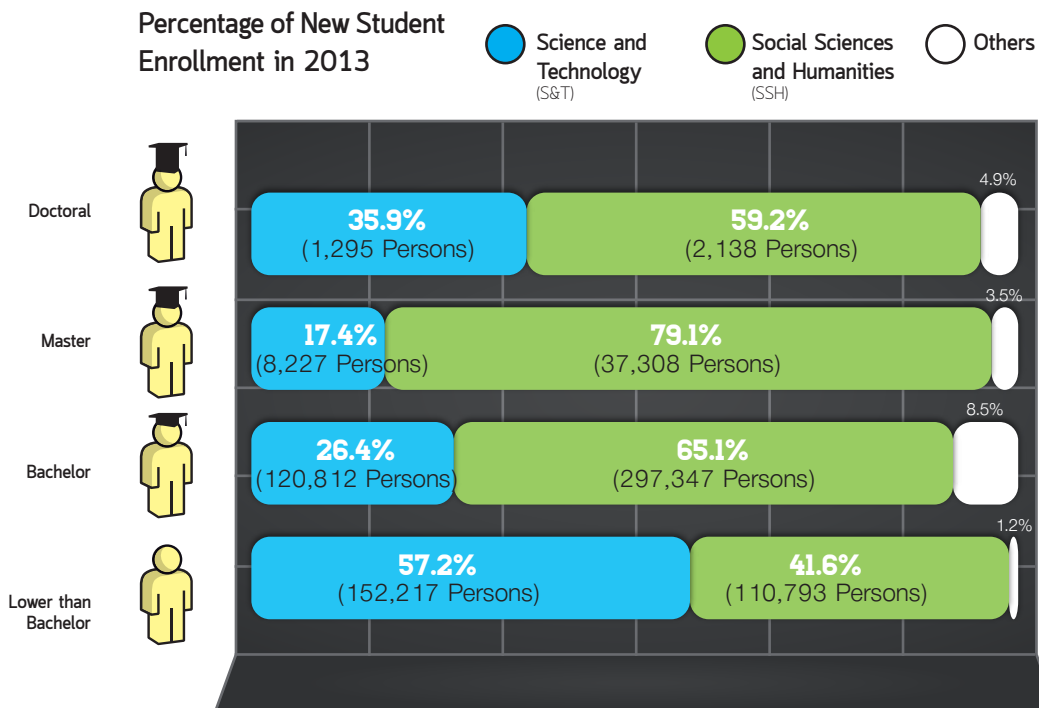
The number of R&D personnel in Thailand (full time equivalent: FTE) was only 8 persons per 10,000 population (data in 2011). When compared with Taiwan, Japan, and South Korea, the ratio of R&D personnel per population in Thailand was 7 to 11 times lower. In addition, in countries with high number of R&D personnel, most of R&D personnel are in private sector. For example, in Taiwan, Japan, South Korea and Singapore, 60-75 percent of R&D personnel work for private sector. On the contrary, in Thailand most R&D personnel work for government and other sectors.

Chapter 4

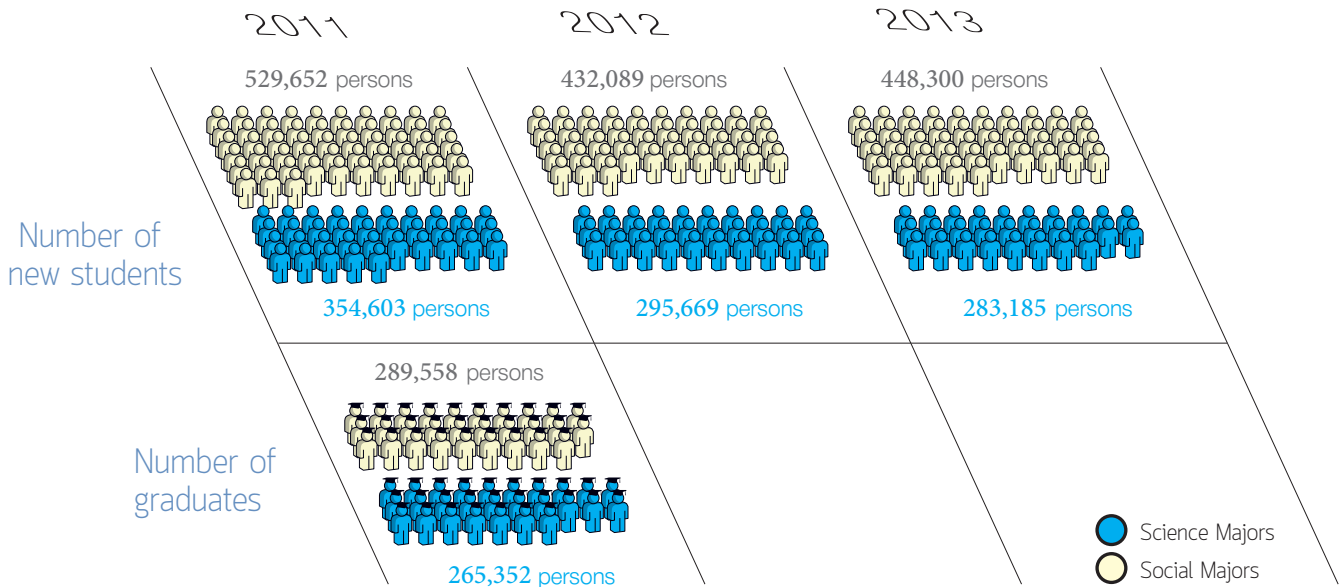
SCIENCE AND TECHNOLOGY PERSONNEL

1 New Student

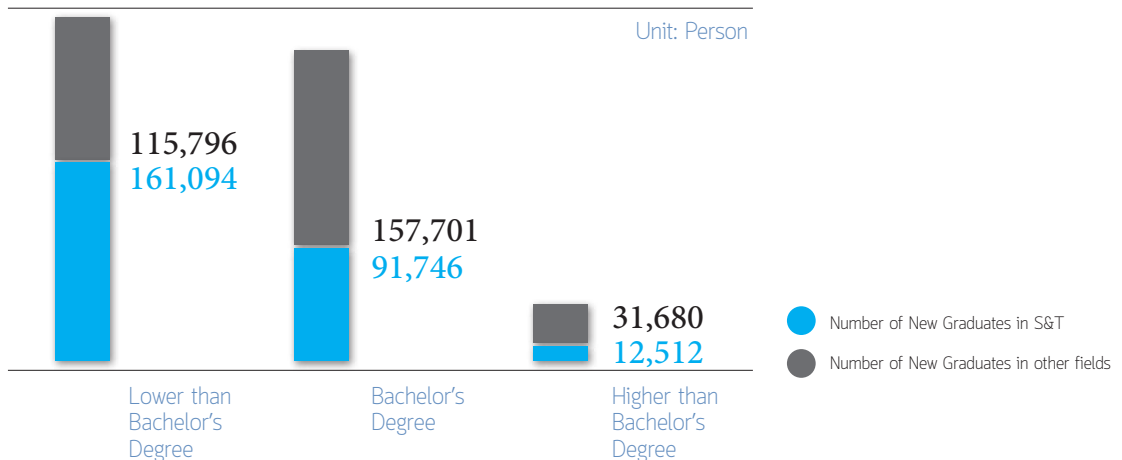
At present, in Thailand, the percentage of new student enrollment in science and technology (S&T) is lower than that of social sciences and humanities (SSH), especially for students enrolling in bachelor's and higher degrees. On the other hand, for the level lower than bachelor's degree, majority of new students enroll in S&T majors.



2 Number of New Students and New Graduates at All Levels



3 Number of New Graduates of All Levels

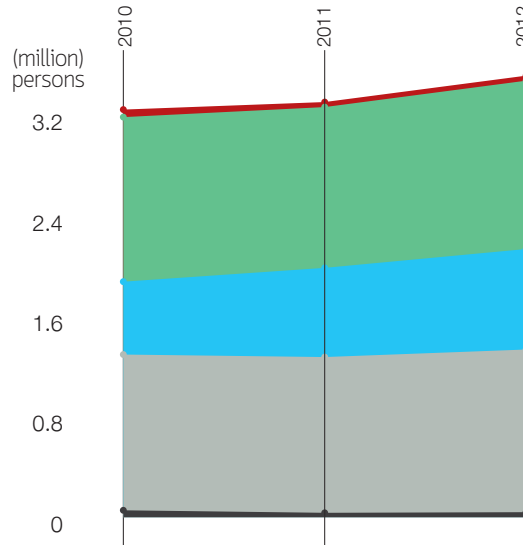


4 Science and Technology Labor Force

In 2012, Thailand's number of S&T labor force were 3,523,881 persons. Of these figure, 3,478,848 persons were employed while 45,033 were unemployed. For employed labors there were 1,339,470 persons working in non-S&T fields while 2,139,378 persons working in S&T fields.

