
# NSTDA'S STRATEGIC PLAN
# 2012-2016

National Science and Technology Development Agency

A Driving Force for National Science and Technology Capability

# CONTENTS

# BACKGROUND AND ACCOMPLISHMENTS

# BACKGROUND OF NSTDA

The National Science and Technology Development Agency (NSTDA) was established by the Science and Technology Development Act in 1991 which combined 4 existing organizations: the Science and Technology Development Board (or STDB, jointly established between the United States and Thailand), and three other National Centers for Technology (the National Center for Genetic Engineering and Biotechnology: the National Metal and Materials Technology Center: and the National Electronics and Computer Technology Center).

NSTDA's principal mandate is to conduct and support research, development, and engineering, to provide technology transfer, and to develop manpower and S&T infrastructure for the country.

# OPERATION GUIDELINES

NSTDA is an autonomous entity reporting to a Governing Board chaired by the Minister of Science and Technology. NSTDA is an umbrella organization that plans and executes the four mandated missions of research and development, technology transfer, human resources development and infrastructure development. Today, NSTDA comprises four national research centers: BIOTEC (National Center for Genetic Engineering and Biotechnology), MTEC (National Metal and Materials Technology Center), NECTEC (National Electronics and Computer Technology Center) and NANOTEC (National Nanotechnology Center; established in 2003). In addition, NSTDA reaches out to other research organizations and universities through joint collaboration, contracted research, and other mechanisms to ensure that the best resources are being captured for the country's innovation needs. To tie all these together, the Technology Management Center (TMC), which was established in 2004, serves as a linkage between scientists and end users to provide applicable technology services.

NSTDA works closely with its partners from other government agencies and the private sector, both domestically and internationally, through different mechanisms to achieve these goals.
Since its establishment, NSTDA has developed 4 volumes of its 5-year action plans. They are:

1. Action plans for fiscal years 1992-1996
2. Action plans for fiscal years 1997-2001
3. Strategic plans for fiscal years 2002-2006
4. Strategic plans for fiscal years 2007-2011

The first action plan (fiscal years 1992-1996) focused on building a solid foundation of research and strengthening the research capabilities of the country. It emphasized the fields of biotechnology, metal and materials technology, and electronics and computer technologies. The plan also focused on human resources development and S&T infrastructure preparation for local innovation development that can be utilized by industry. Two new initiatives were crafted – the Thailand Science Park and S&T scholarships (for domestic and international universities) to build up future research personnel for the country.

The second action plan (fiscal years 1997-2001) deepened the implementation of the original plan but was linked more closely to economic and social development. It also continued to focus on the support required for R&D and research personnel development as part of capacity building in research, development and engineering. In addition, more support was provided to industries that would finally lead to their own R&D establishment. The private sector could also take advantage of the S&T infrastructure in Thailand Science Park. In addition, NSTDA strived to improve the country's Information Technology (IT) capacity. Examples of the IT related initiatives implemented include the Thailand Software Park, the spin-off of the Internet Thailand Public Company Limited, a number of important legal drafts (the Electronic Transactions Act, the Computer Crime Law, the Personal Data Protection Laws, and the Information Infrastructure Law), in addition to the first Thailand's IT Master Plan.

The third plan (fiscal years 2002-2006) included the establishment of the National Nanotechnology Center. FY 2006 marked the beginning of NSTDA's growth period when its annual budget allocated by the Government doubled from FY 2002 (fig. 1.1). As a result, NSTDA adjusted its operation plan to focus more on working with external agencies to form partnerships and leverage resources, as well as extending cooperation to regional areas where research truly makes an impact. In addition, NSTDA formulated strategies to provide support to targeted industries in the country. Using local resources in R&D was emphasized while driving the country towards a knowledge-based economy and society to enhance the competitiveness of the nation.

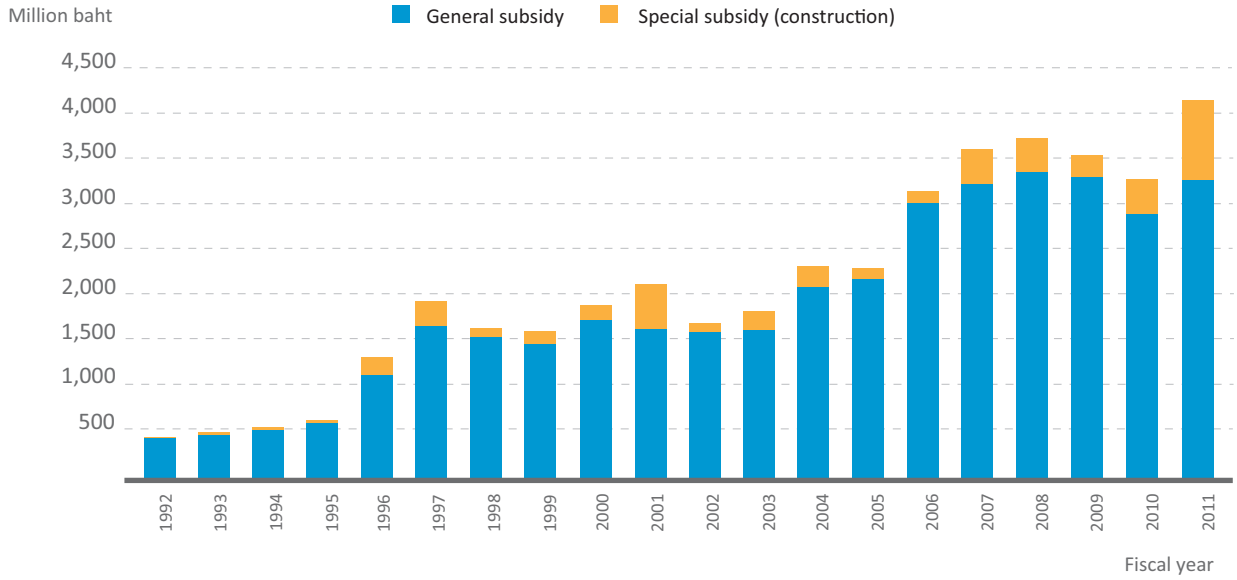



**Figure 1.1 The government budget allocated to NSTDA by the Bureau of the Budget from FY 1992 to 2011**

Note: The figure above does not include the central fund

# ACHIEVEMENTS DURING THE 4TH PLAN (FY 2007-2011)

During its 4th Plan, NSTDA revised its vision statement to be "NSTDA is a key Science & Technology partner towards a knowledge-based economy and society". In forming partnerships, NSTDA aligned and integrated its resources and capabilities to meet the needs of the country. The research outputs were transferred to stakeholders in the manufacturing, services and agricultural sectors as well as to local communities. In addition, the productivity at NSTDA was enhanced through the adoption of a system of program-based budgeting. This new scheme has led NSTDA to create closer connections among its research units. The cluster concept was implemented in this Plan. Eight clusters were created – Foods and Agriculture, Medicine and Health, Software, Microchips and Electronics, Automobile and Traffics, Alternative Energy, Environment, Textiles and Chemicals, and Communities and the Underprivileged. To prepare for further development by industry, NSTDA has tasked its national research centers to develop important and essential Platform Technologies, in parallel with its human resources and S&T infrastructure development.

During this 4th Plan, the Balanced Scorecard (BSC) was also adopted as tool for management. As a result, NSTDA outputs, especially the number of articles published, number of patents filed and number of technology transfers, increased significantly with a real socio-economic impact worth more than 10,000 THB/year.

Successful achievements included the development of a plastic for covering greenhouses, active packaging that extends shelf life for product, a system for traffic assessment and reporting on mobile devices, patenting of the Thai jasmine rice genome, and competitiveness enhancement of more than 2,000 SMEs. In addition, NSTDA has helped steer the establishment of several new agencies in the development of research and innovation for the nation. Examples of this work included the National Science Technology and Innovation Policy Office (2009), the Hydro and Agro Information Institute (2009), the Electronic Government Agency (2011), and the Electronic Development Public Organization (2011). The recent assessment of NSTDA by the Thailand Development Research Institute (TDRI) indicated that the program-based approach to implementation needs to be more focused and have stronger connection among the national research centers. In addition, research outputs were not yet well utilized by industries. More analysis needs to be done from this assessment in the drafting of NSTDA's 5th Plan.

# PERFORMANCE IMPACT ANALYSIS

NSTDA has reviewed its past performance and trends to identify internal and external factors that would impact the country. The role of S&T in the developing preventive measures and risk mitigation along with a search for real world research problems are synthesized to derive the direction and goals of future research plans for the medium and long term. A SWOT analysis of budget, human infrastructure and other risk factors in the next 5 years is being incorporated in the next strategic plan for NSTDA.

## EXTERNAL FACTORS

The 11th National Economic and Social Development Plan (2012-2016) identified a number of international factors which could have a direct impact on Thailand. They comprise: (1) changes in global trade rules and regulations which affect commerce including many tariff and non-tariff barriers to trade; (2) the arrival of emerging economies in Asia; the expansion of economies and demand from the BRIC countries (Brazil, Russia, India, and China); global recovery after the financial crisis; the potential for increases in the prices of gas and goods; and regional integration in parts of the world such as the ASEAN Economic Community (AEC) by 2015; (3) ageing societies and labor migration; (4) global warming, natural catastrophes, and more severe outbreaks of emerging/ re-emerging diseases; (5) the crises in energy and food, and in the balance between energy and food; and (6) the progress of technology, which is playing a more important role in economic and social development.

The above-mentioned changes can be either opportunities or threats to Thailand, and pose a number of challenges in terms of S&T development.

- Changes in the global rules and regulations regarding commerce, investment, finance, environment, and society. Tariff and non-tariff barriers to trade (e.g. labor measures; environmental measures, reduction of greenhouse gas emissions, carbon tax collection, carbon credits, sanitary and phytosanitary measures; human rights; anti-dumping and countervailing duties, etc.) can become either opportunities or threats to developing countries. Thailand will need to expedite the development of infrastructure and technology to cope with the new rules, regulations, and barriers to trade in order to facilitate the country's continuous economic growth.

• The emergence of new economies in the world and the expansion of the economies and demand from the BRIC countries (Brazil, Russia, India, and China). There has been a shift in economic power from western countries to Asia. The middle class in Asia is undergoing the most rapid growth in the world. The consumption of food and energy has increased, causing fuel and goods prices to rocket and there is a very significant growth in demand for new products and services.

• More regional integration in the world, especially for the ASEAN Economic Community: AEC2015. Integration would lead to more power in global economic negotiations. It would also affect the commerce, investment, and the free flow of labor in the region. Cooperation with neighboring countries in these areas would contribute to new opportunities as well as bring challenges to Thailand. Continued research and innovation development is therefore vital. This can be achieved by way of international cooperation, infrastructure development, standards improvement, and improved human resources, particularly in terms of English language ability. This will facilitate the free flow of goods, services, and skilled labor among the ASEAN countries, and allow Thailand to fully benefit from opportunities offered by regional economic integration.

• Shift to an ageing society. This is especially true for developed countries such as France, Sweden, the United States of America, Italy, and Japan. According to the 11$^{th}$ National Economic and Social Development Plan, the ageing population in Thailand will increase by 81.86 million people by the year 2016. There will be more demand for goods and services related to welfare and healthcare. The main focus, apart from health treatment, will be on ailment prevention.

With a move towards an ageing society, Thailand may experience a shortage of skilled labor, and in turn force labor-intensive industries to move their production bases elsewhere. These factors may result in higher unemployment among low-skilled Thai workers, which could lead to economic and social problems, and even unrest.

As a consequence, technology has become an essential learning tool. It serves to connect people of diverse backgrounds and creates opportunities to share their knowledge and experience harmoniously. In addition, technology can enhance economic activity in a number of sectors by improving productivity and decreasing costs.


• Global warming, climate change, and catastrophes. The impact of these factors has been seen in droughts and heavy rainfalls that result in flash floods which directly affect the country's economic activity and the well-being of its people. In the agricultural sector, there is a tendency for labor to migrate to the industrial and service sectors in cities as rural economic opportunities are affected by climate change and natural disasters. This leads to over-urbanization.

