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The 6th Strategic Plan

(2017-2021)

National Science and Technology Development Agency
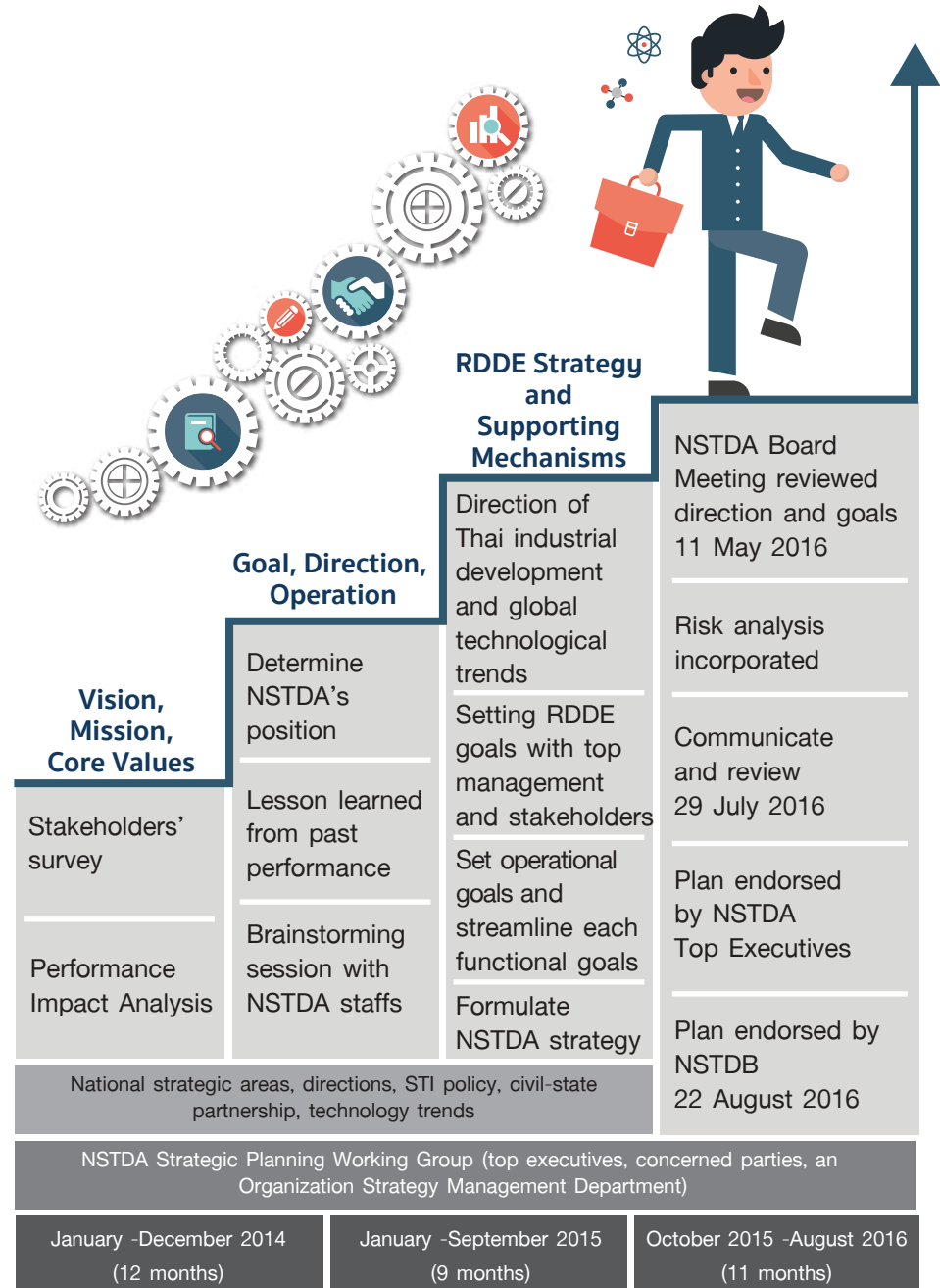
NSTDA and the 6th Strategic Plan

(2017-2021)

The National Science and Technology Development Agency (NSTDA) was established with a principle mandate to promote science, technology and innovation. This mandate is achieved through collaboration with local and international partners in conducting research and development and ensuring the translation of research to innovation that will benefit society, economy and environment. NSTDA has developed a five year strategic plan to serve as a framework for its operation from 2017-2021, and for communication of its goals, direction and strategy to its stakeholders. The stakeholders of NSTDA include governing body, NSTDA staffs, alliances, customers and the public at large.