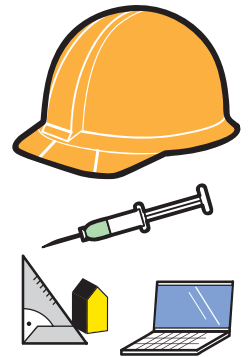
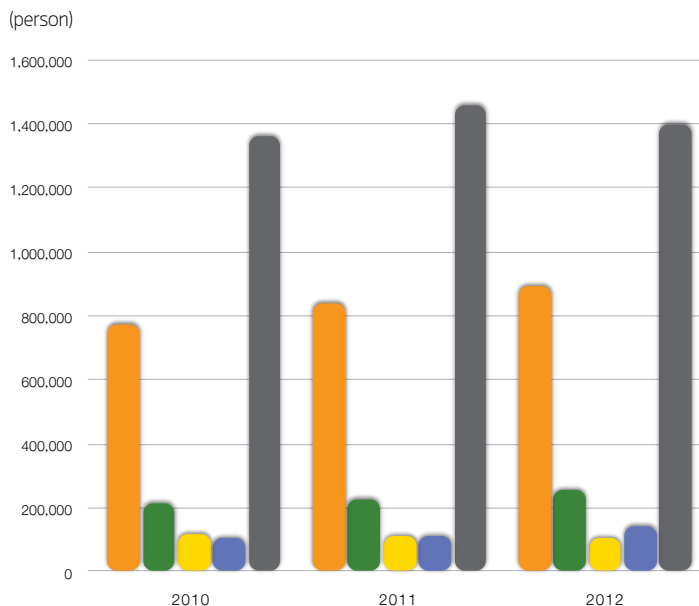
Structure of S&T Labor Force (2010-2012)

- S&T labor force in S&T fields
- Total employed S&T labor forces
- Total employed S&T labor force in S&T fields
- S&T Graduates working in non-S&T fields
- Unemployed S&T Graduates



S&T labor force working and graduated in S&T fields classified by fields of study (2012)

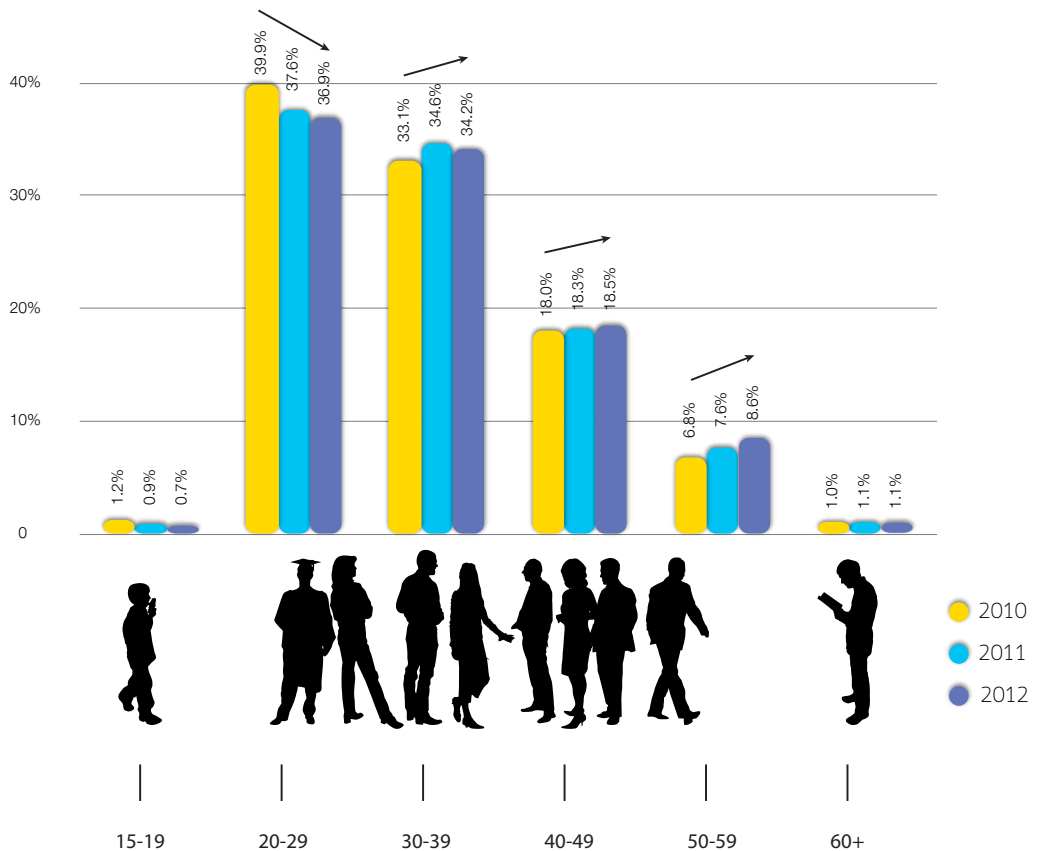
Of all 1.56 million labors working in S&T, 73.1 percent has S&T degree, mostly in engineering.



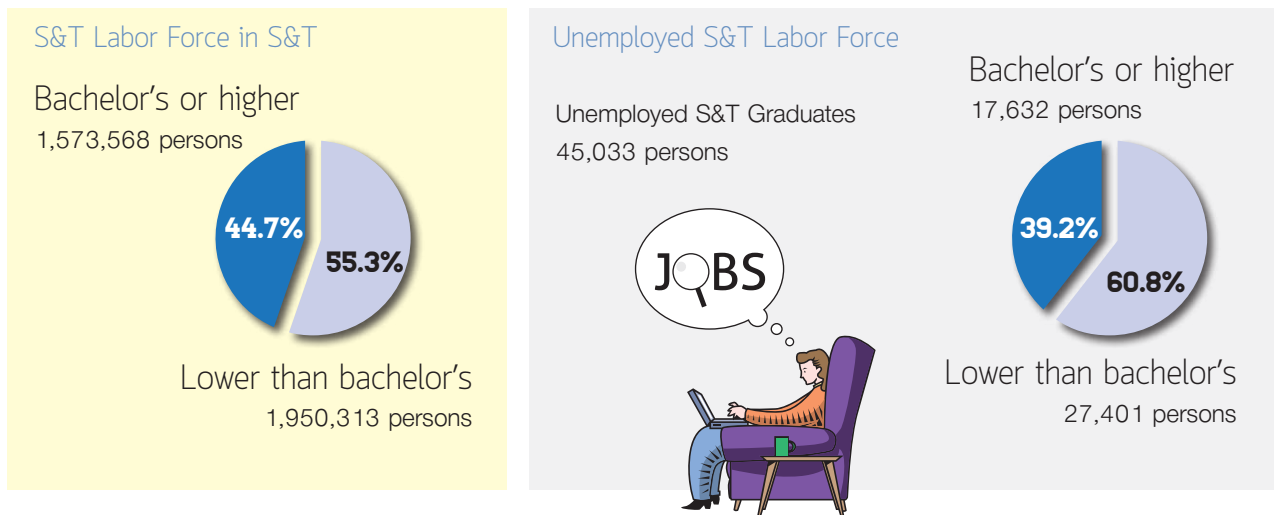
- Engineering
- Health
- Architect
- Computer
- Total

S&T labor force classified by age in 2012

In 2012, the S&T labor force with age between of 20-29 years old was the largest group, accounting for 36.9 percent or 1,300,358 persons. The number of S&T labor force with age between 30-39 and 40-49 were the second and third respectively.



S&T labor force classified by level of education in 2012



S&T graduates working in non S&T fields

In 2012, the number of S&T graduates working in non S&T fields were 1,339,470 persons, which can be classified by occupation as follows.



Source: National Statistical Office



Conclusion

In 2013, new students enrolling in S&T were 283,185 persons (36.42 percent of the total new students enrollment in Thailand). For S&T new student enrollment, 53.75 percent were in lower than bachelor's degree, 42.66 percent were in bachelor's degree, and 3.59 percent were in higher than bachelor's degree.

In 2011, S&T graduates were 265,352 persons, accounting for 46.51 percent of the total graduates in Thailand. Of these S&T graduates, 60.71 percent were in lower than bachelor's degree, 34.57 percent were in bachelor's degree, and 4.72 percent were in higher than bachelor's degree.