In addition, climate change has caused deterioration in the ecosystem balance, coastal erosion, coral reef bleaching, and other detrimental environmental effects. These impacts have negatively affected the tourism sector, one of the country's main industries.

Nevertheless, growing global demand for food, energy, and healthcare could represent opportunities for Thailand. If S&T could be utilized to maintain the agricultural productivity in the midst of climate change, Thailand can maintain its position as a major food producer while at the same time becoming a production hub for biofuels (as alternative energy). The energy crisis has many sectors focusing on the effective utilization of energy, clean energy, and renewable energy. This too presents an opportunity for Thailand to develop the innovation and technology to meet the rising demand for energy. In addition, with the input of S&T, Thailand can build on its reputation as an international healthcare destination.

In the 11$^{th}$ National Economic and Social Development Plan (2012-2016) draft, Thailand will attach importance to the applications of S&T as key drivers for the country's socio-economic development. The Government will create a supportive environment for science and technology; will encourage research and development; and will focus on creating a knowledge-based economy. The Government aims to raise the investment for R&D to not less than 1% of GDP, to raise the private-public expenditure ratio in R&D to 70:30 (from 40:60), and to increase the number of R&D personnel to 15 per 10,000 people (from the current ratio of 5.6 per 10,000 people) by 2016.

In addition, focus is placed on development and production of biofuels as sources of alternative energy. The focus is on developing economical production processes, investment of R&D for product quality, and the creation of standards or unique characteristics of the products. The agri- cultural and services sectors will be the main revenue generation base of the country.

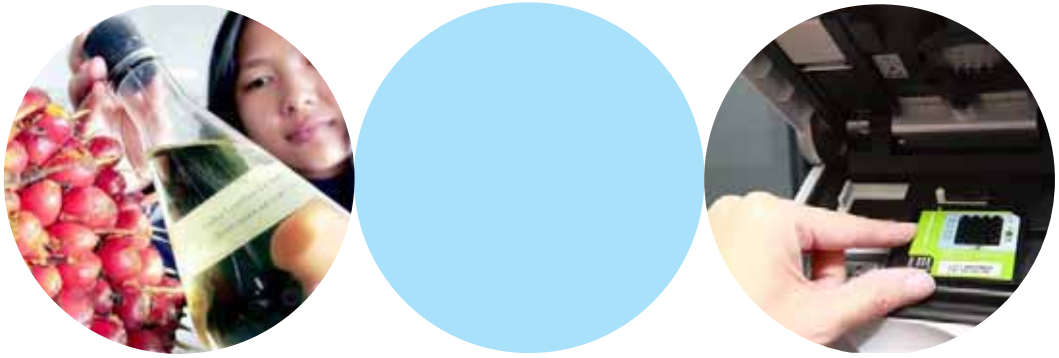
The 11th National Economic and Social Development Plan identifies a number of approaches to ensuring that science, technology, and innovation (STI) remain key drivers behind the country's socio-economic development:

- Development of infrastructure and management for the nation's logistics
- Enhancements, where appropriate, to become a regional medical hub
- R&D on climate change resilience for economic plants and animals
- R&D on energy efficiency
- Development of clean energy and alternative energy from household waste
- R&D on production and processing of agricultural goods to attain world-class quality and standards
- Development of channels to gain access to and make use of technologies that are appropriate for the development of a skilled workforce,
- Development of innovations for a creative economy and for the services sector
- Development of databases and geographic information systems for potential and sustainable management of natural resources such as water, soil, forest, coast, biodiversity and climate change

In addition, the plan addresses mechanisms to push forward the development of STI infrastructure. Examples include incentives for R&D investment and co-investment, joint research foundation establishment, intellectual property protection, Science Parks, incubator centers, R&D institutes, service centers for analysis and testing, research and other enterprise networks, improvement of database and indices, and improvement in rules and regulations that support business.

The 11th draft of the National Science, Technology, and Innovation Development Plan (2012-2021) is in accordance with the 8th Draft of the National Research Policy and Strategy (2012-2016) which was drafted by the National Science Technology and Innovation Policy Office (STI). The vision of this 8th Draft is focused on "Green innovations for sustainable economy with enhanced competitiveness and social well-being".

Its strategic framework is based on five principles: (1) Strengths of society, community, and locality; (2) Capability, flexibility, innovation in the agricultural, manufacturing, and service sectors; (3) Stability in energy, natural resources, and the environment; (4) Improvement of STI human resources; and (5) Development of infrastructure that contribute to sustainable STI development. This fifth principle also involves S&T development for handling the long term affects of global change.



# NSTDA'S INTERNAL STATE OF AFFAIRS

A review of past performance has shown that NSTDA has continued to grow in its activities and outputs while maintaining its strength in human resources. There are currently 455 Ph.D.s (17%) employed at NSTDA. Research and technical staff accounts for 67% of total personnel. When the 4th strategic plan comes to an end in fiscal year 2011, NSTDA is expected to have a workforce of 2,900 employees. When the 5th strategic plan concludes in fiscal year 2016, the number of employees will reach 3,250. This estimation is based on the hiring additional 70 employees per year as shown in Figs 2.1 and 2.2.

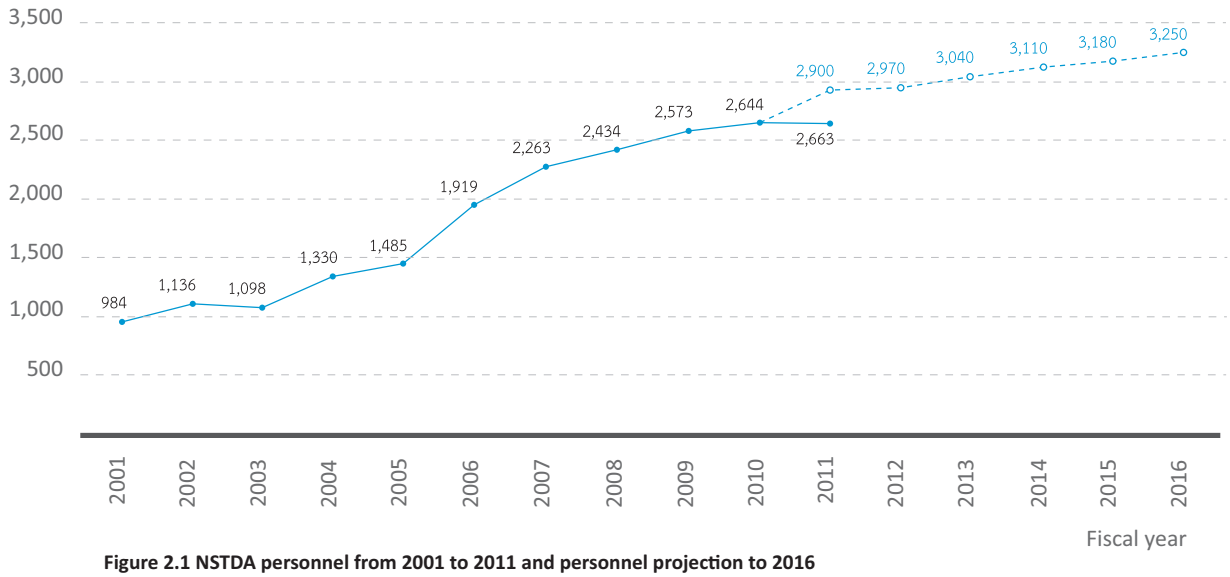



**Figure 2.1 NSTDA personnel from 2001 to 2011 and personnel projection to 2016**

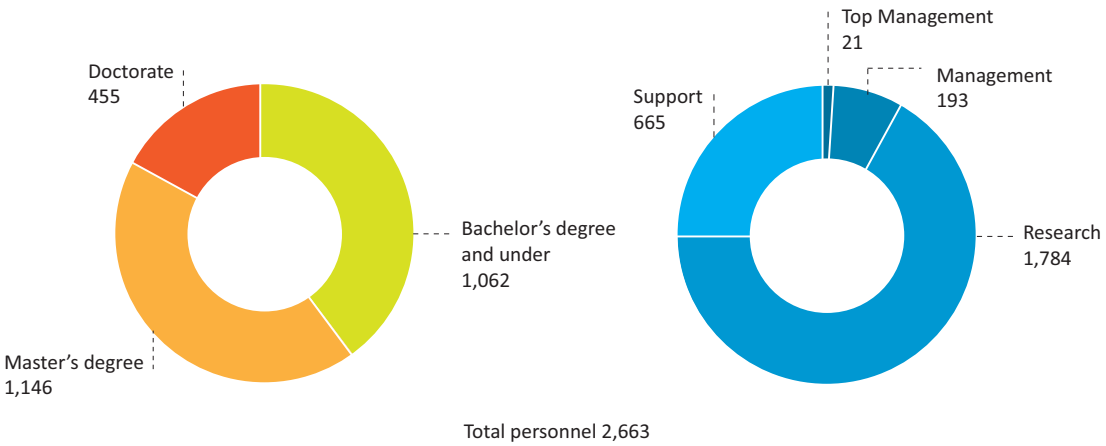



**Figure 2.2 NSTDA personnel categorized by education and position (as of Q3/2011)**

A comparison of performance data from 2003 onward in Figs 2.3-2.6 shows a continuing increase in terms of publications in international journals and patent applications by NSTDA researchers. In fiscal year 2010, the number of publications published in international journals and of patent applications was 639 and 178 respectively. The economic impact of technologies developed by NSTDA being adopted by various agencies and companies is estimated at over ten billion THB each year. It is expected that this impact will continue to increase. This has been achieved with a limited increase in the NSTDA budget allocation from the Government (the average budget increase has been 6% per year over the past five years). Therefore NSTDA needs to increase its budget ratio from other capital sources, such as the private sector, and must effectively manage its resources so as to keep all operations within budget.