The 6th NSTDA Strategic Plan is designed to align with the 12th National Economic and Social Development Plan (2017-2021) and the 20-Year National Strategy (2017-2036). The process of developing the strategic plan involved the review of NSTDA's current situation and the incorporation of inputs from stakeholders. The plan was endorsed by the National Science and Technology Development Board (NSTDB) on 22 August 2016.

The 6th NSTDA Strategic Planning Process

Vision, Mission, Core Values
- Stakeholders' survey
- Performance Impact Analysis

Goal, Direction, Operation
- Determine NSTDA's position
- Lesson learned from past performance
- Brainstorming session with NSTDA staffs

RDDE Strategy and Supporting Mechanisms
- Direction of Thai industrial development and global technological trends
- Setting RDDE goals with top management and stakeholders
- Set operational goals and streamline each functional goals
- Formulate NSTDA strategy

- NSTDA Board Meeting reviewed direction and goals 11 May 2016
- Risk analysis incorporated
- Communicate and review 29 July 2016
- Plan endorsed by NSTDA Top Executives
- Plan endorsed by NSTDB 22 August 2016

National strategic areas, directions, STI policy, civil-state partnership, technology trends

NSTDA Strategic Planning Working Group (top executives, concerned parties, an Organization Strategy Management Department)

January -December 2014 (12 months)	January -September 2015 (9 months)	October 2015 -August 2016 (11 months)

The 6th Strategic Plan

Vision

"To be a key partner for a knowledge-based society through science and technology".

Mission

"To strengthen research, development, design and engineering (RDDE) and technology transfer (TT), and to support necessary S&T human resource development (HRD) and infrastructure development (Infra), facilitated by efficient internal management (Int. Mgt.)".

Core Values

N Nation First

S Science and Technology Excellence

T Team Work

D Deliverability

A Accountability and Integrity

NSTDA's vision, mission and core values reflect its strong commitment to apply Science, Technology and Innovation (STI) to develop solutions to problems confronted by the country, and to address needs of the country and expectations for NSTDA to deliver **socio-economic impact.** Such role in benefiting economy and society will then raise the awareness on STI and confidence in all sectors, thereby increasing **investment in STI activities.**

NSTDA's Goals for 2021

Socio-economic impact generated from NSTDA's output is **FIVE TIMES** the average NSTDA annual expenditure between 2017-2021.

Investment in STI activities from the agricultural, manufacturing and service sectors is **DOUBLED** from that of 2016.

NSTDA Challenges and STI Development

NSTDA has taken into account the challenges confronted by the country. These challenges include urbanization, food crisis, water scarcity, energy security, aging society, climate change, technological breakthroughs and terrorism. These mega trends pose challenges to the society, economy, environment and security of the country.

Migration to the City | Food, Water and Energy Security | Aging Society | Technological Breakthroughs | Climate Change | Insurgent and Cyber Terrorism

Thailand's Vision: Stability, Prosperity and Sustainability

Challenges	20-year National Strategy
Security in life and property	Security
Waste, pollution and traffic congestion	Competitiveness enhancement
Poverty	
Newly emerging and re-emerging diseases	Human resource development
Low productivity and price-fluctuation of agricultural products	Social equality
Environmental issues and trade barriers	Green growth
Drought, flood and resource management	
Value creation for products and services	Rebalancing and public sector development

The 12th National Economic and Social Development Plan (2017-2021) and the 20-Year National Strategy (2017-2036) set to bring about stability, prosperity and sustainability. STI is recognized as a key element to drive the country to achieve the social and economic goals. It can enhance the nation's competitiveness, reduce social inequality and lead the country out of the middle-income trap. The Government also approved a list of 10 industries as Thailand's new economic growth engines, consisting of 5 new S-curve industries and 5 first S-curve industries.