In 2011, S&T graduates working in non S&T fields were 1,339,470 persons. Of these graduates, most of them work as salespersons, product demonstration workers, and models (24.49 percent).

Chapter 5

TECHNOLOGY BALANCE OF PAYMENTS

Technology Balance of Payments (TBP) indicates whether a country is net technology recipient or supplier. TBP also shows the technological capability of a country, which is critical to a national competitiveness

Technology Balance of Payments

TBP consists of money paid or received for the use of patents, license, know-how, trademarks, patterns, designs, and technical services (including technical assistance) and for industrial R&D carried out abroad.

1. Spending on technological fees suggests a dependency on or demand of imported technology
2. Revenue from technological fee reflects the ability of a country to develop internationally competitive technology, which will generate income from exporting technology

What is technology transaction?

The Bank of Thailand collects foreign exchange reported by domestic commercial banks and classifies technology transactions into 2 types.

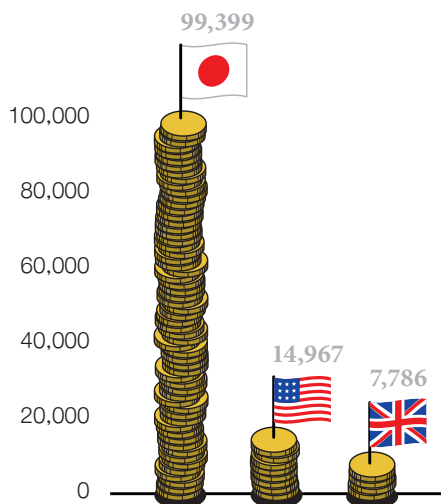
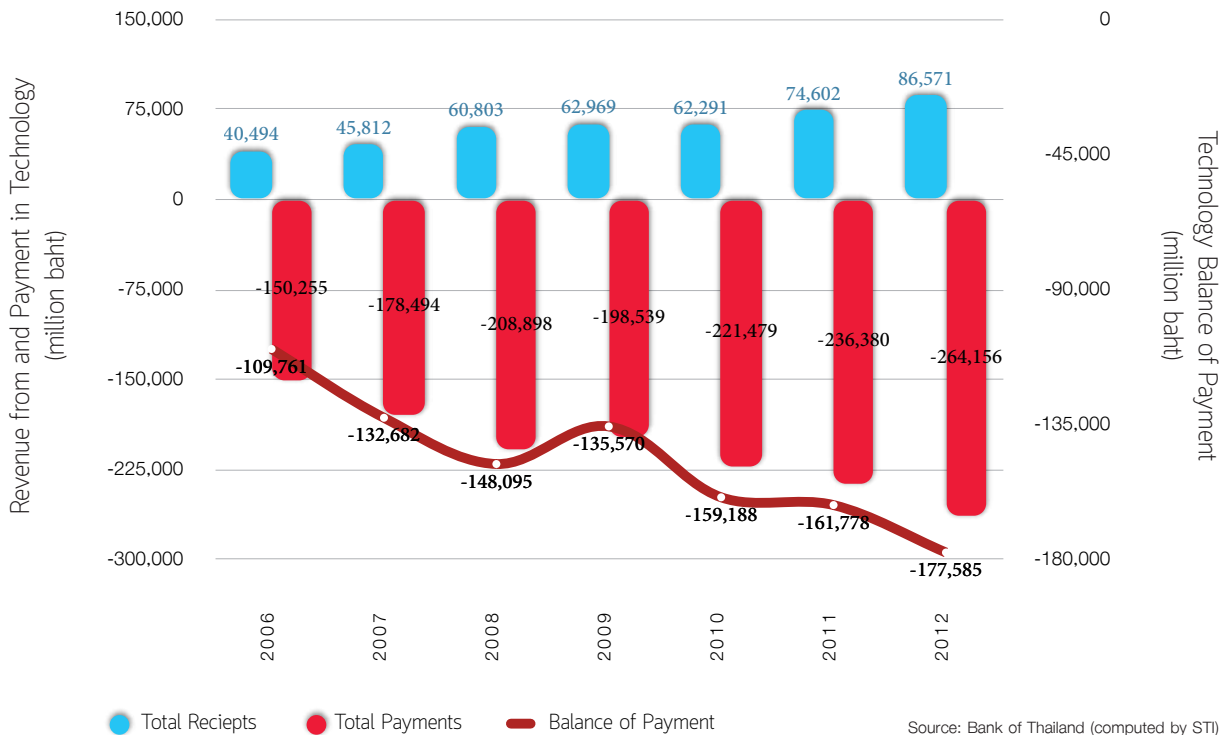
1 Royalty and License Fees refer to the fees for the permission to use of intangible properties including the original items such as trademark, copyright, technique and design, right of production and reproduction of the original copies of books or films.

2 Consulting and Technical Service Fees refer to the compensation of consulting experts and firm's committee, technical service and technical assistance such as setting up machines and electrical system in the plants, service and management fee, and technical operation fee.

Thailand's Deficit in Technology Balance of Payments

In 2012, Thailand's total expenditure on technology was 264,156 million baht while total revenue was merely 86,571 million baht, resulting in the deficit of TBP 177,585 million baht. The TBP deficit tends to increase continuously from the previous years.

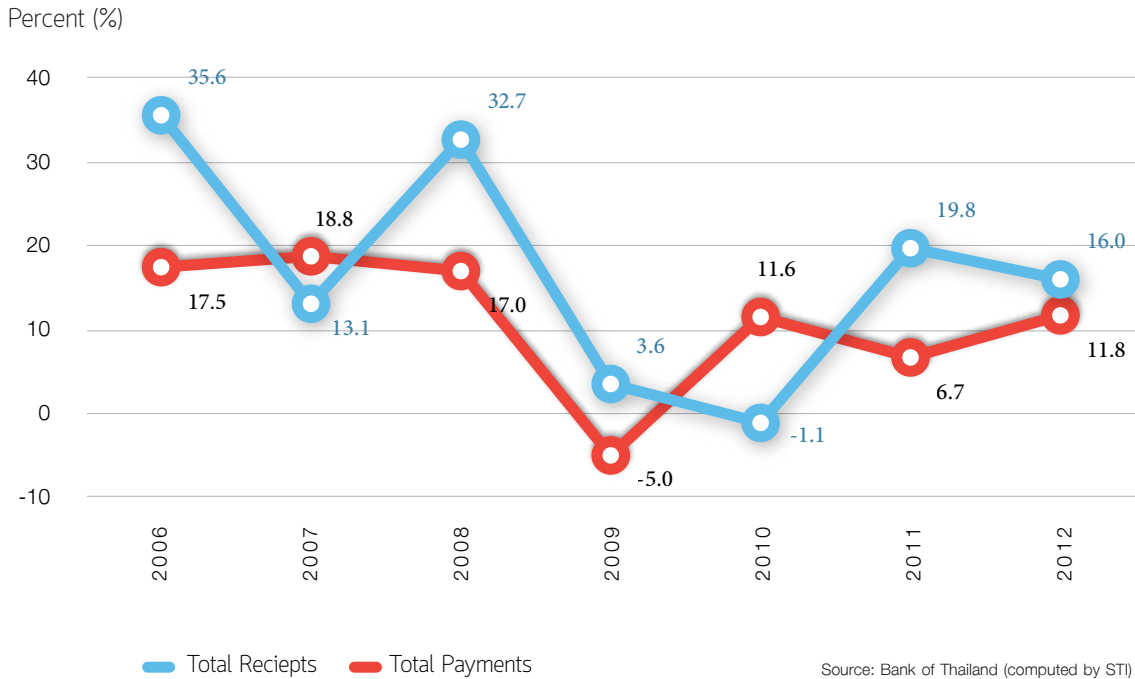
Revenue and Expenditure Growth of Technology in Thailand (2006-2012)



Top 3 countries that Thailand has the most deficit in TBP.

- 1 Japan **99,399** million baht
- 2 USA **14,967** million baht
- 3 UK **7,786** million baht

Growth Rate of Revenue and Payment in Technology of Thailand during 2006-2012



Top 5 industries in Thailand that have the most deficit in TBP.



Automotive and parts

48,602 Million baht



Oil and gas

22,156 Million baht



Retail and wholesale

21,653 Million baht

Architecture and engineering



13,683 Million baht

Electronics



12,259 Million baht



Conclusion

Thailand has experienced the deficit of TBP continuously. However, the growth rate of revenue is higher than that of payment. This dynamic can be seen in other developing countries in which their economy is quickly developed, such as China, Brazil, and Indonesia.