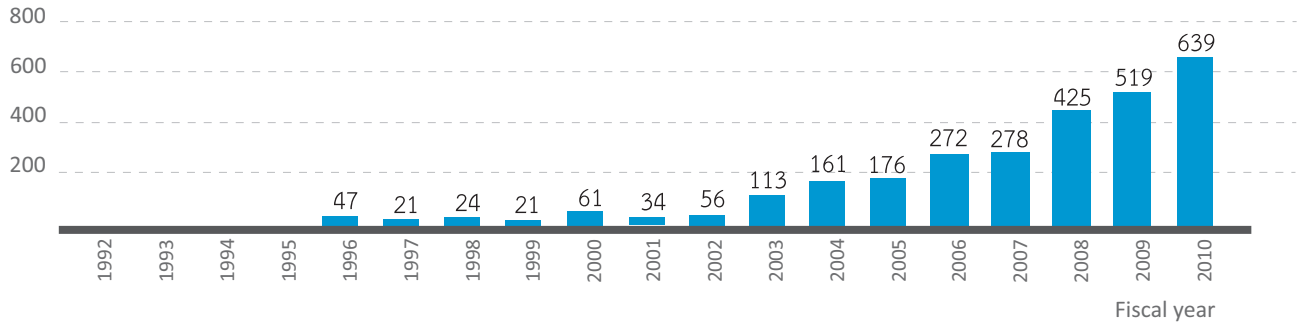



**Figure 2.3 NSTDA publications in international journals from 1996 to 2010**

Note: Data has been collected since 1996

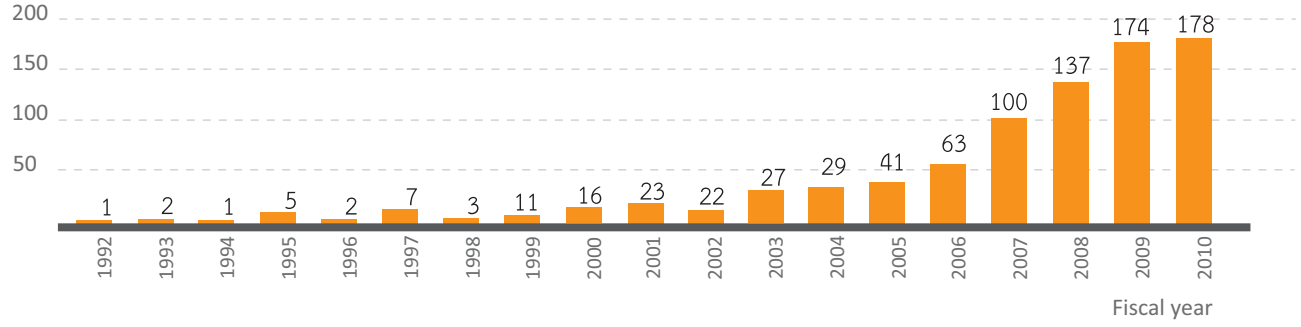



**Figure 2.4 The number of patent application by NSTDA from 1992 to 2010**

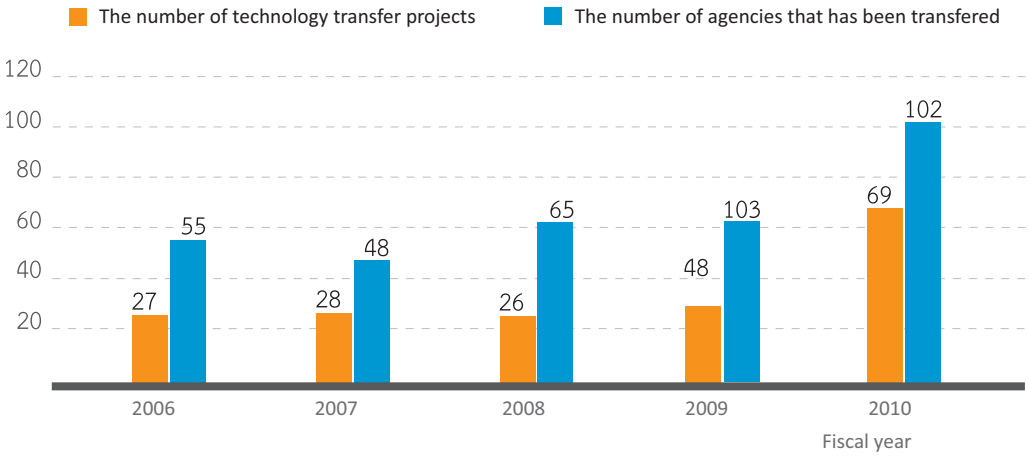



**Figure 2.5 NSTDA's research and development utilization**

| Impact | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Impact in terms of financial value (income from intellectual properties, services, and special projects) | 660 | 847 | 874 | 1,093 | 1,439 |
| Direct impact on economy (revenue and increased investment by clients) | 2,525 | 2,121 | 2,531 | 4,074 | 6,661 |
| Indirect impact on economy (decreased costs, savings, replacements for imports, and increased employment) | 7,179 | 6,079 | 7,759 | 23,024 * | 4,050 * |
| **Total** | **10,364** | **9,047** | **11,164** | **28,191** | **12,150** |

Unit: million THB

**Figure 2.6 Impacts resulting from operations of NSTDA on the economic and social sectors (2006-2010)**
Note: The above data have been collected since 2006.
* In 2009, the relatively high indirect impact was from the Western Digital project, causing a cost reduction of 8.1 billion THB.
* In 2010, there was a change in result reporting by Thailand Science Park where the operating results of those who rented areas from the BOI database were excluded. This explains the significant drop in the indirect impact.

In this phase of the strategic plan, NSTDA will acquire important infrastructure for the "Innovation Cluster II". This will double the area of operations in Thailand Science Park and provide more rental space to local and international technology based enterprises. The target is an increase to 200 tenants by 2016 from the current 60. In addition it is expected that Innovation Cluster II will catalyze increased cooperation among NSTDA researchers, other government agencies and the private sector. As a result, NSTDA needs to make the necessary provisions in terms of personnel and to ensure that the management of Thailand Science Park can respond effectively to these emerging opportunities and to the demands of the private sector.

# CHALLENGES EXPECTED IN THE NEXT FIVE YEARS

An analysis of both NSTDA's external and internal state of affairs has identified opportunities where NSTDA can perform most effectively in responding to global shifts and challenges as well as achieving national socio-economic targets. It is essential that NSTDA continue to build trust with the private sector and be seen to provide value which will ultimately lead to increased investment in science, technology and innovation by companies, both local and international. However, these challenges and opportunities can be difficult and complex. NSTDA's ability to develop technologies in a timely fashion and to ensure that they have real-world usability will be key to NSTDA's success.

NSTDA is responding by adjusting its methodologies that contribute to the integration of technology and competency both inside and outside of the organization. In addition, a system has also been arranged to provide support and motivation to suitably conduct research in accordance with this demand. Meanwhile, consideration is also given to the efficient use of existing budgets and resources as well.

NSTDA must also be able to respond to new challenges and these include operational strategies that include budgetary and financial stabilization as a result of the limited growth in NSTDA's annual budget allocation from the Government. What needed ranges from building effective mechanisms for working with partners to building sufficient confidence among customers or partners in delivering their budgets or resources to NSTDA for operations on their behalf. This will enable NSTDA to meet its national targets as well as those of its partners while being less dependent on government budgets.

With this focus on collaboration with outside partners through joint resources integration, NSTDA needs to adjust its organizational culture by highlighting the importance given to partners, customers, or stakeholders (i.e. a customer-focused culture). The expected outcome is that NSTDA will become a trusted R&D partner and partners will become increasingly confident in working with NSTDA to achieve their own R&D goals. Ultimately this will lead to increased investment by the private sector in R&D and to the creation of a balanced ecosystem of national research and development.

# VISION, MISSION AND CORE VALUES

NSTDA's vision, mission and core values reflect its operational plans for the next five years.

## VISION

"TO BE A KEY PARTNER FOR
A KNOWLEDGE-BASED SOCIETY
THROUGH SCIENCE AND TECHNOLOGY"

# MISSION

NSTDA has a mission bestowed by the 1991 Act of Scientific and Technological Development to operate and promote research and development, design and engineering, human resources development, technology transfer and scientific and technological infrastructure development. So far, the emphasis has been on maximizing research and development capabilities. However, for this 5th Strategic Plan, NSTDA is intending to create substantial and concrete economic and social effects through R&D. Therefore, an important goal is to distribute the outcomes of R&D that are socially and economically beneficial and valuable to the nation. R&D should be conducted to serve goals that actually transfer the technologies into the hands of users.

"NSTDA AIMS TO STRENGTHEN RESEARCH, DEVELOPMENT, DESIGN AND ENGINEERING FOR TECHNOLOGY TRANSFER, AND TO SUPPORT THE NECESSARY SCIENTIFIC AND TECHNOLOGICAL HUMAN RESOURCES AND INFRASTRUCTURE DEVELOPMENT TO SUSTAINABLY MAXIMIZE COMPETITIVE AND NATIONAL DEVELOPMENT CAPABILITIES BY FACILITATING EFFECTIVE AND SYSTEMATIC INTERNAL MANAGEMENT TO SUPPORT THE OPERATIONS OF EVERY DEPARTMENT."

# CORE VALUES

NSTDA's core values are:

## N = NATION FIRST

**Place the nation's benefits and public interests first and foremost.**

Take responsibility for society and the country at large.

## S = SCIENCE AND TECHNOLOGY EXCELLENCE

**Persist in creating excellence in every task.**

Seek knowledge. Take initiative and be creative to the highest standard.

## T = TEAM WORK

**Create team synergy and support.**

Have 2-way communication towards common goals.

## D = DELIVERABILITY

**Commit to delivering quality work**.

Deliver customer satisfaction inside and outside the organization.

Aim for the best outcome.

## A = ACCOUNTABILITY AND INTEGRITY

**Take responsibility.**

Always practice ethical, transparent and disciplined actions to the organization and one's profession.

# STAKEHOLDERS AND EXPECTATIONS

With high expectations from the government sector, private sector, civil society and academics, the success of NSTDA thus depends on its ability to meet them.

Since 2007, NSTDA has been using the Balanced Scorecard (BSC) as an organizational management tool to measure its success in achieving its goals. The success indicators are derived from consultation with customers and stakeholders. The stakeholders of NSTDA can be divided into four main groups and their expectations are as follows:

| Stakeholders | Expectations |
|---|---|
| **1. Agencies for policy development, resource allocation and government regulation** (e.g. the Ministry of Science and Technology, the Bureau of the Budget, the Office of the National Economic and Social Development Board, and the Cabinet) | • For NSTDA to be economical and rapidly deliver usable products that can be widely deployed (within 1-2 years). The organization's objectives must be precise and not overlap with those of other agencies. |
| **2. Alliances/Customers**<br>**2.1 Alliances** include agencies who work with NSTDA as partners, having shared objectives, goals and interests.<br>**2.2 Customers** include those who use NSTDA's products or services for their entity's benefit. | • For NSTDA to be open and accept their input into account.<br>• For NSTDA to operate effectively and respond quickly. To receive useful information, services and advice from NSTDA regularly while sharing their inputs. |
| **3. Staff of NSTDA.** They are producers and service providers to partners and/or customers utilizing their knowledge, skills and abilities. | NSTDA must:<br>(1) Be clear on its personnel's roles and duties;<br>(2) Allow staff to develop their potential;<br>(3) Give feedback on their performance regularly;<br>(4) Provide a flexible working environment;<br>(5) Prepare their career advancement and development; and<br>(6) Provide opportunities for employees to strengthen their best capability. |
| **4. General Public** (e.g. representatives of different social segments) | To see NSTDA's output or products that can be widely used and improve quality of life, environment and economy, as a whole. |

**Source: The NSTDA's Partners Survey of Expectations and Satisfaction report, 3 November 2010.**

In summary, the main expectation for NSTDA is that successful research and development leads to useful outputs. This depends on the sets of problems and needs of the clusters and target industries. Other factors include directions of research, proper selection and utilization of technologies, current technological capabilities and those being developed, joint operation with stakeholders and alliances. Equally important are the effective mechanisms of passing on the developed technology, which will be discussed in the next chapter.

# NSTDA OPERATIONAL GOALS AND DIRECTIONS FOR 2012-2016

# OVERALL OPERATIONAL GOALS

NSTDA is committed to working with partners to conduct R&D whose outputs to be put to practical use and have high value for society and the economy. NSTDA has determined its overall operation to meet Thailand's S&T development goals as follows:

- To conduct research with outputs of practical use that will benefit the country's economy and society with a value three times its expenditure.
- To support the manufacturing, services, and agricultural sector to double their investment in fiscal year 2011 through R&D expenditure.

In order to achieve its goals, NSTDA will improve its management processes and focus on conducting and promoting R&D of high potential along the value chain of targeted industries and clusters. High potential target research groups are those which will create significant socio-economic impact using NSTDA's R&D output. In parallel, NSTDA will focus on human resources development together with constructing the necessary infrastructure to effectively transfer technology.

# RESEARCH MANAGEMENT AND TARGET RESEARCH CLUSTERS

In the current strategic plan, NSTDA will continue to support research programs that integrate with research clusters. The research management system implemented aims to deliver outputs of a high standard and quality. It promotes cooperation between internal research units and other organizations to meet the needs of beneficiaries as well as the targets for the country.

**Targeted Research Clusters** were formed in order to focus on research problems that have practical output with high impact. Each cluster consists of a number of Research Programs and each Program comprises several Research Projects. The four national centers under the NSTDA umbrella play a vital role in conducting research within this framework. They are also tasked to develop "Platform Technologies" and focus on building new and important technology bases in different branches of science. One primary objective is to develop production processes that can respond to the industrial needs in the clusters, both for the present and for the future.