5 new S-curve industries: (1) robotics, (2) logistics and aviation, (3) medical hub, (4) biofuels and biochemicals, and (5) digital.
5 first S-curve industries: (1) next-generation automotive, (2) smart electronics, (3) affluent, medical and wellness tourism, (4) agriculture and biotechnology, and (5) food for the future.
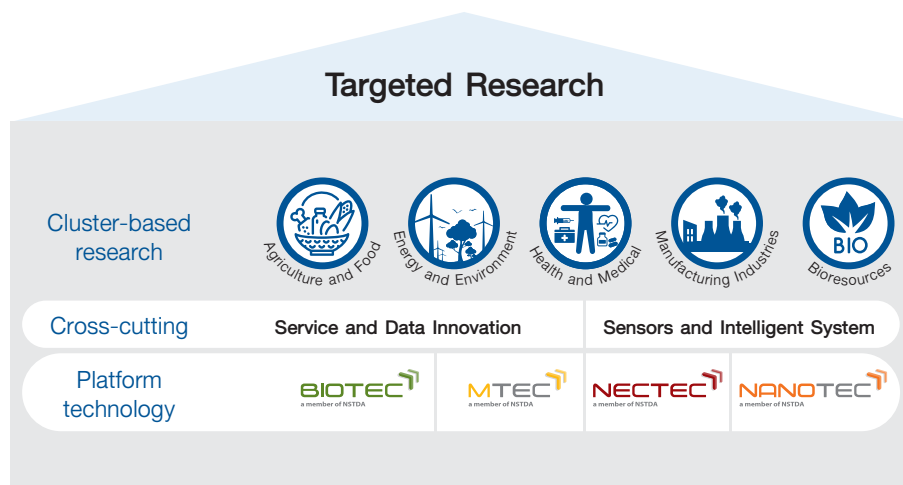
The issues lead to opportunities where NSTDA can perform in responding to challenges in the next five years.

- Generate knowledge assets through meaningful research and build capabilities in 4 core technologies and translate to innovation.
- Carry out fundamental research of international quality.
- Devise mechanism(s) to respond to industrial problems and effectively work with industry, such as the formation of consortiums.
- Actively support important Civil-State-Partnership projects such as upgrading of innovations and productivity, promotion of SMEs and start-up enterprises, development of super clusters and the New S-Curve industries and development of modern agriculture.
- Establish good partnerships with academic and research institutes both locally and internationally.
- Support the establishment of the national innovation system to lead Thailand to sufficiency economy and connect with advanced countries.
- Support the development of STI infrastructure and the national metrology, standardization, testing and quality assurance infrastructure.
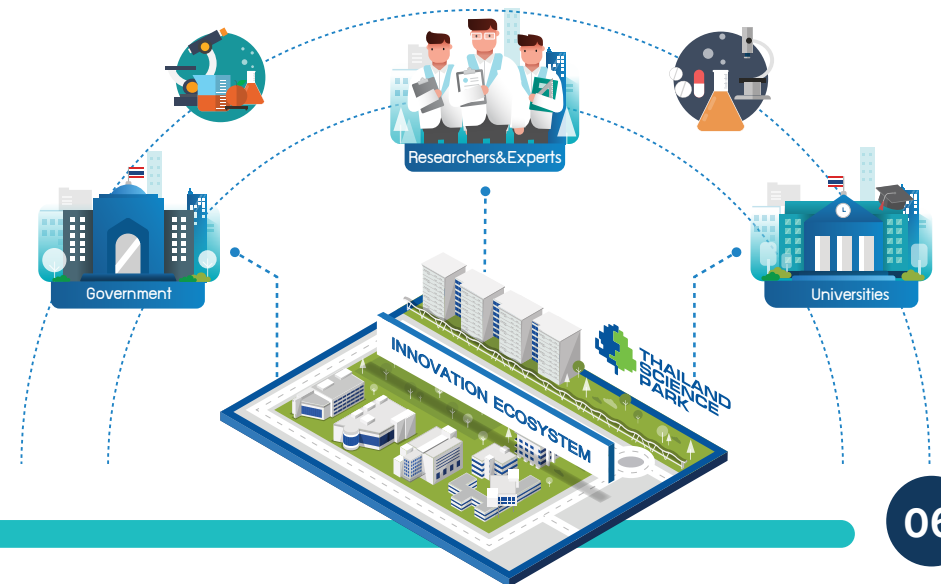
In order to achieve its goals to bring the most of STI benefit to the economy and the society, NSTDA has classified its research and development into three types. Each will require different time frames to create socio-economic impact.

