
Original Article

Thailand biotech business: Product of the national policy

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Nataporn Chanvarasuth

is a policy researcher at the National Center for Genetic Engineering and Biotechnology (BIOTEC) and also in a secretariat to the National Biotechnology Policy Committee. She is one of the team leaders who pushed policy research to establish Biopark and BOI incentive for biotech businesses.

Ramjitti Indaraprasirt

is the Head of the National Center for Genetic Engineering and Biotechnology's (BIOTEC) Public Relations Section.

ABSTRACT Thailand's National Biotechnology Policy Framework 2004–2009 acts as a catalyst to enhance industrial productivity and sustainability. Six goals are identified in the national policy framework, of which two are given priority: 'Kitchen of the World' and 'Healthcare Centre of Asia'. The Board of Investment of Thailand (BOI) is creating a positive environment for local and international industries. BOI provides maximum benefit privileges to biotechnology-related investments. Currently, there are 50 new emerging biotechnology companies in Thailand. More than 80 existing businesses have incorporated biotechnology R&D in their work processes. Government agencies and universities provide supporting services to stimulate biotechnology businesses. R&D infrastructures such as Biopark in the expansion phase of Thailand Science Park will be operational in 2010. The National Science and Technology Development Agency, the National Center for Genetic Engineering and Biotechnology, the Thailand Center of Excellence for Life Sciences, and the BOI under the direction of the Ministry of Industry are major agencies committed to strengthening Thailand's competitiveness in biotechnology.

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INTRODUCTION

Thailand recognises the importance of biotechnology to national prosperity and competitiveness. The launching of the National Biotechnology Policy Framework (2004–2009) by the National Biotechnology Policy Committee signifies Thailand's desire

to enter an era where biotechnology is a key element in the national agenda. The policy fosters cooperation among public and private sectors. In addition, the policy helps in creating a business environment that stimulates investment in areas such as infrastructure, incentives, and incubation services. Increased training of researchers and supporting staff has been initiated in order to meet company needs. Given these interests in fast forwarding the desire to acquire biotechnology skills, Thailand is known globally as a strong

Correspondence:

Nataporn Chanvarasuth
The National Center for Genetic Engineering and Biotechnology,
73/1 Rama VI Rd., Rajdhevee, Bangkok 10400, Thailand
E-mail: nataporn.cha@biotec.or.th

advocate for the promotion of biotechnology alliances.

THAILAND'S NATIONAL BIOTECHNOLOGY POLICY FRAMEWORK 2004–2009

Since Thailand declared 2003 the 'Year of Biotechnology', biotechnology has been used as tool to enhance the country's development in line with government policy and the national agenda. The ultimate goal is to achieve sustainable competitiveness, healthcare for all, equitable income distribution, and a self-sufficient economy.^{1,2} The emphasis is placed on applying core technologies, for example, genomics, bioinformatics, plant, and animal breeding, by means of molecular markers to accelerate development in the following areas: agriculture/food, medical/healthcare, environment protection, and new knowledge creation for the development of higher value-added products, as well as for knowledge-based policy and strategic planning. The advanced technologies are used to promote biotechnology business, including high-end products with high value and new types of services.

Consistent with the national agenda and government policy direction, the six national goals for biotechnology development are as follows:

- Goal 1:** *Emergence and Development of New Bio-Business.*
- Goal 2:** *Biotechnology Promotes Thailand as Kitchen of the World.*
- Goal 3:** *Thailand Represents Healthy Community and Healthcare Centre of Asia.*
- Goal 4:** *Utilisation of Biotechnology to Conserve the Environment and to Produce Clean Energy.*
- Goal 5:** *Biotechnology as the Key Factor for Self-Sufficient Economy.*
- Goal 6:** *Development of Qualified Human Resource system.*

NUMBER OF BIOTECHNOLOGY BUSINESSES

The list of biotechnology companies has been collected from various existing databases arranged by (1) Department of Business Development under the Ministry of Commerce, (2) the Federation of Thai Industries, (3) the Thailand Biotech Guide, and (4) the National Center for Genetic Engineering and Biotechnology (BIOTEC). A new biotechnology business is defined as a recently established company using advanced biotechnology for its activities. A business categorised as a new biotechnology company can be a manufacturer, service provider, or research centre that does only research. Currently, there are approximately 50 new biotechnology companies in Thailand. One half of these new companies are in the service business, including laboratory services, clinical tests, and stem cell banks. Another half involves manufacturers producing diagnostic devices and various kinds of biomolecules. Figure 1 shows the percentage of the new biotechnology business by focus area. The medical/health sector has the highest interest from the new investment. Examples of the new biotechnology businesses are shown in Table 1.