Thailand should consider developing its domestic capability through efficient technology transfer from foreign contraction. In addition, Thailand has to make substantive efforts for raising the quality of S&T education and training at all levels.

Chapter 6

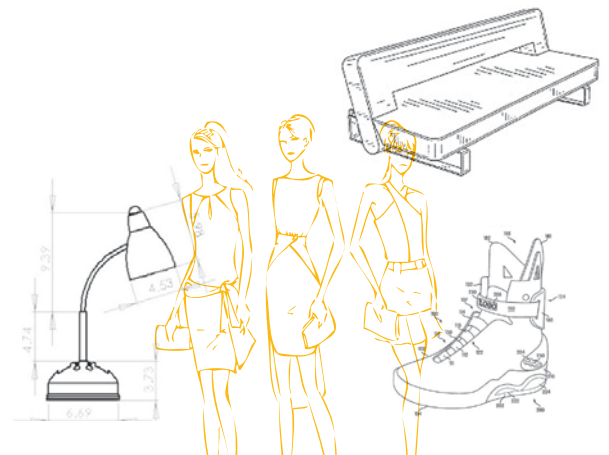
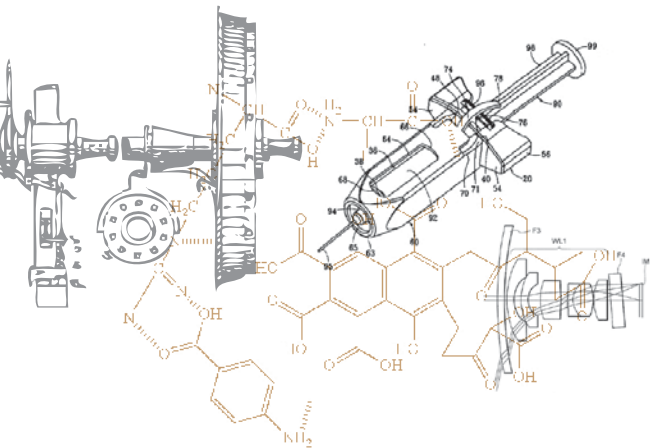
PATENTS

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What is patent?

Under the Patent Act (B.C. 2522) patent protection is granted for an invention or industrial design. To qualify for a protection, the invention has to be new, useful and non-obvious.

1 **Invention** refers to a discovery or idea to create a new product or process, or any improvement of process, which has the industrial application in agriculture, commerce and handcraft. The invention patent is protected for 20 years from the filing date.

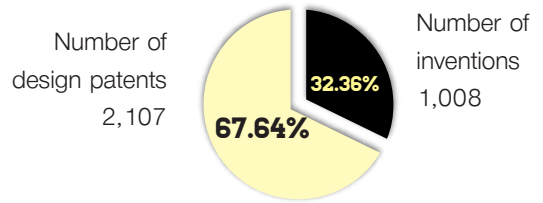
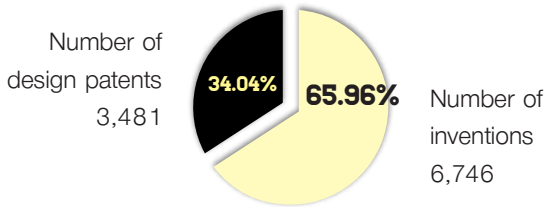


2 **Industrial design** refers to a design of a product or component, which can be used as a functional model. The design patent is protected for 10 years from the filing date.

Patent Statistics in Thailand in 2012

Number of Patent Applications Filed
10,227

Number of Patent Granted
3,115



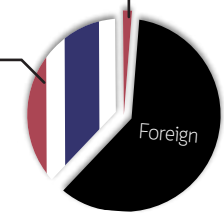
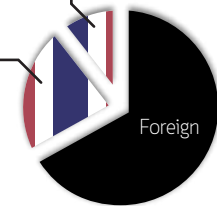
The number of patent applications by Thai was 3,360

The number of invention patents received by Thai was 1,068

The number of patents granted to Thai was 39

The number of design patent applications by Thai was 2,292

The number of design patents granted to Thai was 1,173



Japan filed the largest number of patent applications in Thailand
(3,028 patents).



Japan was granted the largest number of patents in Thailand, compared with other foreign countries.
(969 patents).

International Patent Classification

The World Intellectual Property Organization (WIPO) classified invention patents, using the International Patent Classification (IPC), into 8 classes.

- Human Necessities** such as agriculture, forestry, hunting, tobacco, and clothing.
- Performing; Operations; Transporting** such as physical or chemical processes, cleaning, cutting, printing, and vehicle decoration.

3 **Chemistry; Metallurgy** such as organic and inorganic chemistry, water treatment, glass, cements, biochemistry, petroleum, vegetable and animal oil, sugar

4 **Textiles; Paper** such as spinning, weaving, braiding, sewing, paper production

5 **Fixed Construction** such as construction of roads, railways, or bridges, hydraulic engineering, foundations, plumbing installation, sewerage, cesspool

6 **Mechanical Engineering; Lighting; Heating, Weapons; Blasting** such as machines or engines in general, gears, and storing gases or liquids

7 **Physics** such as measuring, testing, optical signaling, musical instruments, and information storage

8 **Electricity** such as generation, conversion, distribution, and electronic circuitry

In 2012, the total number of patent applications filed by Thais was 1,068.

No. 1 **27.71%**
Human Necessities



No. 2 **19.94%**
Chemistry and Metallurgy



No. 3 **15.26%**
Performing; Operations;
Transporting



In 2012, the total number of patents granted to Thais include

No. 1 **(9 patents)**
Performing; Operations;
Transporting



No. 2 **(8 patents)**
Human Necessities



No. 3 **(6 patents)**
Fixed Construction
and Physics

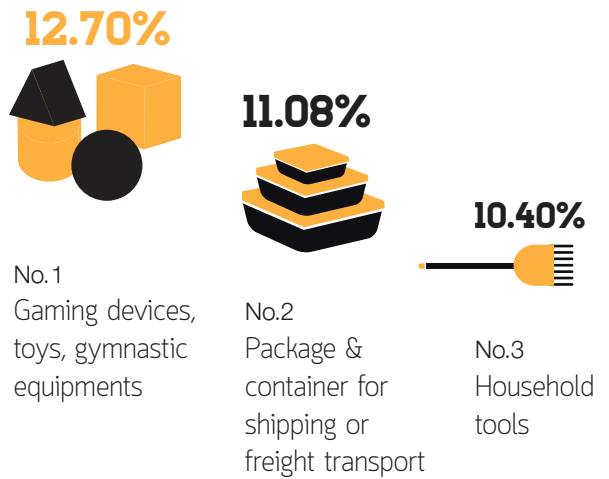
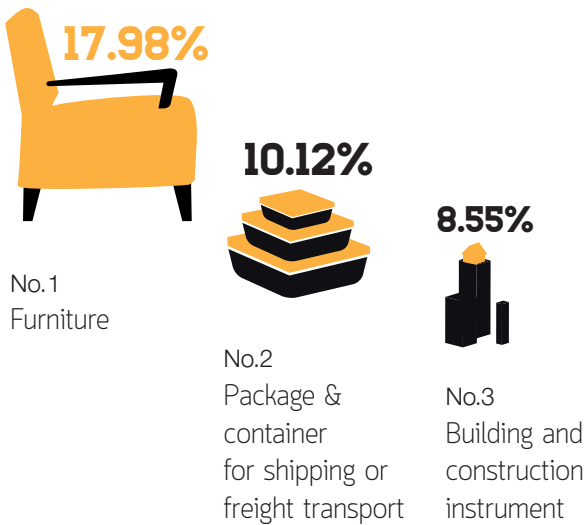


Design Patents by Thais

The World Intellectual Property Organization (WIPO) has classified international industrial design into 32 categories.

The number of design patent applications filed in 2012 was 2,292. These contribute to:

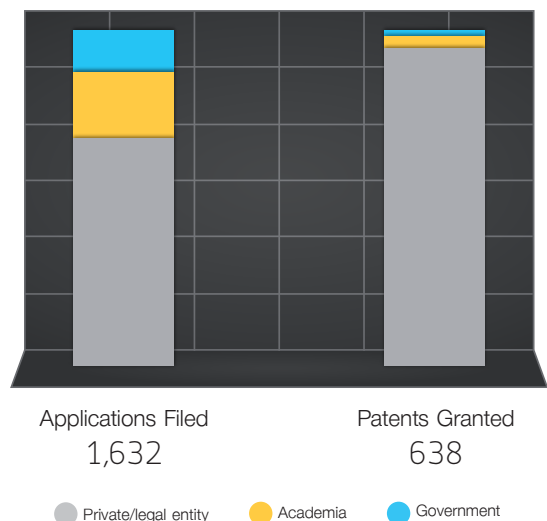
The number of design patents granted in 2012 was 3,115.