● **Targeted research.** This focuses on the translation of research to real-world application in order to realize tangible socio-economic impact by 2021.

● **Cluster-based and cross-cutting research.** Cluster-based research addresses the country's need, whereas cross-cutting research concentrates on core technologies with applications in various clusters.

● **Platform technology.** The focus is on building up capability, human resources and infrastructure in key technologies that will be important for long-term national development.

Targeted Research

| Cluster-based research	Agriculture and Food	Energy and Environment	Health and Medical	Manufacturing Industries	Bioresources
Cross-cutting	Service and Data Innovation			Sensors and Intelligent System	
Platform technology	BIOTEC a member of NSTDA	MTEC a member of NSTDA	NECTEC a member of NSTDA	NANOTEC a member of NSTDA	

Targeted Research

1. Modern Agriculture focuses on employing advanced technologies to improve productivity, diversify agricultural products, cope with the effects of climate change and support resource-efficient farming practices. Such technologies include advanced plant breeding, precision farming, forecasting and early warning systems, biocontrol, the application of Life Cycle Assessment (LCA), carbon footprint and water footprint approaches to products, as well as product innovation to add value to farm produce.

2. Biofuels and Biochemicals concentrates on topics such as improving efficiency of fuel and biomass conversion to electricity and heat, development and improvement of the 1st generation biofuel technology and biorefinery platforms. Additionally, this topic aims to support the development of a production process of some important intermediate substances using bio-resources as raw materials. Those substances can be applied in biochemical industry, bioenergy and other related industries which is supporting the development of Thailand's Bioeconomy scheme.

3. Food for the Future is targeted at research into starter culture technology and probiotics that will support the manufacturing of safe and high quality food products. The program also addresses development of natural food supplements; development of technologies for medical food and food for the elderly; food processing technologies that will support the compliance with sustainability standards; diagnostic tests for foodborne pathogens, contaminants and residues; and traceability.

4. Enhancement of Public Health and Quality of Life focuses on technologies that will develop people to reach their full potential. These include technology supporting children's health management; personal health record systems, accessible health information and mobile applications for personal health monitoring and advice; integrated database on health; assistive and independent living technology; technology and content for distance learning; technology for monitoring, prevention and surveillance of diseases; modern and traditional medicines, vaccines and medical devices; technology supporting emergency medical services and referral management.

5. Next-Generation Automotive and Logistics concentrates on electric vehicle and railway technology. Research and development on electric vehicle covers topics such as energy storage systems, high efficiency motors and drives, lightweight materials for frames and parts, assembly line and infrastructure. Railway research focuses on track work, rolling stock, power supply system, signaling system, railway system testing and policy development and advocacy.
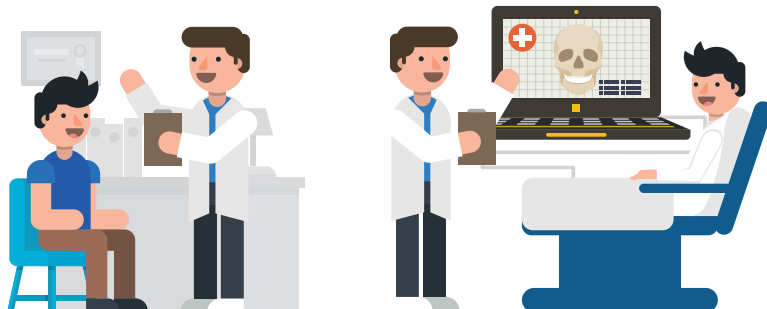
Advancing Research to Utilization

i Digital Technology

1. Digital Technology.
Technologies and prototypes will create service innovation for the living and tourism to support the smart city development, improve quality of life, ensure security and offer convenience. This will involve an integration of video surveillance systems, real-time traffic information, bus schedule information, image recognition and object detection technology. An intelligent command center will be set up on cloud service to pilot "Internet of Things" by collecting data from sensors, video surveillance and GPS.