Furthermore, NSTDA has initiated a new **"Cross-Cutting Program"** to link the various research groups, targeted research clusters and the platform technology groups more effectively. The goal of this program is to ensure that NSTDA's research and development activities have the highest chances of success in being adopted by various industrial sectors. The relationships between the research clusters, the cross-cutting program and the platform technology groups are illustrated in Fig. 4.1:

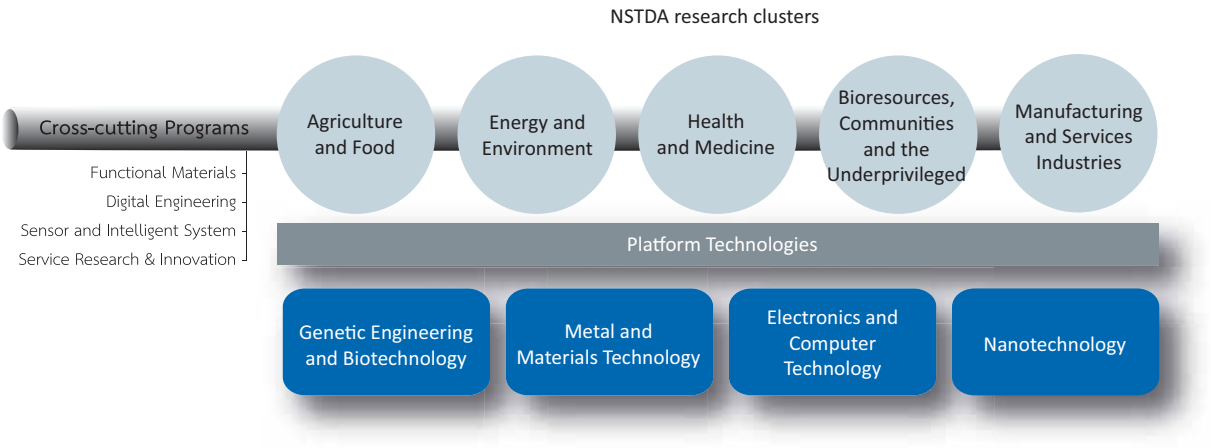



**Fig. 4.1 NSTDA research and development clusters during the fifth strategic plan**

# TARGETED RESEARCH CLUSTERS

To streamline its operations, NSTDA has reduced the number of targeted research clusters from 8 to 5. They are: Agriculture and Food; Energy and Environment; Health and Medicine; Bioresources, Communities and the Underprivileged; and Manufacturing and Service Industries. Details of each of these clusters and the various research programs within the clusters are provided below.

## 1) Agriculture and Food Cluster

The Cluster approach seeks to apply S&T across the whole value chain by maximizing productivity and reducing post-harvest losses, improving the quality of food products, and producing in a sustainable manner. This cluster focuses on increasing the country's capabilities in the production of three important economic crops which are rice, tapioca and rubber.

**The Rice Program:** The Rice Program aims to increase the rice industry's competitive capability throughout the production chain while reducing environmental impact. Key operation plans include: (1) Developing technology for rice breed improvement and better production efficiency; focusing on the use of molecular marker technology in rice breed development for desirable attributes such as climate and pest tolerance while giving high yields; passing on to farmers and target communities the technologies for rice seed development to allow sufficient availability of high quality seeds; developing agricultural equipment and machinery; and developing information systems to monitor rice disease and pest outbreaks to minimize yield losses. (2) Improving rice mills by appointing engineering specialists to provide guidance on efficiency development; improving the efficiency of medium and small rice mills to double production; reducing power consumption and reducing losses from damaged rice. (3) Developing rice processing technologies and processes for improved safety standards; and developing new value-added rice products to ensure product diversity. (4) Developing logistics systems for increased efficiency and to reduce costs by implementing information and communication technology in delivery and logistics management. (5) Minimizing environmental damage, avoiding trade barriers and focusing on the development of technologies for rice farming, low greenhouse gas emissions, and water consumption reduction by such methods as rice variety improvement.

**The Tapioca Program:** The target for the Tapioca Program is to increase the competitiveness of Thailand's tapioca industry throughout the production chain while minimizing negative environmental effects. The program pays great attention to four main operations: (1) Developing technologies which help enhance the efficiency of tapioca production by increasing the yield from 3-4 tons/rai to 5-6 tons/rai though culture control and breed selection. Also involved is biotechnological breed improvement and the development of efficient tapioca harvesting, which helps farmers reduce the amount of tapioca left in the soil and minimizes labor costs. (2) Improving and developing the efficiency of tapioca production to reduce the consumption of power and heat by improving tapioca factories' biogas production systems. (3) Developing technologies and processes for modified tapioca flour production and for the development of new value-added products. This will help reduce dependence on imported raw materials while supporting new industries such as bioplastics, medical polymers and bio-based products for animal food production. (4) Developing and distributing tapioca ethanol production technology.

**The Rubber Program:** The aim of the Rubber Program is to develop technologies that will help increase production efficiency, modernize natural rubber production technology, produce value-added natural rubber products, and upgrade the capabilities of medium and small rubber product producers such as the manufacturers of rubber gloves and tires. The program is focused on three activities: (1) Conducting research and development on drought-tolerant rubber tree breeds, improving breeding technology and developing highly-efficient harvesting equipment and technologies; (2) Modernizing production technologies for higher quality natural rubber products using clean technology; (3) Improving the competitiveness of the rubber glove and tire industries by providing infrastructure support in terms of product analysis and testing to international standards, and on machine efficiency improvement.

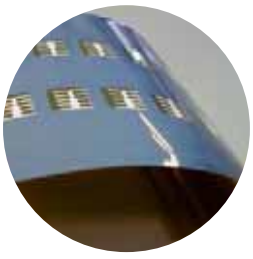
In addition to these flagship programs, NSTDA also supports a number of other research programs including the following: **The Seed Program** aims to support the use of S&T to increase the capabilities of the country's seed production industry. The overall target is to increase the seed export value to 5,000 million THB by 2016. The operations focus mainly on sustainable germplasm management, biotechnology for improved efficiency in new breeds through cooperating with the private sector; the development of disease diagnostics which are essential for production and export; and giving support to small seed producers for high value seed production. The research and development is focused mainly on corn, chili, tomato, and melon.

**The Animal Health and Production Program** is determined to strengthen animal production technologies by emphasizing domestic resources and raw materials so as to reduce dependence on imports. The operations concentrate on using biotechnologies for animal breed improvement such as molecular marker technology in pig and shrimp breed improvement. The program also focuses on the developing vaccines including hemorrhagic septicemia and cattle tick vaccines, foot and mouth disease vaccines for pigs as well as vaccines for poultry. This research and development aims to extend the effectiveness of vaccines for better convenience

in the field of medicinal management, production and testing. The passing on of technology to users should also be made easier. Meanwhile, research on animal feed emphasizes the improvement of nutritional efficiency of major, minor, alternative and supplementary ingredients. This can lead to the development of suitable food formulas which result in higher capacities of cattle, chicken, pig and shrimp production, both in field testing, and in commercial distribution.

**The Plant for the Future Program** is targeted at extending the capacity of technologies for breed improvement and technology management to increase production efficiency and effectiveness. It focuses mainly on energy crops such as sugar cane and palm oil as well as on the development of adaptive, global-warming-tolerant plant breeds.

**The Food Innovation Program** concentrates on supporting the use of S&T for quality food production where value-added products can be made safe for consumers. This program is conducting R&D in the area of evaluation and risk management of food bacteria such as Campylobacter and Salmonella in chicken, *Vibrio parahaemolyticus* in shrimp, and toxins used during food production. Not only is scientific information on food safety a necessity in world trade negotiations to avoid trade barriers, but it can also be used for the management of safe and better quality food production. Additionally, the program is also committed to conducting research for the development of food products and production processes through joint operations with the private sector.




## 2) Energy and Environment Cluster

NSTDA gives priority to the utilization of S&T for energy security and minimizing environmental effects, especially greenhouse gas emissions. This is to increase the trade and environmental competitiveness of Thailand's industrial sector, particularly for the agricultural and food industries.

The target technologies include:

**(1) Technologies for efficiency measurement and evaluation of resources and energy consumption, and the effects on environment throughout the life cycle of materials, processes, products and the organization.** This cluster uses the materials and energy life cycle databases as reference in the evaluation and development of an environmentally friendly future. It also supports evaluation systems for carbon footprint, water footprint, biological variety, ecological economic efficiency, sustainability and effects on other important environmental factors in accordance with international standards. The goals are for Thailand's industrial sector to be sustainable and globally competitive.

**(2) Technologies for resources and energy efficiency consumption,** waste management, industrial production and power consumption in large buildings, commercial buildings and households, focusing on the utilization of technologies that are widespread in industry including motors, steam boilers, compressors, pumps and electric fans.

**(3) Technologies for renewable energy production with economic impact** in the short and medium term. These include biofuels production systems, electricity power generation from biomass or municipal solid waste, biogas production and the use of solar energy for water heating and agricultural product dehydration. New energy production technologies will also be developed and these include biofuels for the future, green products for engines, solar energy systems, and carbon capture and energy storage technologies.

### 3) Health and Medicine Cluster

NSTDA emphasizes the use of science, technology and innovation to increase the efficiency of preventive and rehabilitative health care and medical treatment. This cluster comprises the following programs:

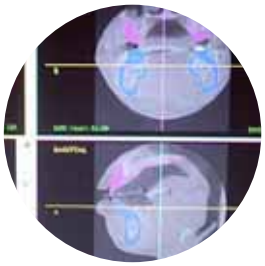
**(1) The Emerging and Re-emerging Infectious Diseases Program** aims to build a knowledge base and products that respond to and solve the problems of emerging and re-emerging diseases such as hemorrhagic fever, malaria, influenza, avian flu, tuberculosis, melioidosis and chikungunya. The program provides support for significant and urgently needed research and development including test kits, medicines, vaccines and spread-prediction technologies. The three main operational goals are to develop prototype hemorrhagic fever vaccines that can be tested on Phase 1 patients; to develop prototype substances for malaria prevention to be tested on small animals; and to develop the potential of epidemic-spread-prediction systems through the use of mathematical models by 2016.

**(2) The Clinical Genetics Technology Program** seeks to develop technologies and data for the prediction and prevention of chronic diseases and diseases in the elderly such as osteoporosis and nephropathy, as well as developing test kits or technologies for the pharmacogenomic diagnosis of medicinal allergies in Thai people. Emphasizing the prevention of severe drug allergies and the responses to expensive medicines that require continuous use such as those for cancer and psychiatric treatment, the three main goals are to develop genetic diagnosis technologies for severe medicinal allergy prevention; to identify biomarkers for the study of disease development from early stages for the timely prevention of certain diseases including kidney disease; and to increase the efficiency of the prevention and diagnosis of osteoporosis by 2016.

**(3) The Materials, Equipment and Technology for the Disabled and the Elderly Program** aims to develop technologies and innovations for the safety, monitoring, rehabilitation, and improvement of life quality for the disabled and the elderly so as to provide them with a good quality of life. The program supports small industries that produce instruments and equipment for the disabled and the elderly by focusing on research and development on four-joint substitute kneecaps; visual interpretation systems for the Thai language for the mute; and hearing aids for deaf students. Prototypes will be developed for mass production by the private sector at a later date.

**(4) The Hospital Practice and Medical Devices Support System** aims to put to use integrated technologies, especially IT, management and materials technologies, to solve problems that may occur during medical operations. This program also supports community service centers as a means to improving the efficiency and effectiveness of public health services in Thailand.






### 4) Bioresources, Communities and the Underprivileged Cluster

This cluster focuses on utilizing S&T to enhance community capabilities and to improve their quality of life (health, environment and education). Such improvements make a good "science for community model" which will help other communities develop themselves and form a knowledge base of bioresources management. This can help to save the environment and minimize the effects of global warming on bio-diversity, and will be concretely beneficial in value-added product production.NSTDA provides support to rural communities by transferring technologies that will improve the quality of life of farmers in target areas of the country. These include technologies to solve saline soil problems, technologies for coastal resource rehabilitation and utilization, bio-organic fertilizer production, better highland rice and soy products, organic agriculture and alternative energy technologies. In addition, NSTDA will strengthen local communities through the formation of community enterprises, which will enhance crop production and the processing of specialty harvests. Farmers who join this program can apply the know-how to achieve and maintain a sustainable livelihood. Model science communities will be established to illustrate effective self-sustainability and independence using local and communal resources. Such model communities will lead to the establishment of other "Science Communities". NSTDA will also promote S&T learning in schools while supporting the community enterprises, an important factor in building sustainable communities

The Bioresources Program aims to build knowledge and local management capability, to develop techniques and tools to conserve and restore bioresources, and reduce the impact of global warming on local biodiversity while adding economic and social value to local bioresources. NSTDA will support the development of tools for conserving, restoring and reducing the impact of global warming on wildlife and the ecosystem such as biological indicators/warnings, restoring forests/carbon-capturing wildlife and managing endangered plant and animal species.