Private / legal entities play the major part in patent application.

In 2012, the total number of patent applications filed in Thailand was 1,632. The patent applications filed by private/legal entities were 67.71 percent while academic institutions filed 19.91 percent. Government agencies filed only 12.38 percent of the total patent applications.

In 2012, there were 638 patents granted or around 39.09 percent of total patent applications filed. Of these granted patents, private/ legal entities, government agencies, and academic institutions were granted 94.51, 3.61 and 1.88 percent respectively.

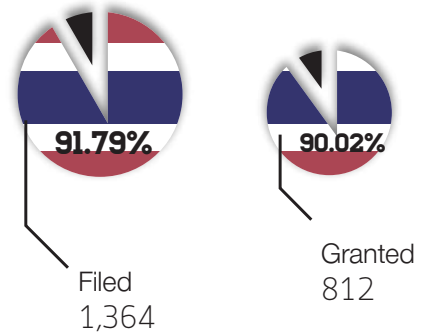


Petty Patent

Petty patent refers to a document issued by the government to protect inventions of non-high technology or incremental inventions. It has to be new and has industrial application. The term of protection for petty patent is 10 years.

In 2012, the number of applications for petty patent filed in Thailand was 1,486 (1,342 in 2011). Most of the petty patent applications were filed by Thais (91.79 percent).

The petty patents granted in 2012 were 902 (929 in 2011). Among these were granted to Thais around 90.02 percent.



Patents by Thais in other countries in 2012

Japan Patent Office: JPO



Patent applications filed by Thais 24

Patents granted 11

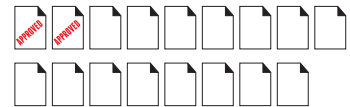
The US Patent and Trademarks Office: USPTO



Patent applications filed by Thais 134

Patents granted 46

European Patent Office: EPO



Patent applications filed by Thais 66

Patents granted 7

Source: Department of Intellectual Property



Conclusion

In Thailand, the number of patent applications being filed and granted is quite small. Most of the patent applications are filed by foreigners. The number of patents by Thais is granted less than 10 percent of all patents granted each year.

The government should raise awareness of Thai people about the significance in obtaining patents and pass necessary laws. The government should also reform the patent registration system since it faces a considerable delay in the examination of patent application. Moreover, the IP regime of publicly funded research has to be clear as to the ownership, management and protection system.

Chapter 7

SCIENTIFIC AND TECHNOLOGICAL PUBLICATIONS

Scientific and technological publication is an output from study, exploration, research and development, which is a source of knowledge that can be referenced and extended.

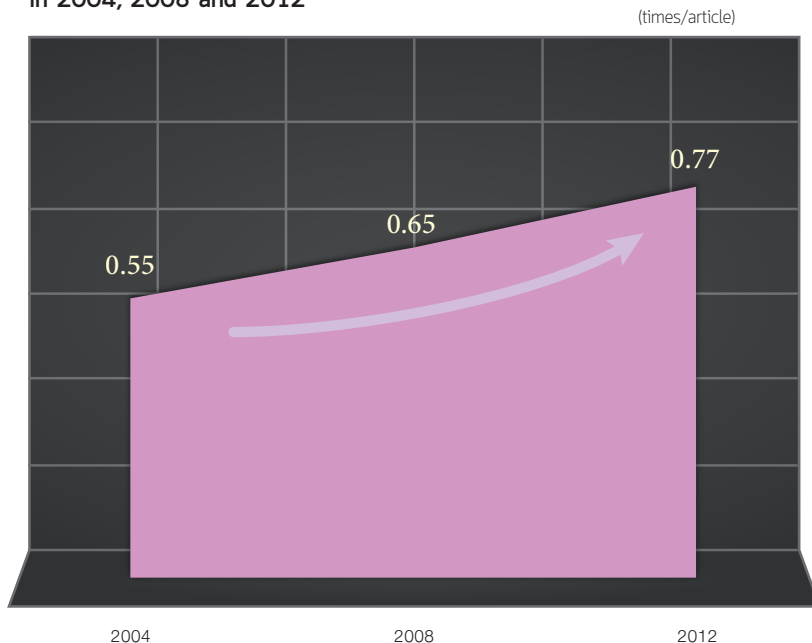
In addition, scientific and technological publication is an indicator of R&D competency and collaborations among domestic and international institutions.

Publications in TCI database

The number of domestic academic journals in science and technology, which is collected in the Thai Citation Index (TCI) database, is 251 in 2012.

In Thailand, data during 2008-2012 has shown that the number of publications in domestic academic journals increased by 9 percent each year.

Frequency of citation per scientific and technological article in 2004, 2008 and 2012



Source: Thailand Research Fund (TRF)

TCI

Thai Journal Citation Index, (TCI) operated by Thailand Research Fund (TRF) in cooperation with King Mongkut's University of Technology Thonburi (KMUTT), collects information on scientific and technological publications in domestic academic journals

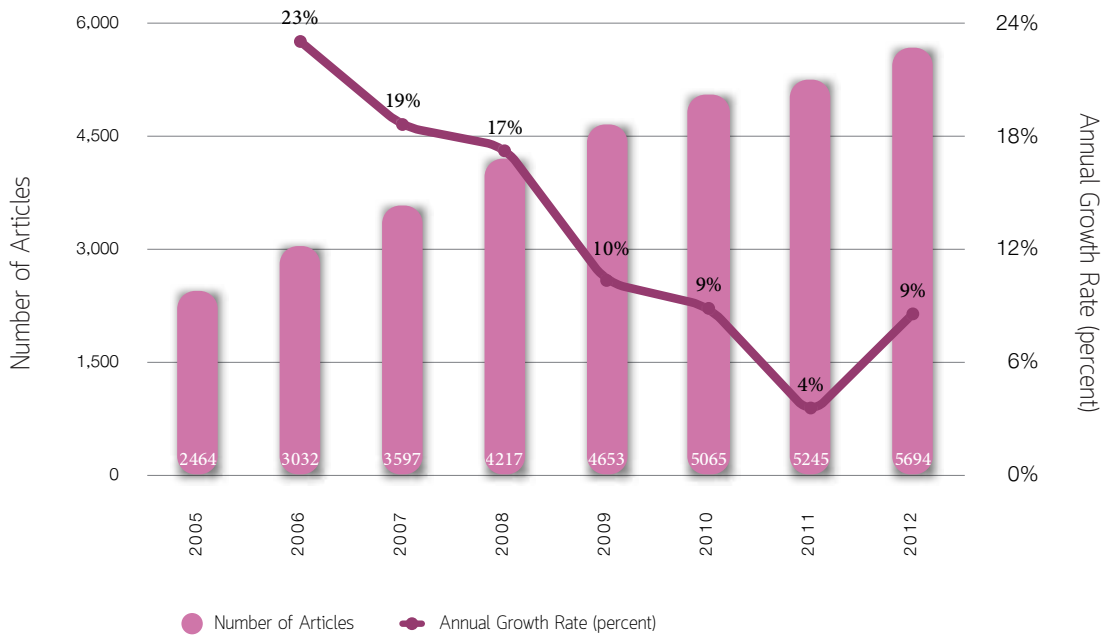
The number of citations per article in scientific and technological journals has continued to increase.

Publications of Thai researchers in international database.

From Science Citation Index Expanded database (SCI-EXPANDED) in 2012, there were 2,694 scientific and technological articles published by Thai researchers, increasing by 9 percent from 2011.

The data during 2005-2011 shows that the annual growth rate of scientific and technological publications in Thailand tends to decrease. In 2006, the growth rate increased by 23 percent before declining to 4 and 9 percent in 2011 and 2012 respectively.