The biotechnology policy does not focus only on increasing the number of new biotechnology companies, but also on encouraging existing companies to invest in R&D using biotechnology procedures. Currently, more than 80 existing companies have invested in biotechnology R&D units and thousands are applying for technical

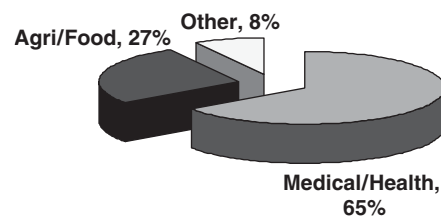


Figure 1: Percentage of new biotechnology companies in Thailand.

Table 1: Example of the new biotechnology companies

Company name	Area of business activities
1. Innova Biotechnology Co. Ltd, http://www.innovabiotechnology.com	Diagnostic kits
2. I-Med Laboratory Co. Ltd, www.imed.co.th	Diagnostic kits
3. Theravite Co. Ltd, http://www.theravitae.com/	Stem cell
4. Stem Cell for Life Co. Ltd, http://www.stemcellforlife.co.th	Stem cell
5. International Bio Services Co. Ltd, www.ibs.mahidol.ac.th	Clinical research
6. International Drug Development Co. Ltd, http://www.iddth.com/	Clinical research
7. Heart Genetics Co. Ltd, http://www.heartgenetics.com/	Genetic testing
8. Asian Nutraceutical Center, http://www.asianlife.com.ph	Cosmetics from herb
9. Specialty Biotech Co. Ltd, http://sbtthai.com/index.php	Yeast and yeast extract
10. Purac Thailand Co. Ltd, http://www.purac.com/index.php	Lactic acid for food, cosmetic, and bioplastic

assistance. As shown in Figure 2, the existing companies in agriculture/food are active players in this category. Table 2 shows the names of some of the companies in this category.

KITCHEN OF THE WORLD

Biotechnology is applied to support Thailand in becoming the ‘Kitchen of the World’ by including higher biotechnology in agricultural/food research and enhancing capability in inspecting and certifying food quality, standard, and safety. Each year, Thailand exports agricultural and food products valued at over US\$23 bn on average. Major exporting products include rice, cassava, sugar, natural rubber, seafood, and canned pineapples. Thai fruits and processed foods are marketed worldwide. Tom Yum shrimp or chicken has become a favourite dish for many people. To secure product quality, the national policy aims to increase the use of biotechnology at every step of food production, from agricultural management to food safety.

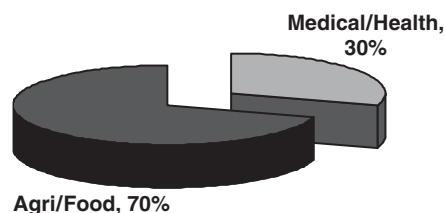


Figure 2: Percentage of existing companies investing in R&D using biotechnology.

Table 2: Example of existing companies investing in biotechnology R&D

Company name	Area of biotechnology R&D
1. Thai-China Flavors & Fragrances Industry Co. Ltd, http://www.tcff.co.th/	Flavorance from herb
2. International Laboratories Corp. Ltd, www.ilc-cosmetic.com	Cosmetics from herb
3. Greater Pharma Co. Ltd, www.greaterpharma.com	Drug and vaccine
4. Biopharm Co. Ltd, http://www.biopharm.co.th/site_public_th/about/index.html	Drug
5. Erawan Pharmaceutical Research and Laboratory Co. Ltd, http://www.choheng.co.th/new.htm	Modified starch
6. Khao-La-Or Laboratories Ltd, Part http://www.khaolaor.com/home.php	Supplementary food from herb
7. Nutrix Public Company Limited, www.nutrix.co.th	Probiotics
8. Thai Commodities Co. Ltd, http://www.thaicommodities.co.th/home.asp	Food flavour
9. Better Products and Technology, http://www.betagro.com/	Food flavour and colour
10. Thai Fermentation Industry Co. Ltd, http://www.msg-racha.com/	Food flavour and enzyme
11. Earth Life Co. Ltd, http://www.earthlife.co.th/index00.html	Enzyme
12. Pakkret Floriculture Co. Ltd, http://www.pakkretfloriculture.co.th/new.asp	Diseases free micro-tuber
13. T.K. R&D Co. Ltd,	Tomato strain improvement
14. Mitrphol Co. Ltd, http://www.mitrphol.com/en/02_business/04_research.php	Diagnostic kit
15. Kamphaeng-Saen Commercial Co. Ltd, www.kcfresh.com	Biocontrol