A national database of living organism resources will be established to provide support for research on the applications of microbes. The utilization of these bioresources (e.g. enzymes for agricultural and health industries and screening processes) will provide added value to the industrial bio-technology products while reducing the import of microbes and related goods.



### 5) Manufacturing and Service Industries Cluster

NSTDA is aware of the importance of R&D for technologies in the manufacturing and service industries in order to enhance capability, create added value and thereby improve competitiveness in these industries. It has set up R&D strategies for the manufacturing and service industries for the years 2011-2016, focusing on manufacturing industries vital to Thailand's economy. These are the hard disk drive industry, the air-conditioning and refrigerator industry, and the automobile and automobile parts industries.

**(1) The Hard Disk Drive Industry Program** supports Thailand's goal of continuing to being a competitive R&D hub for hard disk drives in the region and to maintain existing manufacturing bases. Key operational plans include R&D that will increase production efficiency and technology for testing hard disk drives and their parts. This will support Thai entrepreneurs and allow them to design and produce satisfactory automation systems for hard drive producers to increase the value content of Thai products in the industry, and to develop production processes of hard drives of 5-10 Tbpsi. This will increase Thailand's attractiveness as a destination for advanced research.

**(2) The Air-conditioning and Refrigeration Industry Program** seeks to encourage the Thai air-conditioning industry to participate in R&D work for air-conditioning products, which will lead to added value for products and exports. NSTDA researchers will work with the private sector in the joint design and development of principal components including R&D on new heat exchangers.

**(3) The Automotive and Automotive Parts Industry Program** is focused on helping build local capacity in the design of automotive parts including energy efficient electronic drive systems. In the short term NSTDA will support the commercial production of multi-purpose vehicles and electric car prototypes, while the medium-term plans are to produce light-weight body parts and chassis, and to come up with technologies that will help design and produce light-weight small passenger cars. Such products will be competitive in performance, weight, and price without compromising safety.

# CROSS-CUTTING PROGRAMS



The four cross-cutting programs at NSTDA comprise technologies that can be developed and applied across several clusters. These are:

**(1) Functional Materials Program**

Initially this program will focus on producing plastic films that have specific qualities to support the agricultural and food industries, developing construction materials and production technologies to minimize power consumption, and developing medical materials for medicinal use. Additional functional materials will be developed in coming years.

**(2) Digital Engineering Program**

The objective of this program is to increase confidence in the use of digital engineering technologies by Thai industries involved in the design and manufacture of automotive parts, air-conditioners and condensers as well as machinery and steel production. Joint research between government research agencies, educational institutions and the private sector is being encouraged. This is to increase the potential and quality of product design processes, and to develop production processes in industry. The expectations are for digital engineering technologies to solve design and production problems, reduce production time and costs thereby increasing the competitiveness of these industries.

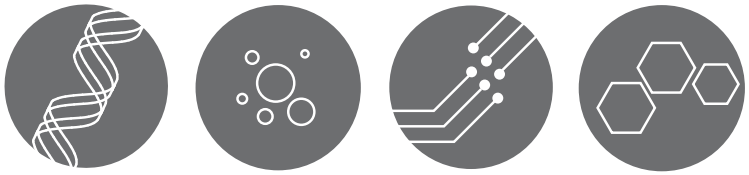
**(3) Sensor and Intelligent System Technologies Program**

This program targets the development of bio-sensor technologies which can be applied across a number of industries such as ensuring food safety in the shrimp and chicken processing industries, and measuring and controlling fertilizer and water dispersal in farming operations. NSTDA is also developing bio-sensors capable of air pollution analysis and water and soil analysis.

**(4) Service Research and Innovation (SRI) Program**

The overall goal is to support service innovations to increase the potential of Thai industry by developing and promoting basic elements of SRI such as cloud computing, software tools, and new business models. Once distributed, industries can learn to use and apply these elements to independently create effective and sustainable service innovations.

# PLATFORM TECHNOLOGIES



NSTDA's four National Centers are engaged in developing a number of platform technologies which are focused on building new and important technology bases in different branches of science. The primary objective of these technologies is to support the industrial needs of the clusters, both now and into the future. There may not be an immediate need for these technologies but it is expected that industry will increasingly draw on these technologies in the future.

### (1) Platform Technologies for Genetic Engineering and Biotechnology

NSTDA is focusing on the research and development of three technologies: **(1) Functional Genomics Technology:** The goal is to study the relationship between gene expression and genome data, and to quickly extend the capabilities of metabolite studies as well as the studies of essential substances as a whole. The understanding of living organisms can allow for the application of genetic information and thus help to develop technologies for faster analysis and processing of several tasks such as base order identification, omics, protein analysis and bioinformatics analysis. **(2) Microbial Biotechnology:** The objectives are to increase the technological capabilities for multi-gene modification, to improve the control of biosynthesis pathways, to create cells with desired properties and functions, and to develop technologies for microbial cultivation for essential substances production at the pre-industrial level. Also, this group of technologies will support the synthesis of substances at an extensive rate for increased capabilities for the utilization of living cells as bio-product manufacturing factories. This should help produce high-value substances effectively. **(3) Agro-Biotechnology:** This type of technology development is to develop infrastructures that match biological safety standards to support plant breeding and genetic modification, improve the capability of the technologies relating to specific gene expression of plants and technology for highly effective gene or gene cassette transfer, and to invent technologies for the benefit of research and development in disease diagnosis, preventive vaccines and emerging disease prevention in animals. Fig. 4.2 illustrates the targets of the three platform technologies:

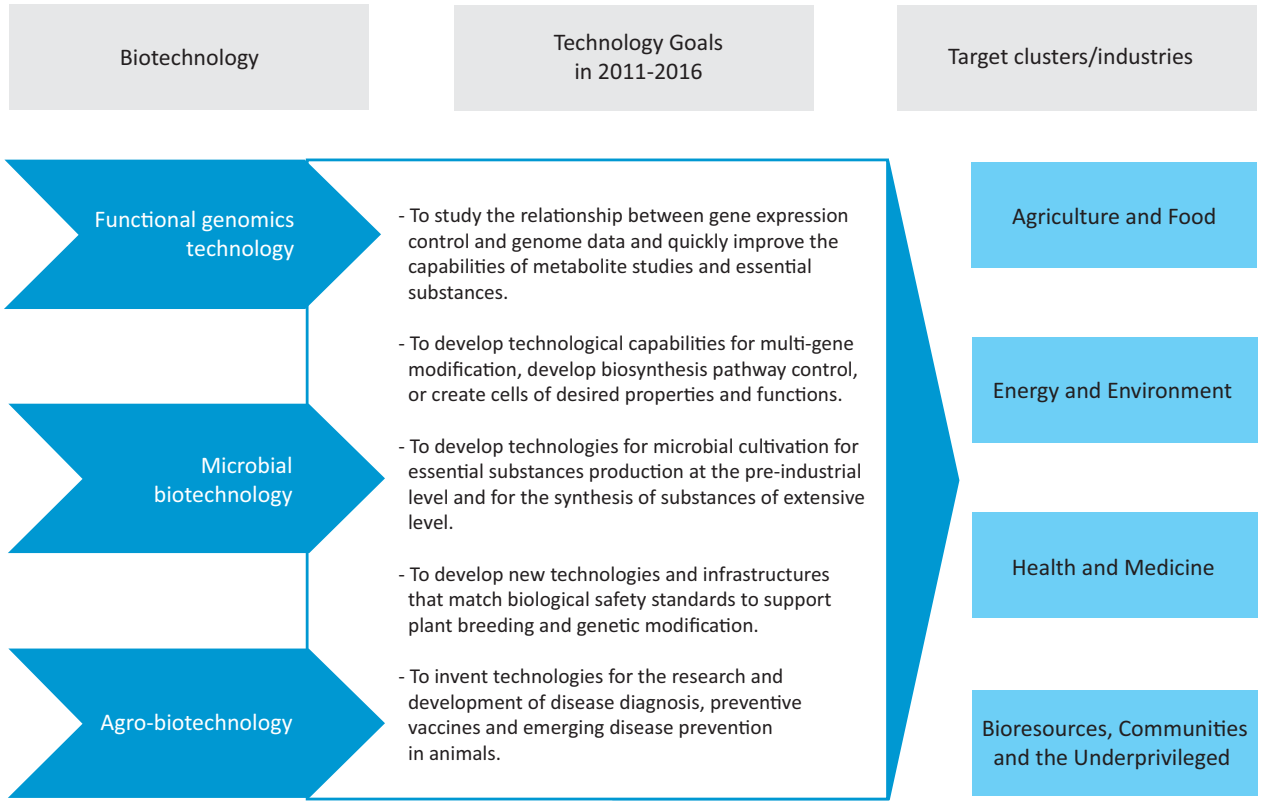



**Figure 4.2 Goals of Platform Technology for Genetic Engineering and Biotechnology**

### (2) Platform Technologies for Metal and Materials

This group of platform technologies represents an important base for the country's development. As the market demands that materials and production processes be improved for products to be competitive, the development of basic materials technologies is necessary to support both the research clusters as well as industrial growth now and into the future. **Computer Aided Design, Engineering and Manufacturing Technology** emphasizes the creation and development of computer programs (CAD/CAE) to help with materials for design and production simulation. This is to analyze and identify whether a product in the design process can be used effectively and to avoid trial and error in prototyping. Such technologies save a lot of time and money as detailed in Fig. 4.3 of the overall targets of the program. **Materials Design and Production Technology** aims at applying technological knowledge of materials to product development in terms of design, quality and for the production process. They help to produce products of the desired quality while saving time and cost and with reduced input in terms of energy and resources. This relationship is detailed in Fig. 4.4.