The number of S&T publications in SCI-EXPANDED database during 2005-2011



Source: Thomson Reuters Web of Knowledge; Web of Science, Science Citation Index Expanded (SCI-EXPANDED), processed by National Science, Technolog

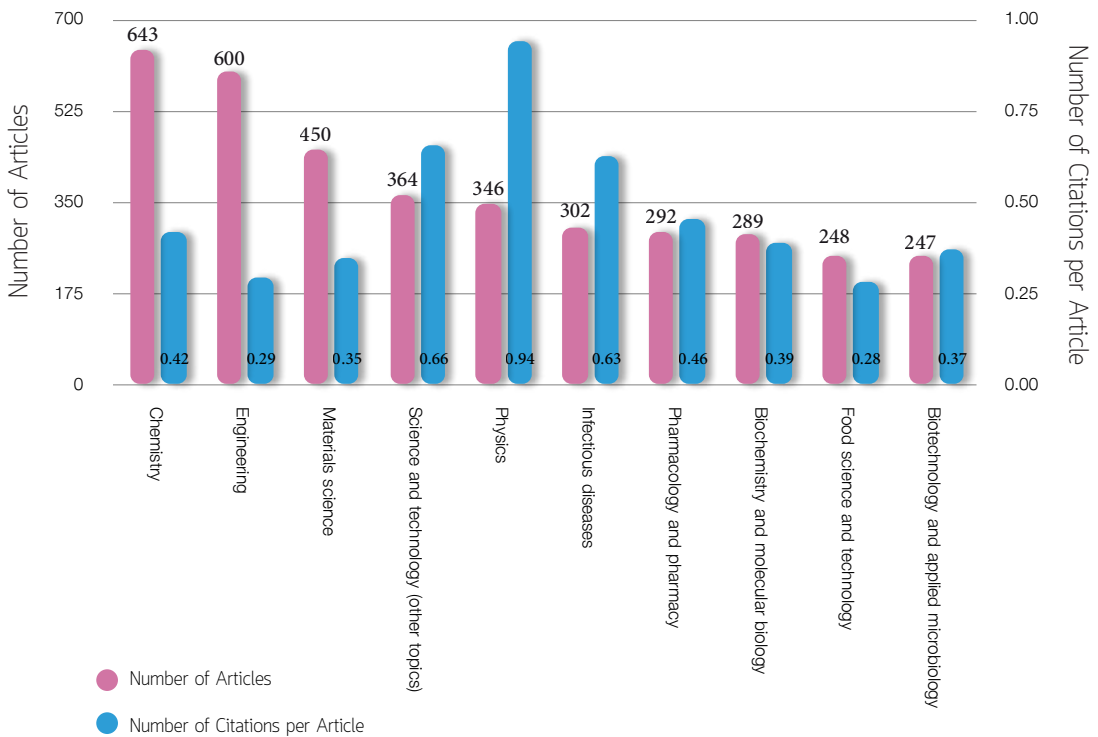
SCI-EXPANDED

Science Citation Index Expanded (SCI-EXPANDED) is one of the two widely used databases of scientific and technological publications in international academic journals. Another popular database is SCOPUS.

10 subjects with highest number of publications

In 2012, chemistry was the subject that obtained the highest number of publications (643 articles) in Thailand. The second and third were engineering and material science with 600 and 450 articles respectively.

The top three subjects in terms of number of citations per article were physics (0.94 times/article), other science and technology (0.66 times/article) and infectious disease (0.63 times/article).



Source: Thomson Reuters Web of Knowledge: Web of Science, Science Citation Index Expanded (SCI-EXPANDED), processed by National Science, Technology and Innovation Policy Office (STI)



Conclusion

Data from Thailand Journal Citation Index Center (TCI) has shown that in 2012 there were 7,386 scientific and technological articles publication in domestic academic journals. Moreover, the number of citations per article was 0.77, which increased from 0.65 times per article in 2008.

From Science Citation Index Expanded (SCI-EXPANDED) database, the number of academic publication by Thai researchers has increased. In 2012, there were 5,694 published articles, increased by 9 percent from the previous year.

Of all articles published in international academic journals by Thai researchers in 2012, the largest number of publications (643) was in chemistry whereas articles in physics have the highest number of citations per article on average(0.94 times per article).

Chapter 8

INFORMATION & COMMUNICATION TECHNOLOGY

ICT and country development

Information and communication technology (ICT) is one of key drivers of country development, particularly for achieving a transition to knowledge-based economy. The effective use of ICT can improve quality of life, reduce the educational gap, and increase efficiency in industrial production and government service provision.



Fixed Line Phones

The demand of fixed line phones in Thailand tends to be stable. During 2006-2008, the fixed line phone subscriptions were steady around 6.7 million numbers. Between 2009 and 2012, the numbers of fixed line phones has continuously declined.

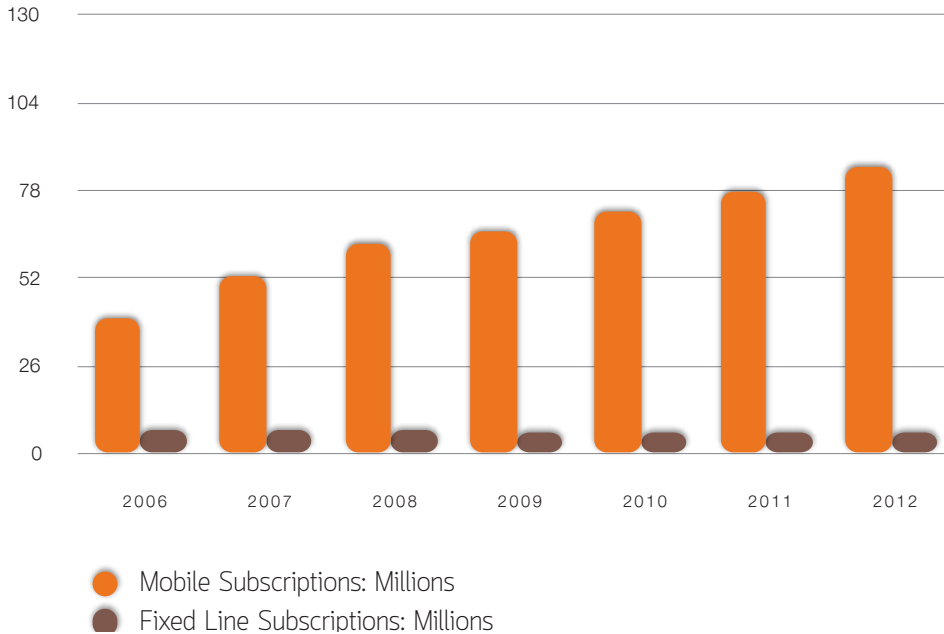
There were only 5.9 million numbers of fixed line phones in 2012 or 9.24 numbers per 100 people. Mobile phones started to replace fixed line phones because they were more flexible to use and their service fees tend to decrease over time.

Mobile Phones

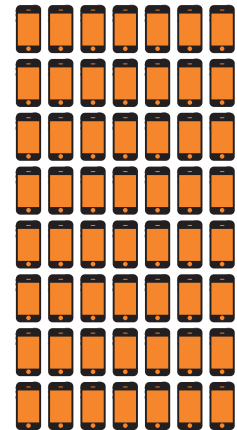
Mobile phones become a part of daily life of people nowadays. The shift towards digital communication allows people to connect with the Internet via mobile phones for viewing television, listening to radio, sending and receiving email, and using all kinds of applications.

The number of mobile phone users shows the increasing trend. In 2012, there were 85 million subscriptions or 127.9 hundred thousand per 100 people.

Fixed Line Phones and Mobile Phones



In 2012, there were **5.9 million** subscriptions of fixed line phones and **85 million** subscriptions of mobile phones.



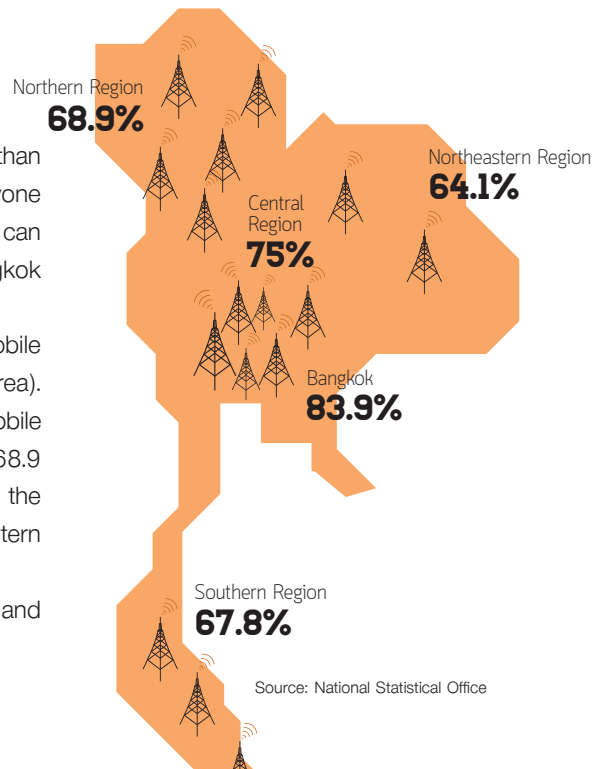
Source: 1. National Statistical Office
2. Office of the National Broadcasting and Telecommunications Commission
3. TOT Public Company Limited

Digital divide

Although the number of mobile phones is greater than the number of population, suggesting that almost everyone can benefit from communication infrastructure, those who can access ICT mostly reside in urban area, particularly Bangkok and metropolitan areas.