Implementation of the cluster model helps connect key players in the supply chain. The cluster promotes the use of biotechnology and at the same time becomes the channel

directing all stakeholders' needs to the policy makers. The fulfilment examples from the cluster approach are indicated in the shrimp industry and the seed industry. At present, Thailand is accepted as a global leader in the production and exportation of farmed shrimp. Advanced biotechnology methods such as the marker-assisted technique are used for strain improvement. Farmers are able to raise broodstock instead of catching parent breeding stock from the open sea. Biomolecules such as the monoclonal antibody specific to shrimp virus diseases (eg yellow head virus and white spot syndrome virus) are developed for diagnostic devices. Available commercial diagnostic kits help farmers to screen out the infected shrimp larvae and make better decisions in farm management. The seed cluster is another fine example. Thailand is home to approximately 100 seed companies, 20 of which are multinationals.³ To produce high quality seeds in time needed, Biotechnology techniques such as the marker assisted selection (MAS) and tissue culture are used as routine procedure. Since Thailand has germplasm banks and consists of abundant experienced farmers, the Thai seed industry has shifted its role from contract seed producers to producing new seed varieties under Thai brand names. This is considered a major achievement arising from including a higher biotechnology component in agricultural research. The idea of using genetic engineering techniques is also under government consideration. At present, the government and public opinion allow the field trial of genetically modified organisms for scientific studies. The Institutional Biosafety Committee has been established and biosafety guidelines and regulations are available for investors.⁴

HEALTHCARE CENTRE OF ASIA

Biotechnology is used as the core technology in improving quality of life and health and to support Thailand in becoming 'the healthcare center of Asia'. Because of Thailand's

international standards, qualified overseas trained physicians and hospitality, it has put on the map as the best healthcare provider. In 2007, over 1.5 million foreign patients travelled to Thailand seeking medical treatment ranging from open hearts surgery to general physical examination.

In addition to premium healthcare products, Thailand is also known as a venue for biotechnology research programmes in areas related to emerging diseases (eg bird flu), re-emerging diseases (eg HIV and tuberculosis), and tropical diseases (eg malaria and dengue). Investment in various kinds of research programmes leads to the success of the business. Examples of commercial products originating from the joint research programmes include the world's first biosensors for Avian Influenza, simple CD4+ lymphocytes detection, and alpha Thalassemia strip test. Thailand also obtains international patents in this area. One example is a US patent for 'antimalarial pyrimidine' derivatives and the methods of making and using them. Currently, the development of platform technologies such as genomics and bioinformatics is becoming an area of interest and one that Thailand is looking to explore. According to Thailand Bio-Opportunities, examples of potential products are microbes for fermentation process, drugs from bioresources, diagnostic devices, and services.⁵ Services such as genetic testing, clinical testing, and stem cell treatment are generally considered add-on services that put Thailand at the forefront of healthcare in Asia.

QUALIFIED HUMAN RESOURCES

The key factor for Thailand's continuous progress in biotechnology development is the availability of qualified human resources. Thailand has the reputation among ASEAN member countries as the regional training hub for biotechnology.⁶ Each year, Thai research agencies receive research trainees from ASEAN countries. The programme is currently expanding to accommodate pacific

island countries and Mongolia. Research topics range from plant physiology, to protein-ligand, to food technology. In addition to overseas research trainees, 24 local universities around the country have included biotechnology in their course of studies. There are approximately 800–900 BSc graduates in biotechnology, some 400–500 MSc graduates, and approximately 40 PhDs per year. Collaboration among universities, research institutes, and private companies has also played a critical role in increasing the availability of qualified researchers to meet industries' needs. The pool of more than 1,500 biotechnology experts is accessible online.

In addition to the regular programmes generating graduates for industries, there are several programmes initiated through the collaboration of universities, companies, and research organisations. For example, the Food Engineering Practice School Program is a problem-based learning programme established through the collaboration of King Mongkut's University of Technology Thonburi, BIOTEC, and companies. Examples of these companies are Charoen Pokphand Foods PCL, Thai Royal Food International Co. Ltd, and B. Foods Product International Co. Ltd. Before graduation, students who attend this programme have to spend at least one semester at food plants to solve real problems found in the manufacturing process. The research problems are set by the plants' engineers and the students' advisors. Another project announced recently is called NSTDA Chair Professor. The project is supported by the Crown Property Bureau Foundation and the National Science and Technology Development Agency (NSTDA). The idea of this project is to increase the number of qualified professors who could multiply the number of graduates and generate academic papers as well as models to benefit Thai industries.