**ii** Electronics, Robotics and Automation
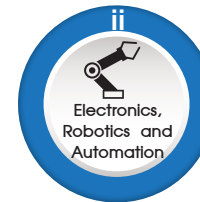
2. Electronics, Robotics and Automation.
Automation technologies will be applied to actual production lines in various industry to improve productivity and enhance production standards, which will help Thai manufacturers to upgrade to be advanced OEM. Examples are technologies such as smart electronics, next-generation automotive and developing industrial robots prototypes.

iii Service and High-end Tourism Industry

3. Service and High-end Tourism Industry.
Technologies will be applied to a pilot project aiming to develop "Andaman Bio-resort Towns" in order to increase tourism revenue with environmentally-friendly products based on traditional knowledge, reduce pollutant emissions and preserve the environment in Andaman coast provinces. Examples are technologies and innovations for disaster monitoring and warning system, management and utilization of marine natural resources, organic and health food, nutrition therapy, biodegradable packaging and herbal products.

cross-cutting
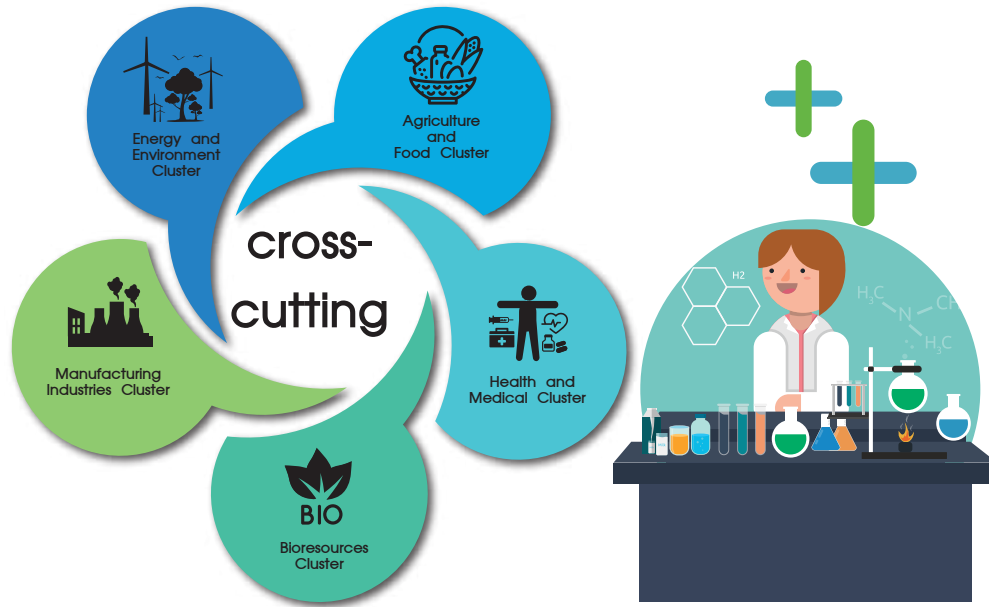
Agriculture and Food Cluster

aims at improving the productivity, manufacturing high quality products, minimizing wastes during the production process and making the industry sustainable through environmentally friendly processes that are adaptive to the effects of climate change. This cluster consists of the following programs: cassava, seed, adaptation to climate change in agriculture sector, animal health. and production, and food innovation.

Energy and Environment Cluster

sets goal to improve energy security, reduce greenhouse gas emissions, enhance competitiveness of manufacturing and service sectors in the areas of sustainability and the environment-related trade measures. The cluster comprises the following programs: sustainable environment, energy and resource efficiency, renewable and alternative energy, energy storage systems and NSTDA-EGAT joint program, the latter being a program jointly sponsored and managed by NSTDA and the Electricity Generating Authority of Thailand (EGAT).

Health and Medical Cluster

aims at developing technologies or products to support public health, improve efficiency in healthcare budget and deal with emerging diseases. This cluster comprises 3 research programs: newly emerging disease and re-emerging disease program, medical biotechnology program, and medical device and digital healthcare program.

Manufacturing Industries Cluster

targets at improving efficiency in the manufacturing process to enhance competitiveness of Thai manufacturers. The focus is on automotive parts, railway technology, electric motors and control systems, automation and robotics and injection molding technology.

Bioresources Cluster

aims to employ science and technology to manage biological resources for conservation, sustainable utilization and development of bioindustry. This cluster has two programs; bioresource management and utilization of bioresources in bioindustry.

Cross-cutting Research

Service and Data Innovation Program places emphasis on developing information innovation to enhance the service industry in the areas of healthcare and city planning and management such as traffic and safety management.