In 2012, Bangkok had the highest number of mobile phone users (83.9 percent of the total population in the area). The second, the third, and the fourth regions in terms of mobile phone users were the Central (75 percent); the North (68.9 percent) and the South (67.8 percent). The region with the lowest number of mobile phone users was the Northeastern (64.1 percent).

Nonetheless, the digital divide between Bangkok and other regions showed a decreasing trend over time.

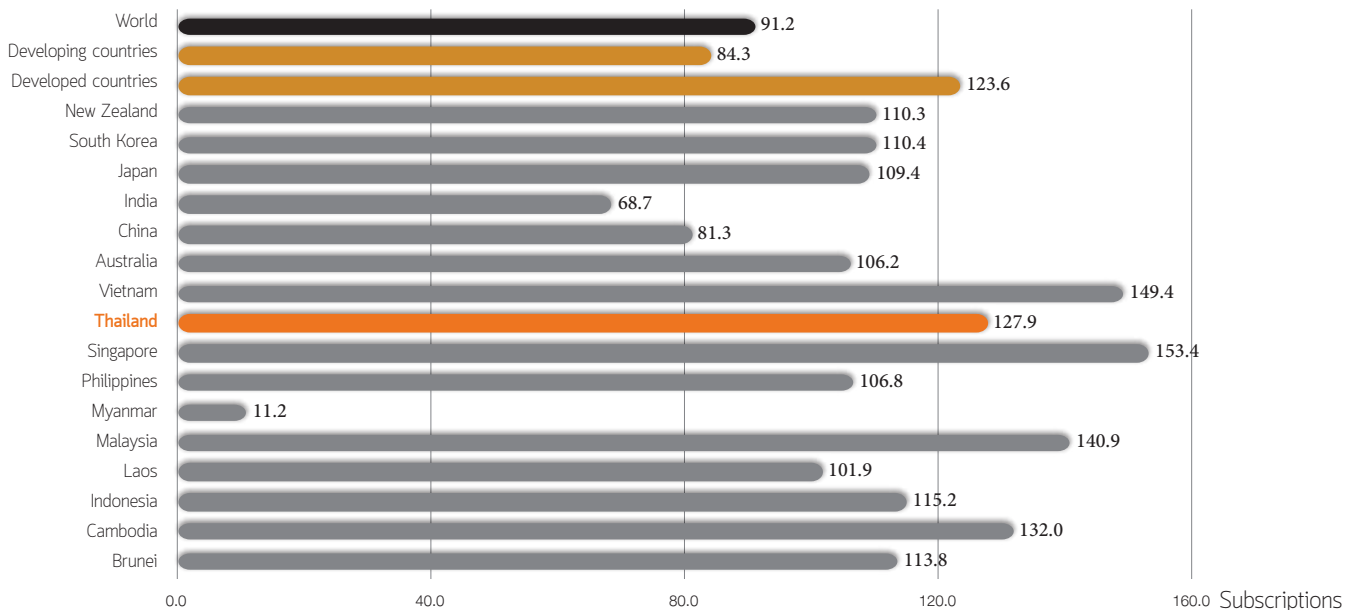


Source: National Statistical Office

Rank of mobile phone subscriptions per population in ASEAN

In 2012, among ASEAN countries, Singapore had the highest number of mobile phone subscriptions per 100 people (153.4 numbers); the second, the third, and the fourth were Vietnam (149.4 numbers), Malaysia (140.9 numbers), and Cambodia (132.0 numbers) respectively. Thailand was the fifth with 127.9 number of mobile phone subscriptions per 100 people.

The number of mobile phone subscriptions per 100 people in Thailand and ASEAN+6

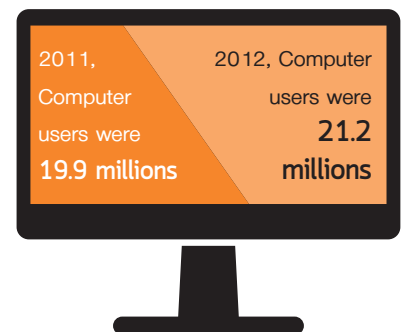


Source: 1. International Telecommunication Union (ITU)

2. Office of the National Broadcasting and Telecommunications Commission (for information about Thailand)

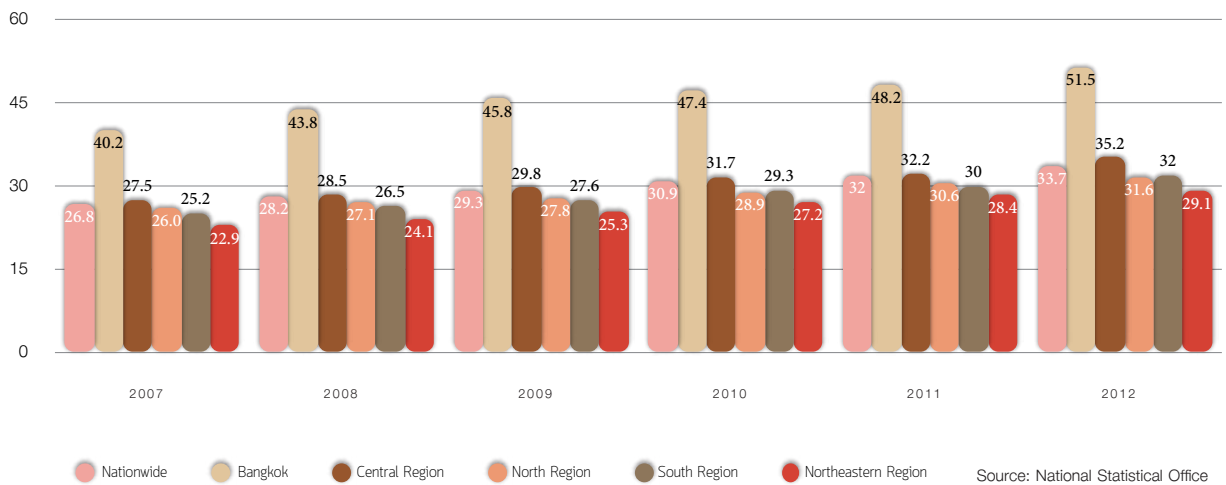
Urban residents used computer more than rural residents

A survey by National Statistical Office in 2012 showed that the total number of computer users was 21.2 million people or 33.7 percent of Thai population at age 6 years old and above. This represents 6.5 percent increase in total number of computer users from 2011.



In 2012, Bangkok had the highest number of computer users (51.5 percent of population in the area) in Thailand. The Central, Southern, Northern and Northeastern regions had 35.2, 32.0, 31.6 and 29.1 percents respectively.