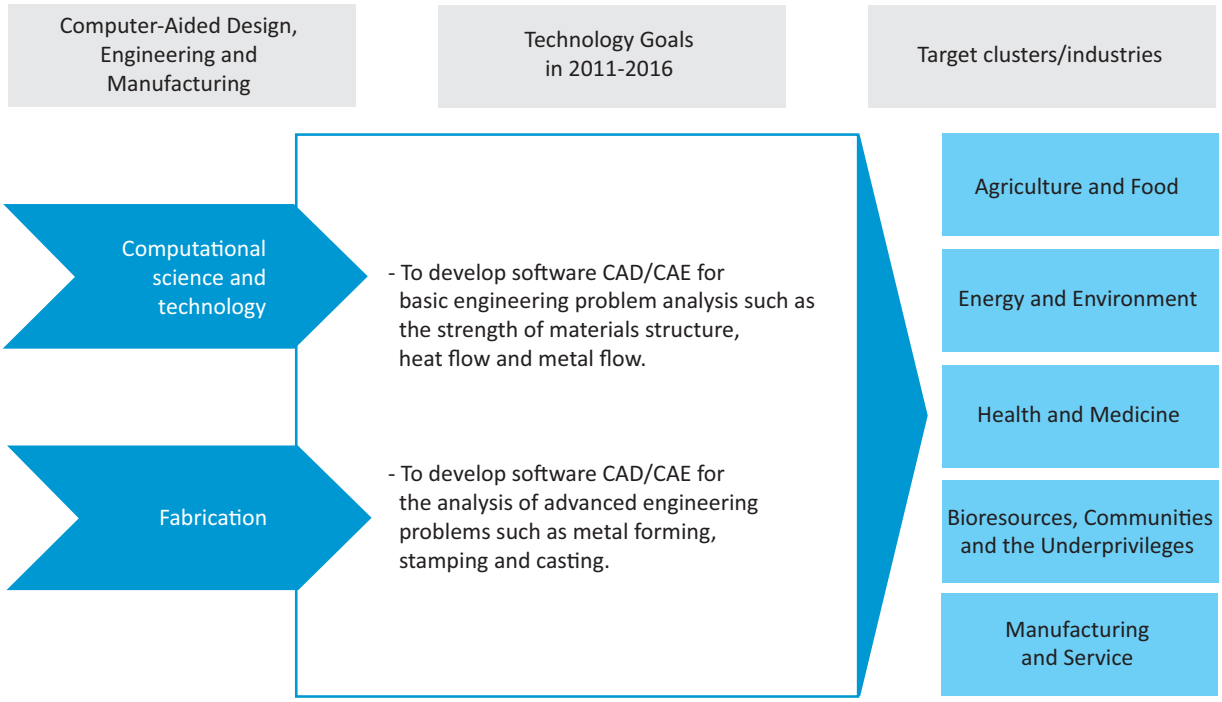



**Figure 4.3 Goals of Computer-Aided Design, Engineering and Manufacturing Platform Technology**

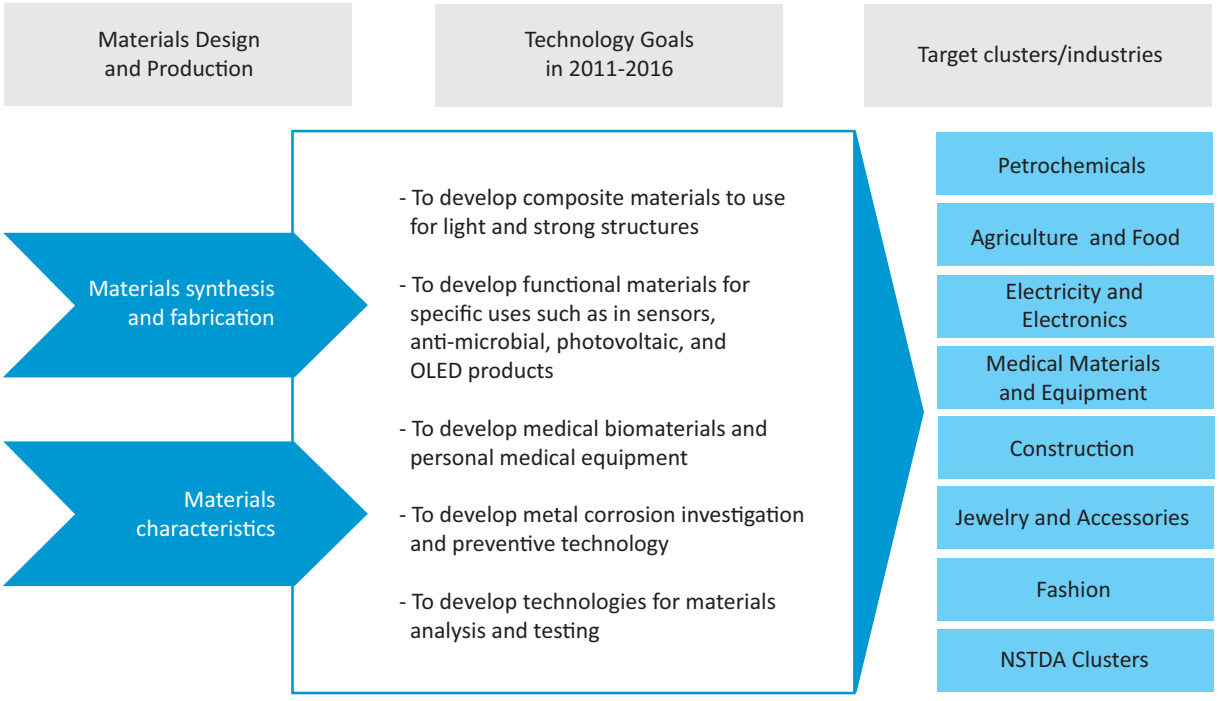



**Figure 4.4 Goals of Materials Design and Production Platform Technology**

### (3) Platform Technologies for Electronics and Computers

These platform technologies are to be applied toward the product, process, or components of products and services by focusing on the creation and development of technologies for innovation on the basis of the strength of core technologies in electronics and computers presently owned by NSTDA. This will lead to end applications that can serve and link with the information technology and communication framework for Thailand or "Smart Thailand 2020" concerning innovation, "green" technology, usability, digitally connected, universal design and interoperability. The applications will be passed on to different clusters that support related product and service industries, especially those related to software, microchips and electronics.

NSTDA has decided to focus on R&D of two main platform electronics and computer technologies: **(1) Electronic Devices and Systems Technology:** The focus is on platform technologies in the form of devices and systems that are anticipated to play important roles in creative differentiation when applied to innovations at a cluster level, especially for agricultural and energy sectors. It was found that embedded systems, power electronics systems, and photonics, including a new generation of electronic devices relating to these three systems, have high potential in serving the needs of widespread inventions in the form of products or services within 3-5 years. **(2) Service Informatics Technology:** The objective is to focus on the research and development of technology to serve a wide range of service-based businesses that come in many forms. These include digital data and the use of 3D visual information and infrastructure for the Internet. Movements and the exchange of activities should occur while semi-automatic information access will be utilized and truly serve the actual needs of the country. The goals of platform technology in electronics and computers are defined in Figs. 4.5-4.6.

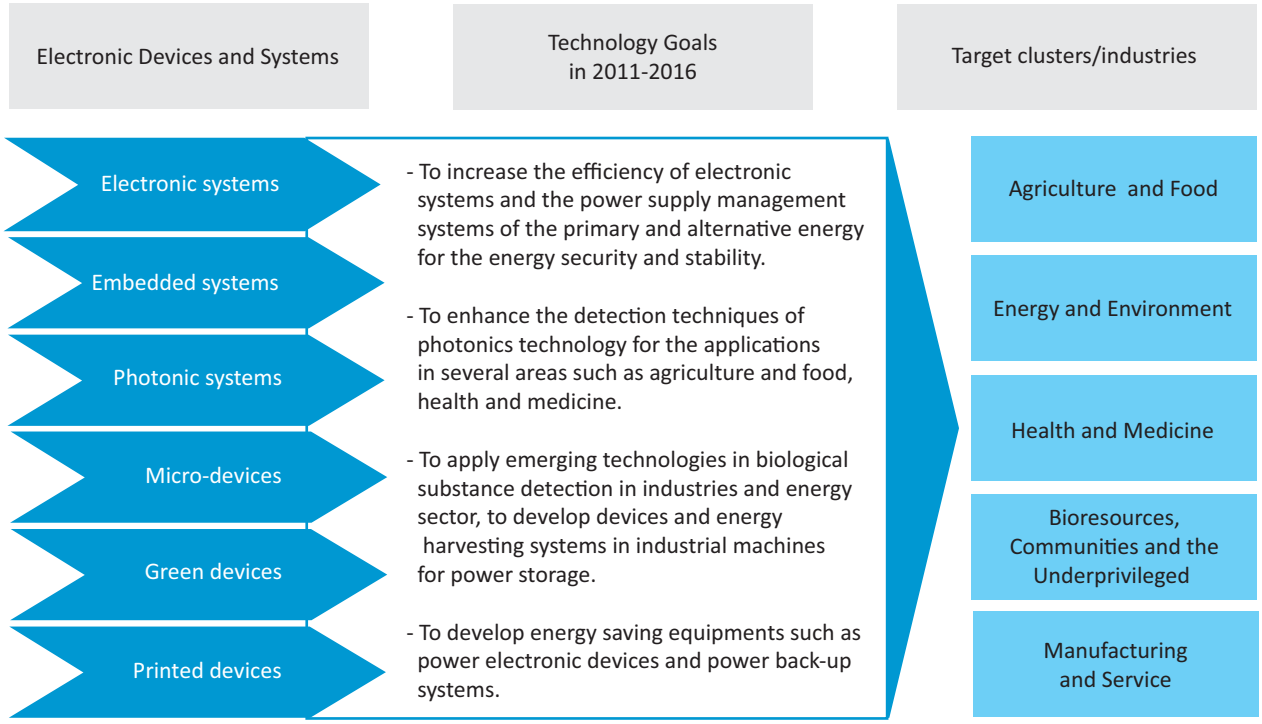



**Figure 4.5 Goals for Electronic Devices and Systems Platform Technology**

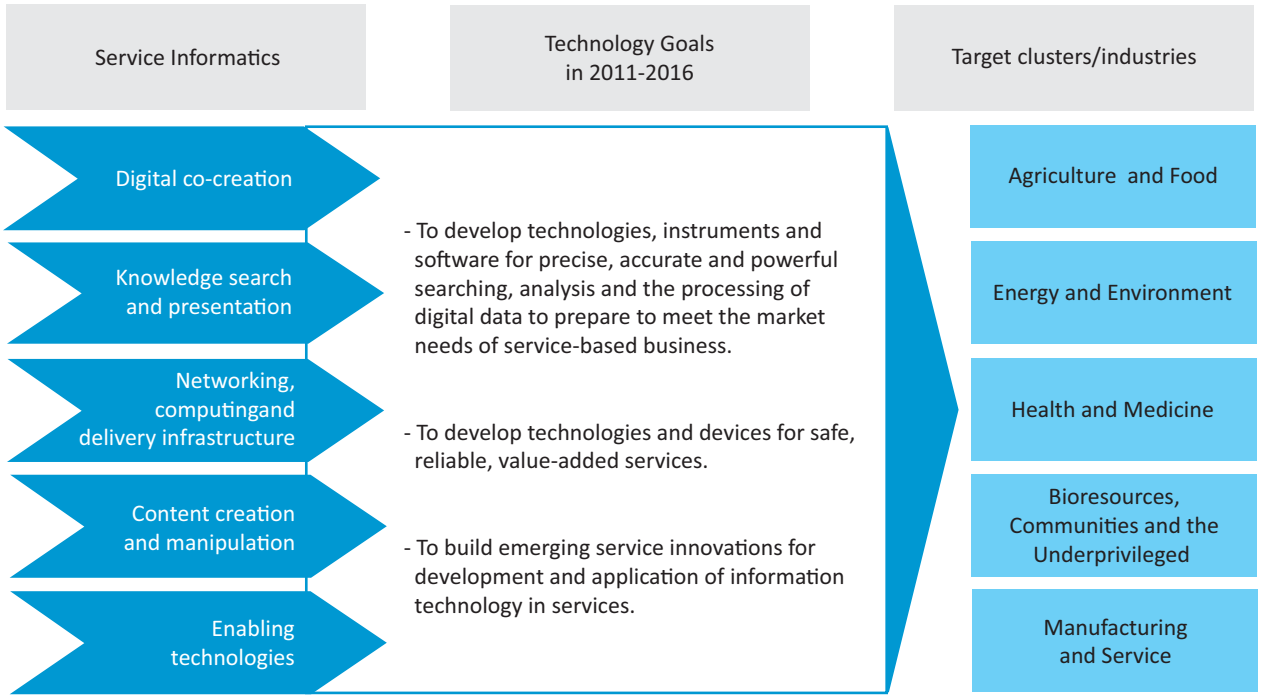



**Figure 4.6 Targets for Service Informatics Platform Technology**

**(4) Platform Technologies in Nanotechnology**

This group of platform technologies is based on nanoscience and nanotechnology and focuses on R&D in 3 groups: **(1) Nano-coating** utilizes the special qualities of nano-particles and/or to use a coating technique to improve the surface quality of products by coating them. Such products will be better to use and the specific qualities will also add more value to them. **(2) Nano-encapsulation** involves the research and development of a special substance wrapping and retaining system. This helps to add stability to certain substances and control the time and place at which they are released. **(3) Functional Nanostructure** is associated with the design, synthesis, modification or structural fabrication of nanometer level materials. Special physical or chemical qualities of functional applications can be added to them. The targets for platform nanotechnology are detailed in Fig. 4.7.