Sensor and Intelligent System Program concentrates on developing sensor technology and embedded systems for diagnosis, monitoring and prediction or as an automatic controlling system for applications in agriculture, food, environment and healthcare.

Platform Technology
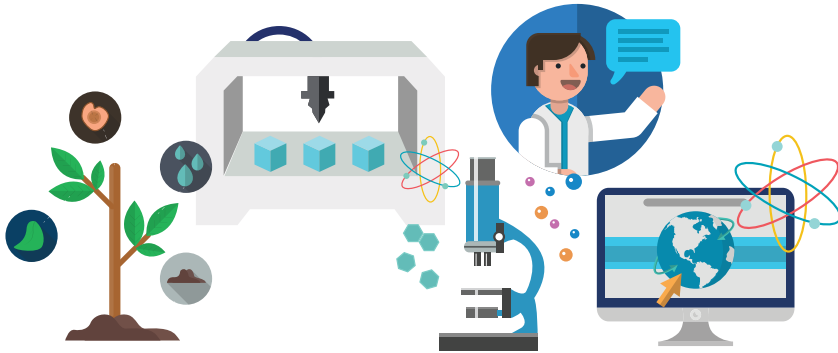
Platform Technology for Genetic Engineering and Biotechnology

is dedicated to developing synthetic biology technology by applying big data analytics and bioinformatics for the analysis of integrated multiple omics. The platform also emphasizes on creating tools for restructuring cells in DNA/Metabolic pathway levels to get the desired characteristics, and high technologies such as genome technology, sensors and image processing technology that will contribute to the development of food industry for the future and modern agriculture of Thailand.

Platform Technology for Metal and Materials

puts emphasis on the synthesis, processing and manufacturing of materials to meet desired quality, reduce production cost and time and enable business sustainability in energy efficiency and environmental protection. The program also focuses on building up capacity in design, engineering, manufacturing and testing of materials and products by employing cutting-edge technologies such as automation and robotics, 3D printing, computer-aided design and engineering analysis.

Platform Technology for Electronics and Computers

is to develop core technologies that will enable wide range applications. Sensor technology is developed for diagnostic tools, for example. Technologies to be developed will focus on solar cell and power supply systems; wireless communication technology; intelligent system that can process speech, natural language and image; brain-computer interface; big data; and Internet of Things (IoTs).

Platform Technology for Nanotechnology

aims to design and synthesize new compounds or materials at the nanoscale forms, such as quantum dot, nanoparticle, nanocrystal, nanorods, carbon nanotubes, nanofiber, graphene or nanofilm and nanocomposites. The program also includes manufacturing, assembly and product development to yield high quality and safe products by employing advanced technologies such as 3D printing, printed circuit board, lithography and lab-on-a-chip. In addition, building up capacity in nano-scale characterization and testing is emphasized to support research and manufacturing sectors.

NSTDA Strategy

To drive research, development, design and engineering, all missions of NSTDA (RDDE, HRD, TT, Infra and Int. Mgt.) must work in cohesion. Supporting mechanisms are devised to put all missions into alignment towards a common goal.

RDDE & Technology Transfer goals
Identify targeted research and translational mechanisms
Capacity building in design and engineering
Quality assurance system
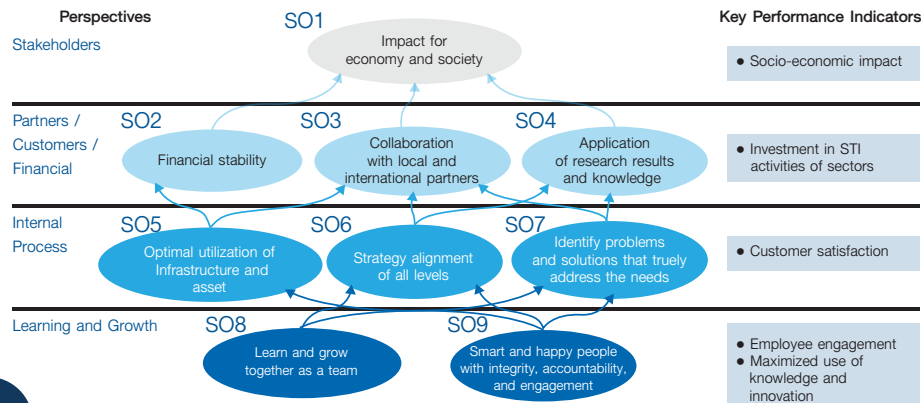STI for community and improving quality of life