Computer users in each region

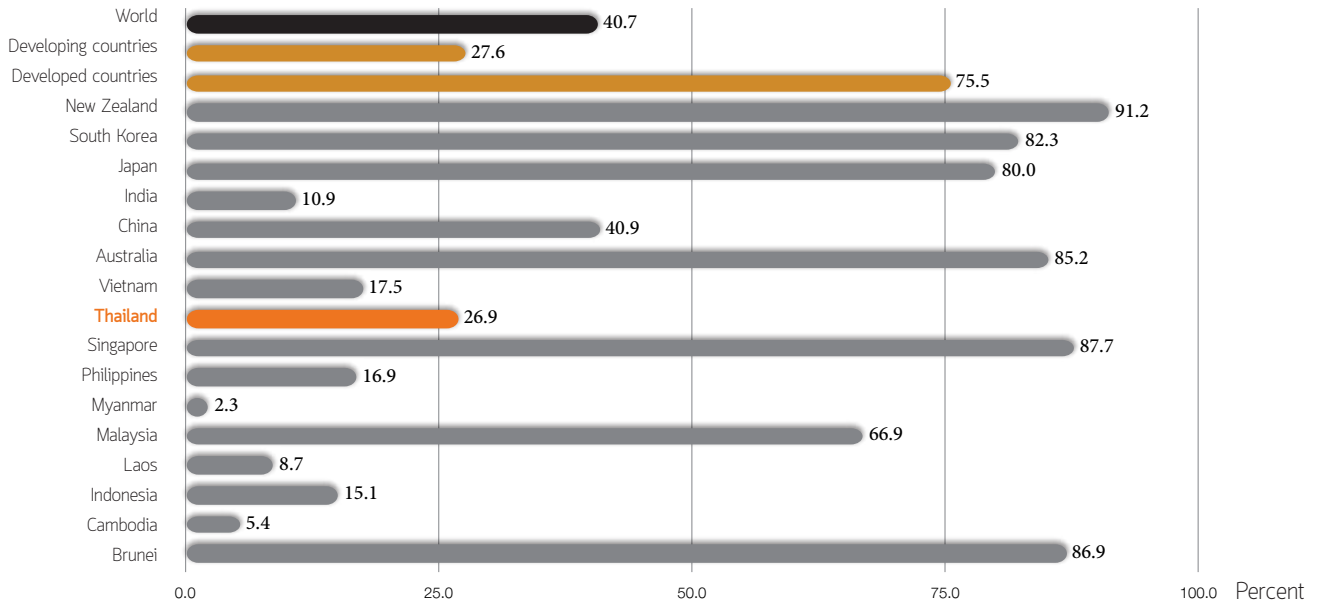


Number of computer users in Thailand and ASEAN

In 2012, among ASEAN countries, Singapore had the highest number of households having computers, which was 87.7 percent of all households. Brunei was the second with 86.9 percent. Malaysia and Thailand had the share of households owning computers of 66.9 and 26.9 percents.

Among ASEAN+6, Thailand ranked 9, which had the share of households owning computers quite close to the average of developing countries (27.6 percent) but lower than the global average (40.7 percent).

Number of Households Owing Computers in Thailand and ASEAN+6

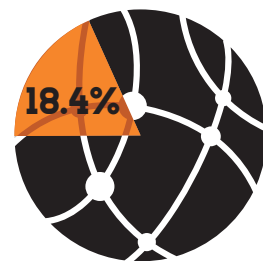


Source: 1. International Telecommunication Union (ITU)
2. National Statistical Office (for information about Thailand)

Access to the Internet

A survey by National Statistical Office in 2012 showed that of all 20 million households nationwide, only 3.7 million households connected to the Internet (18.4 percent). For the enterprise survey, there were only 433,314 or 2.3 million enterprises (19.2 percent) using Internet. However, in overall, the number of internet accesses tended to increase when compared with the previous year.

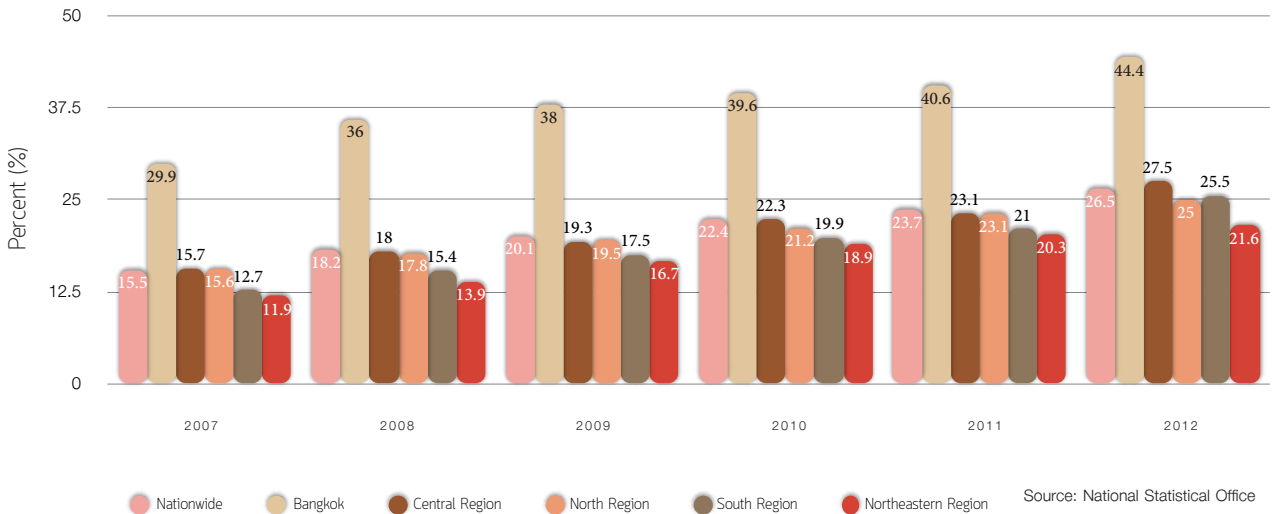
Total households nationwide **20 millions**
Households using Internet **3.7 millions**



In 2012, population at age 6 years old and above using Internet, Bangkok remained the area with the highest number of residents using Internet, similar to the previous year (44.4 percent or 2.8 million people). The Central, Southern, Northern, and Northeastern regions had the percentage of population using Internet 27.5 (4.1 millions), 25.5 (2.2 millions), 25.0 (2.9 millions), and 21.5 (4.6 millions) percents respectively.

This information reflects the inequality in accessing the Internet because most of the Internet users still concentrated in the economically advanced areas.

Percentage of Internet users in each region

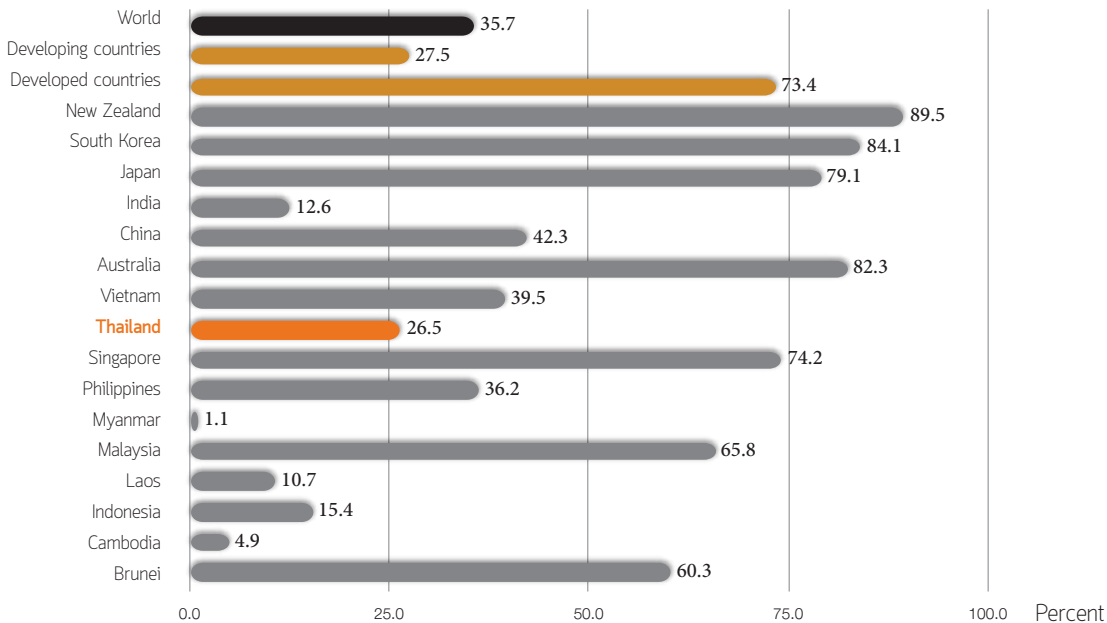


Number of Internet users in Thailand and ASEAN

In 2012, among ASEAN countries, Singapore had the highest number of internet users per population (74.2 percent), followed by Malaysia (65.8 percent), Brunei (60.3 percent), Vietnam (39.5 percent), the Philippines (36.2 percent), and Thailand (26.5 percent).

When compared with ASEAN+6, Thailand ranked 11, which was nearly the lowest, with the share of Internet users lower than the average of developing countries (27.5 percent) and lower than the global average (35.7 percent).

Percentage of Population Using the Internet



Source: 1. International Telecommunication Union (ITU)

2. National Statistical Office (for information about Thailand)



Conclusion

Although the fast development of mobile phone technology can help reducing digital divide, Thai citizens still face the problem of accessing to ICT as clearly seen from the vast difference in the number of Internet users in Bangkok versus other regions as well as inside versus outside urban areas.

Information and Communication Technology (ICT) is a crucial infrastructure of science and technology, which drives the competitiveness of the country. Therefore, the government should adequately and timely invest in ICT.

Thailand Science Technology and Innovation Profile 2014

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