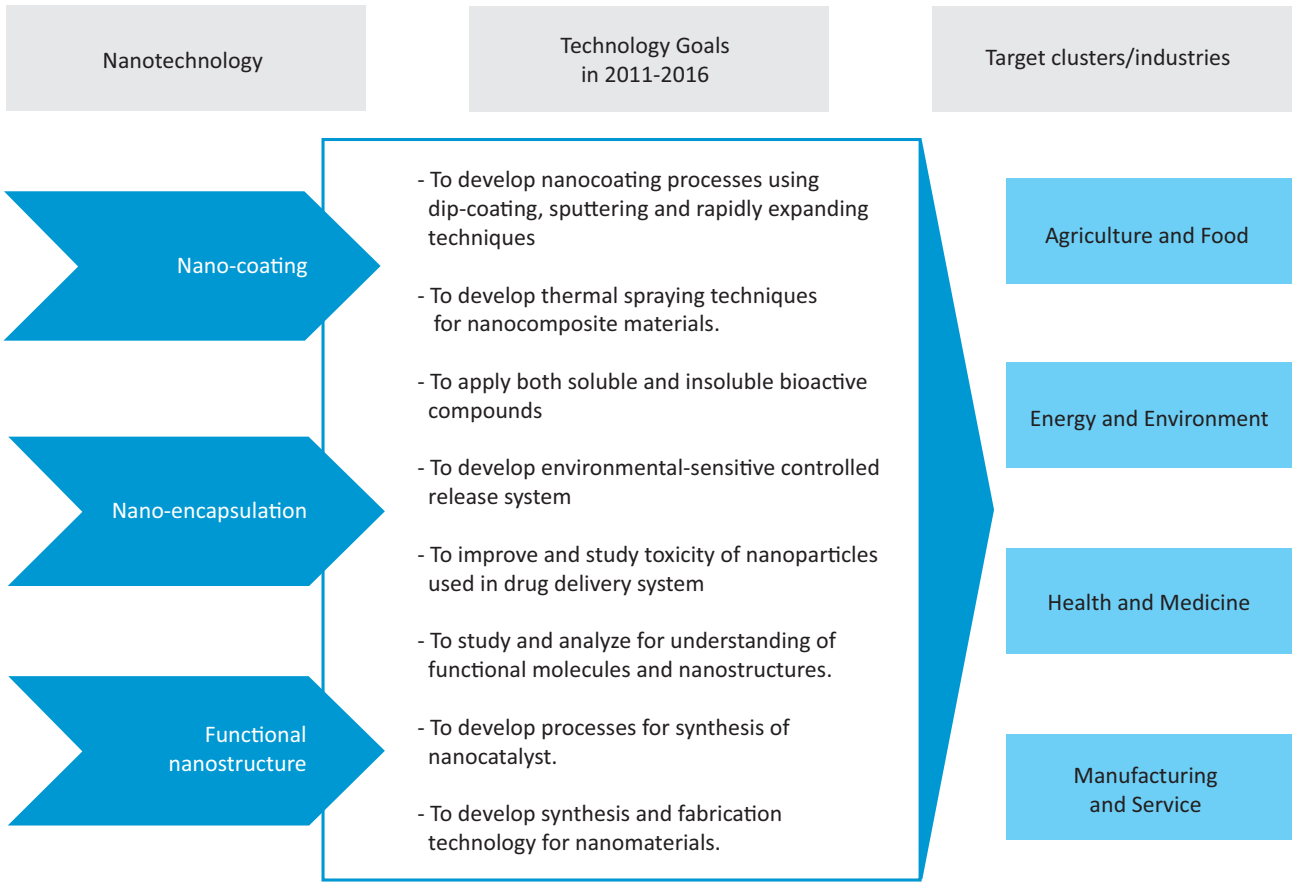



**Figure 4.7 Goals of Platform Technology for Nanotechnology**

# DELIVERY MECHANISMS

This strategic plan puts emphasis on the development of delivery mechanisms to ensure that NSTDA's R&D work reaches the end-user in the most effective and efficient manner possible. The main mechanisms are (1) accelerated delivery and (2) entrepreneur support.

## Accelerated Delivery Mechanisms

These mechanisms aim to support the transfer of technology by making full use of NSTDA's capabilities in terms of commercialization and utilization. The mechanisms will bring in participants or beneficiaries and focus on cooperation with other organizations in the form of networks and partnerships. The main means by which NSTDA achieves this is through the Technology Licensing Offices (TLOs) and Business Development Units in each of the National Centers. These are key units through which NSTDA manages the rights and intellectual property surrounding NSTDA's research, and they are the primary link to NSTDA's customers. To support this effort, NSTDA operates an effective marketing and brand creation campaign which builds NSTDA's reputation as a solution provider and a valuable R&D partner. This work also ensures that the activities of the National Centers are communicated to the public in a consistent manner through the use of a common brand. In addition NSTDA is supporting and encouraging its researchers in engaging with business partners and alliances, providing clients with technology market intelligence, as well as establishing a service network that links potential technology users with the NSTDA's Research Department and Technology Rights Management Unit. During this strategic plan, the organization shall operate through the NSTDA Commercialization Group (NCG), a working group consisting of representatives from the units and departments mentioned above, to improve these mechanisms to ensure they are systematic and effective in promoting NSTDA's research capabilities.

## Entrepreneur Support Mechanisms

NSTDA employs several mechanisms to support cooperation with the private and government sectors. The goal is to increase the intensity of activities in S&T jointly conducted by NSTDA and the production and service sectors. The main supportive mechanisms can be divided into four groups: technical support service provision, business and financial support, human resources development and basic structural support for entrepreneurs.

### (1) Technical Services

NSTDA's main objective is to stimulate research and development in many sectors, and one way it is doing this is by being a solution provider through the provision of analytical, testing, guidance, and cooperative and contract research services. The main targets are entrepreneurs in the production and service sectors, especially SMEs, to help them increase their capabilities to apply S&T in production and service process improvement. One important goal is to expand the scope of the existing technological support mechanism for industries, the Industrial Technical Assistance Program or iTAP, to the Industrial Research Assistance Program, or iRAP, which supports more research and development of the private sector.

### (2) Business and Capital Management

The most important goals are to facilitate and encourage investment in research and development by the private sector through the provision of low interest loans, joint business development and investment,

### (3) Human Resources Development for Entrepreneurs

This mechanism will conduct special training that links the research conducted by NSTDA with both public and private needs, and helps keep the private sector up to date on rapidly developing technologies.

### (4) Infrastructure Support

Thailand Science Park (TSP) is the country's leading integrated R&D hub which came into operation in 2002. It is managed by NSTDA's Technology Management Center and is a critical component in Thailand's efforts to strengthen its capabilities in research and innovation. In addition to the state-of-the-art facilities and business space, the park offers a comprehensive range of value-added services to support technology businesses.

# THAILAND SCIENCE PARK AS AN INNOVATION DRIVER FOR THE PRIVATE SECTOR

Thailand Science Park is an affordable and reliable choice for companies looking to set up a presence in Asia to tap into the growing market opportunities in the region. Tenants of the park benefit from a full range of services and support, including:

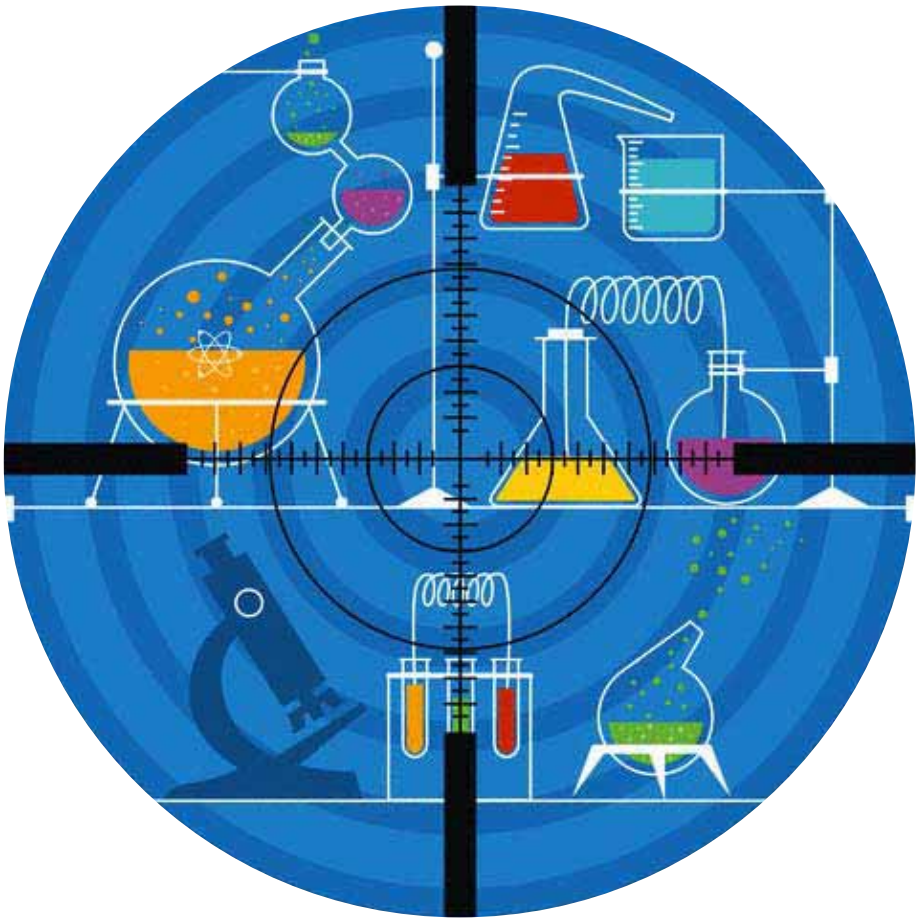
- Technology and Technical Support under the Industrial Technology Assistance Program (ITAP)
- Financial Support under the Company Directed Technology Development Program (CD)
- Intellectual Property Services provided by the Technology Licensing Office (TLO)
- Contract Research and Collaborative Research Support from the Science and Technology Knowledge Services (STKS)
- Revenue Tax Exemption supported by the Research and Development Certification Committee Secretariat (RDC)
- Joint Investment Fund administered by the NSTDA Investment Center (NIC)

Tenants also will enjoy the privileges and incentives accorded to companies operating in BOI Zone 3, the most attractive of all BOI incentive schemes.

Thailand Science Park will further support the industry through its Thailand Science Park-Incubator (TSP-I) programs. The TSP-I program aims to help promising start-up companies and aspiring entrepreneurs turn their unique product ideas into successful businesses. TSP-I will incubate these start-ups and get them ready to go to the market. Some of these start-ups will eventually 'graduate' from the program and become tenants of TSP.

Thailand Science Park is able to support the R&D and business activities of technology companies of all sizes.

- Young technology startup companies can set up at the TSP-I to accelerate their early stage growth by tapping into comprehensive business support services and subsidized facility support.
- Small and growing technology companies can rent space in the incubation building at a subsidized rate to carry out their research activities.
- More established and larger technology companies can choose to either rent space in existing facilities or lease a plot of land to build their own facilities. The TSP is able to offer technical, financial, human resource, legal and business support to tenants to make it affordable for them to conduct research activities at the TSP.