PARTNERSHIP DEVELOPMENT **ASSET MANAGEMENT**

Collaborations and partnerships	International Cooperation	S&T Human Resources Development	NSTDA Human Resources Development	Infrastructure	Internal Management
Proactive in forming partnership with other agencies with the "speed, quality & friends" philosophy, targeting at groups with different needs.	Identify areas of cooperation with international partners that will enhance NSTDA's capacity.	Develop quality S&T human resources for the nation through various programs.	Smart and happy people with integrity, accountability, and engagement	Become "Comprehensive Science Park" and ASEAN Hub in testing, design and engineering.	Policy, goals and processes are in alignment, and corresponding with ICT, strengthening NSTDA brand and public relations.

NSTDA uses Balanced Scorecard (BSC) as a tool to identify its strategic objectives, necessary actions needed to support each objectives and ultimate goals, as well as how to measure success. This is depicted in the following diagram.

Perspectives — Key Performance Indicators

Stakeholders
SO1 Impact for economy and society — ● Socio-economic impact

Partners / Customers / Financial
SO2 Financial stability
SO3 Collaboration with local and international partners
SO4 Application of research results and knowledge
● Investment in STI activities of sectors

Internal Process
SO5 Optimal utilization of Infrastructure and asset
SO6 Strategy alignment of all levels
SO7 Identify problems and solutions that truely address the needs
● Customer satisfaction

Learning and Growth
SO8 Learn and grow together as a team
SO9 Smart and happy people with integrity, accountability, and engagement
● Employee engagement
● Maximized use of knowledge and innovation

Five Strategies have been Identified:

Strategy 1 : Partnerships for Nation's Benefits. This strategy involves identification of national priority areas and formulation of a roadmap for each area. Each roadmap is used for the planning and of resource, infrastructure, equipment and human resources.

Strategy 2 : Open NSTDA. This strategy aims to reach out to form partnership with various alliances, create brand awareness and visibility of NSTDA in the local and international arena. Modes and contents will be designed according to communication strategy to ensure the public outreach and the realization of high impact of NSTDA outputs.

Strategy 3 : RDDE Excellence. This strategy involves employing management tools to manage research quality, from identifying problems with users all the way to market analysis and commercialization. Stage Gate and Technology Readiness Level (TRL) methodologies are used in management of research project, development of necessary standards and regulations, in order to devise commercialization plans.

Strategy 4 : **STI Solutions Provider.** This strategy is to design unique measures and mechanisms to facilitate STI investment and commercialization, including offering STI infrastructure as services. Examples are the "Fund of Funds", business models, technology licensing process, technology transfer scheme, mechanisms to support crowd-funding, social enterprises and spin-off mechanism.

Strategy 5 : **Simple and Smart.** This strategy aims to enable high efficiency and high quality in NSTDA operations, emphasizing on a flexible, fast, and accurate process that meets satisfaction of internal and external customers. Information and communication tools are employed to expedite internal operation and manpower management and development in order for NSTDA to deliver exceptional outputs.

Continuous Improvement for Efficiency and Quality

NSTDA employs PDCA (Plan–Do–Check–Act) approach in its operations at all levels and activities, from strategic to operational levels.

Plan NSTDA has a 5-year strategic plan and an annual action plan. In addition, a risk management plan is developed as a measure to prevent and respond to impact caused by internal and external changes.

Do Balanced Scorecard (BSC) and Individual Action and Development Plan (IADP) are used in the deployment of plan into action. NSTDA has systems in place to ensure the high quality of human resources and research projects. Supporting infrastructure, mechanisms and activities also exist and are streamlined to expedite and facilitate technology development and transfer such as resource allocation, product design and development, IP management, marketing tools, testing labs, alliance development, manpower development and ICT.

Check Regular reports in various dimensions are made available to top executives and committees for review and analysis. In addition, evaluation, internal audit and internal control processes are set up to monitor and evaluate projects and activities to assure outputs are delivered with efficiency, accuracy and transparency and conform to regulations.

Act Review and analysis are constantly conducted and feedback in the loop of planning to improve the plan at all levels. This is to ensure that the NSTDA plan is up-to-date, responsive to change and can continuously deliver quality work that will benefit the country.