# NSTDA STRATEGY MAP, EVALUATION AND DIRECTION

NSTDA uses the Balanced Scorecard since its Fourth Strategic Plan for the implementation of its corporate strategy. The Balanced Scorecard has also been used as a tool to communicate the strategy to staff at all levels and all units. Thus, employees understand the direction of growth and competition, and consistently perform their duties in a coherent manner. In the Fifth NSTDA Strategic Plan, its strategy map, based on four perspectives of the Balanced Scorecard are determined. They consist of stakeholder perspective; partner, customer and financial perspectives; internal perspective; and learning and growth perspective. NSTDA has set ten strategic objectives in its strategy map (Fig. 5.2)

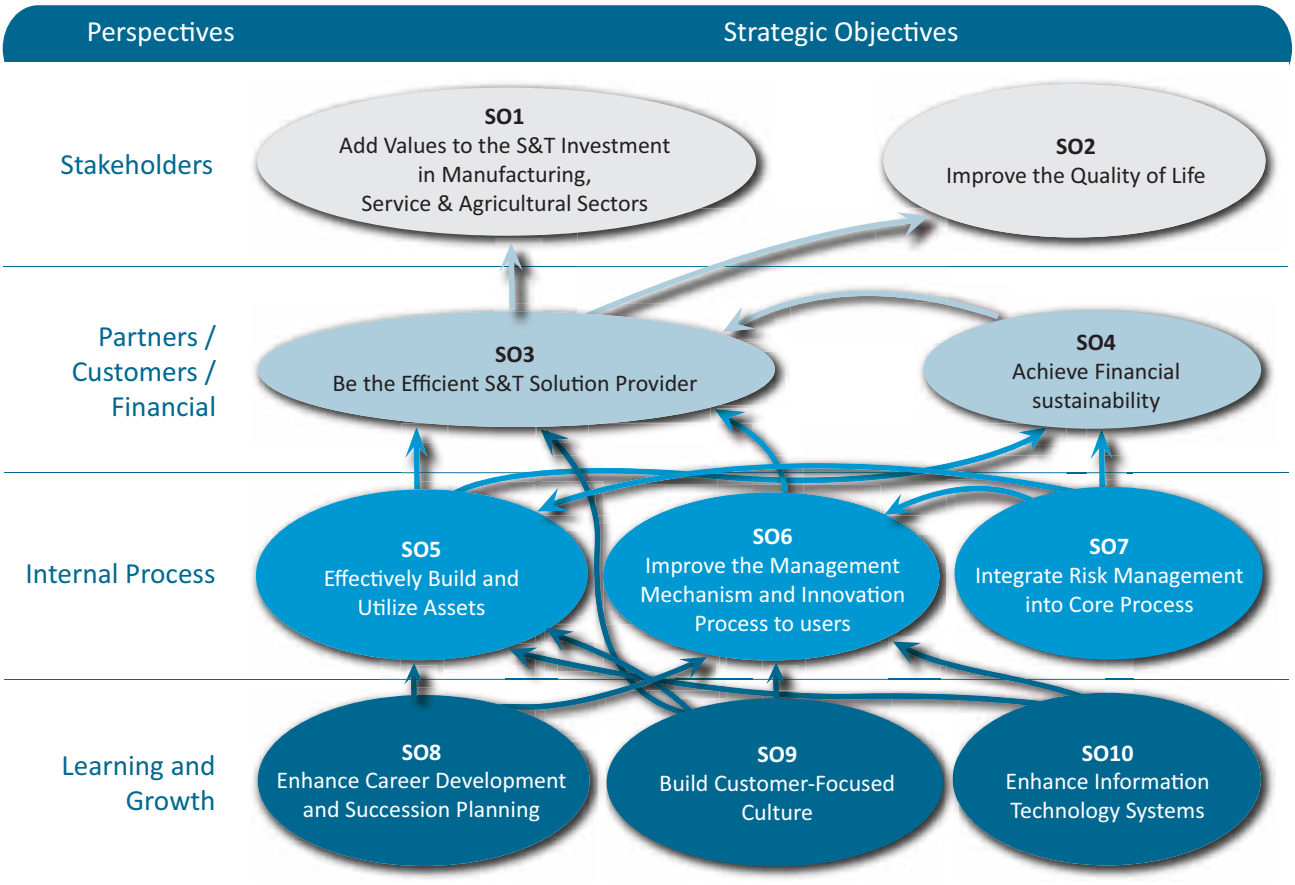



**Figure 5.2 NSTDA strategy map for future sustainability**

### SO1: Add value to the S&T investment in Manufacturing, Service and agricultural sectors

NSTDA must be able to efficiently apply S&T in the production, services and agricultural sectors. It must create confidence in all sectors, thereby increasing investment in S&T activities in order to raise the value of products and services, and enhance their competitiveness.

| Indicators: | Target: |
|---|---|
| Investment in S&T activities in the production, service and agricultural sectors | Investment will double at the end of fiscal year 2016 compared to fiscal year 2011. |

### SO2: Improve quality of life

NSTDA focuses on the application of S&T to benefit society, improve quality of life, conserve and rehabilitate the environment, and create a mechanism that raises social awareness on science and technology, which will lead to a knowledge-based society without destroying culture and traditions.

| Indicators: | Target: |
|---|---|
| The volume of work resulting from the collaboration between NSTDA and partners that improves the quality of life for communities or groups in terms of the economy, education, health, environment, and safety. Such work must have good publicity and be positive. | At least ten outputs by fiscal year 2016. |

### SO3: Be the efficient S&T solution provider

NSTDA must develop the capabilities of its units and collaborate with partners in producing work, until it garners better credibility from users/customers, resulting in more permanent use of the S&T services of NSTDA.

| Indicators: | Target: |
|---|---|
| 1) The number of new customers.<br>2) The number of old customers who return. | Increase new customers by 20% and keep existing customers by at least 80% within five years. |

### SO4: Achieve financial sustainability

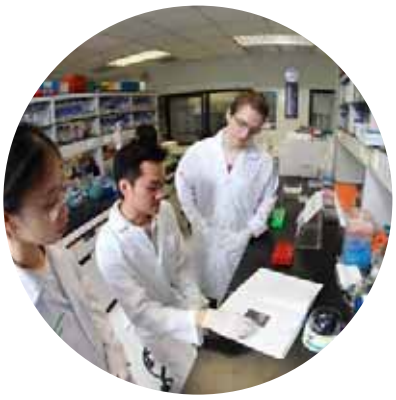
To improve the organization's stability, NSTDA must build itself in such a way that it will always be the first choice to provide science and technology services to solve the problems of the nation, business and industrial groups, organizations, communities, and the public. Although NSTDA does not focus on revenue generation and profit maximization as businesses do, higher income proves the value of NSTDA work that benefits the country. NSTDA must use the revenues for S&T development, properly aiming at enhancing the country's competitiveness and improving the quality of Thai people's lives.

| Indicators: | Target: |
|---|---|
| Revenue/expenditure ratio | Revenues will not be less than expenditure at the end of the fiscal year of 2016. |

### SO5: Effectively build and utilize assets

With capable personnel and correctly analyzed data under effective risk management, NSTDA needs to accelerate its development in order to increase the value of the existing assets, both tangible and intangible. The aim is to make NSTDA the first choice in science and technology.

| Indicators: | Target: |
|---|---|
| Total income/total assets ratio | Total income to total assets at the end of fiscal year 2016 will increase by at least 30% compared to fiscal year 2011. |



### SO6: Improve the management mechanisms and the innovation process to users

With the aim of making NSTDA the first organization in stakeholders' minds when they think of science and technology, the agency must improve the flexibility and speed of processes in all systems to suit internal and external changes, including rapidly changing technology. Also, it must maintain good and transparent control systems under effective risk management. These include research management systems from innovation to users, research delivery, budgetary planning, and internal and external communications.

| Indicators: | Target: |
|---|---|
| The research management system from innovation to users, research delivery mechanisms, budget planning systems, and internal and external communication systems have qualifications in accordance with the requirements*, and must be practical and compatible. | The qualifications of the systems comply with the requirements 100%. |

* Remarks: The requirements are as follows:

1. Set the cost structure of services and cost and activity management.
2. Apply the Stage Gate and Technology Readiness Level (TRL) in budgeting and planning process for expanded investment, commercial utilization, and effective internal and external communications.
3. Systematize research management, laboratories and research units, focus on the large multidisciplinary projects and deliver research output to users. Create a mentoring system, increase the number of non-permanent research staffs and foster innovation.
4. Cultivate a culture of strategic and planning to employees to consider effective resource management. Encourage NSTDA employees at all levels to participate in planning, procurement and management of resources.
5. Develop databases and utilize relevant data, such as science and technology progress, capabilities of related agencies, local and global technology trends.
6. Make NSTDA to be recognized through the media by compliance with NSTDA PR strategy. Build NSTDA communication platform infrastructure and create the 'single message' for communication.

### SO7: Integrate risk management into core processes

NSTDA has the ability to manage risk and appropriately integrate risk management in its operations. Risk management must consider the interests of all stakeholders in all sectors.

| Indicators: | Target: |
|---|---|
| NSTDA has Enterprise Risk Management. | The Enterprise Risk Management is in compliance with ISO 31000 |

### SO8: Enhance career development and succession planning

Human capital is a fundamental resource for all research units so effective human resources management is therefore vital. NSTDA must offer personnel development and career advancement through systems that allow skilled and experienced personnel to grow and reach their full potential. At the same time, NSTDA must develop and prepare personnel for important positions in the organization. The human resources development and management needs to be in accordance with the organization's changing situation and circumstances.

| Indicators: | Target: |
|---|---|
| NSTDA has personnel who are ready to take up key positions continually. | All important positions. |

### SO9: Build a customer-focused culture

Under NSTDA core values, its personnel should deliver qualitative and quantitative work to beneficiaries. The aim is to make all activities in the chain of work and services effective, and efficiently deliver work that meets the needs of customers or end users.

| Indicators: | Target: |
|---|---|
| Survey results on positive recognition of those using NSTDA work and services, which focus on customers/users. | Above 80% |

### SO10: Build a customer-focused culture

NSTDA must use Information Technology to manage data taken from a variety of activities and operations in order to obtain useful information for management. In addition, the agency must apply Information Technology to improve the working environment and enhance flexibility and creativity.

| Indicators: | Target: |
|---|---|
| Working effectively anywhere, anytime, based on the security of data. | Working 24 hours x 7 days per week. |

# STRATEGIES THAT NSTDA MUST IMPLEMENT TO ACCOMPLISH ITS OBJECTIVES

Objectives determine "What does the organization work toward?" but strategies indicate "How can the organization achieve it?" NSTDA has identified nine strategies to achieve the above objectives:

**Strategy 1 (be consistent with SO1, SO4 and SO6):** Collaborate with partners in all missions for value creation/added-value in terms of production and services. Help push for science and technology to become a national priority. NSTDA has to increase funds from other sources rather than the national budget to achieve its goals and it must control operating expenses.

**Strategy 2 (be consistent with SO2):** Use S&T to enhance the economy and help communities improve revenues; health and safety through activities by collaborating with partners; and R&D networks involving technology transfer and personnel development.

**Strategy 3 (be consistent with SO3, SO6, SO9 and SO10):** Grow NSTDA into an open organization in both "physical and psychological aspects", and develop a corporate culture focused on the needs of NSTDA customers. Develop a smart call center and smart information system connecting NSTDA complete and accurate research data with the needs of customers.

**Strategy 4 (be consistent with SO3, SO5 and SO6):** Develop comprehensive research management starting at the level of labs, research units and joint operation units. The organization must be able to apply its Technology Readiness Level in planning, making investment decisions and in achieving results. It must have management systems for intangible assets, such as intellectual property, know-how, know-why and copyright in order for the effective continuation of research development.

**Strategy 5 (be consistent with SO5 and SO6):** Be cost-effective in providing services (training, collaborative research, commissioned research, counseling and technique services). The organization needs to effectively use both tangible and intangible assets, and encourage and support its personnel to achieve their full potential.

**Strategy 6 (be consistent with SO3, SO8 and SO9):** Systemize personnel development and management in order to continuously have a new-generation of leaders ready for key positions. The personnel need to understand the demands of customers/users, have high management capability, morality and ethics, and be able to continuously innovate.

**Strategy 7 (be consistent with SO10):** Integrate data from various internal and external sources (personnel data, budget and planning data, and research data). The data must be verified and analyzed correctly so that they are reliable and can be used by management for decision-making in a timely manner. Users, both NSTDA personnel and outsiders, can access all information systems with a single window secure entry and the system must be efficient anytime, anywhere.

**Strategy 8 (be consistent with SO3 and SO6):** Develop data warehouses useful for the organization and the country. These should include the progress of related S&T, the capabilities of related agencies, the conditions and trends of industry/targeted local and overseas technologies.

**Strategy 9 (be consistent with SO7):** Efficiently integrate NSTDA risk management with the management system in compliance with ISO 31000.

National Science and Technology Development Agency
111 Thailand Science Park,
Phahonyothin Road, Klong 1, Klong Luang,
Pathumthani 12120, Thailand.
Tel. +66 2564 7000
Fax. +66 2564 7004-5
www.nstda.or.th