Joint research with international business identities such as Novartis and Shiseido is a crucial part of national development. In order

to work closely with Thai researchers, a number of international companies have decided to locate their R&D centres to carry out only proprietary research in Thailand. Examples of these R&D centres are Shiseido Southeast Asia Research Center, Air Product Asia (Technology Center) Co. Ltd, Alltech Asia-Pacific Bioscience Center, and Ecolab Southeast Asia Technical Research Center.⁷

GOVERNMENT INCENTIVE

Advancement in biotechnology cannot be made possible without government support. In 2007, The Board of Investment of Thailand (BOI) announced the maximum privileged promotion for biotechnology industry. The qualified projects can be R&D projects and/or manufacturing projects that adopt modern biotechnology processes to upgrade their productivity. All qualified projects receive an eight-year corporate income tax holiday and exemption from import duty on machinery and equipment. Projects locating in a Science and Technology park receive an additional 50 per cent income tax reduction for another five years after the expiration of the tax holiday. At present, the privilege package focuses on four areas:

1. seed, plant, and animal improvement;
2. biopharmaceutical agents including drugs, vaccines, and therapeutic proteins;
3. diagnostics for disease screening, biosensors, and gene chips; and
4. biomolecules and bioactive compounds using microorganisms, plants, or animal cells (eg enzyme, monoclonal antibody, and recombinant protein).

Examples of projects that obtained the privilege package are (1) vaccine for dust mite allergy, (2) probiotics for animal feed, and (3) biomolecule from cocoon extraction using enzyme. This year BOI reports that 45 biotechnology-related companies are operating under the privilege package. The total investment under the privilege is worth over 19.5 billion baht. BOI intends to increase the

number of companies and the amount of their investment when it announces 2008–2009 as ‘Thailand Investment Year’.⁸

R&D INFRASTRUCTURE

For biotechnology R&D to prosper, certain infrastructures with appropriate environments are required. The Thailand Science Park (TSP) is home to four excellent national R&D centres, foreign R&D centres, and start-up companies. Located in Pathum Thani province, TSP is about 40 km from Bangkok and currently houses more than 2,500 researchers. Biopark is known as the part of TSP that serves biotechnology businesses. At Biopark, a business can rent the area to do their research, use shared equipment, and request necessary services. There are infrastructures such as a wet and dry laboratory, a pilot plant, a greenhouse, and a convention centre available for the biotechnology business. Besides high-class infrastructure, a business can request soft services such as incubation, technical

assistance, technology acquisition, technology transfer, and intellectual property services. Activities such as international seminars, practical workshops, and business-to-business meetings are arranged continuously throughout the year. According to the space limitation, TSP is able to serve only 53 start-up companies (40 Thai and 13 foreign businesses), of which 30 per cent are biotechnology businesses. Figure 3 shows examples of infrastructures in TSP.

The second phase of TSP is under construction and is scheduled for completion in 2010. This phase comprises four interconnected towers with an additional 127,000 m² of space.⁹ Necessary R&D facilities such as BSL-3 will be available to meet the needs of the biotechnology companies.

SUPPORT AGENCY

Biotechnology investors can seek support from two autonomous government agencies: the NSTDA and the Thailand Center of



Figure 3: Infrastructures in Thailand Science Park.

Excellence for Life Sciences (TCELS). NSTDA provides service support including funding (eg R&D grants, short-term loans, and joint investment), technology assistance (eg technology acquisition, industrial consultancy, intellectual property service, and training), and incubation for start-up businesses. Under NSTDA umbrella, BIOTEC and TMC (Technology Management Center) are main service providers for a biotechnology business. BIOTEC provides opportunity for joint and contract research, as well as testing and analytical services. TMC provides services that help a business upgrade its capability and productivity. On the other hand, TCELS supports the biotechnology industry by acting as source of assistance for individual stakeholders in life science industry. For example, TCELS linked international investors with Thai researchers to establish a clinical research organisation. In addition, TCELS initiated programmes such as the post-trauma stress disorder after Tsunami disaster and the pharmacogenomics for AIDS patients.¹⁰ Furthermore, BOI under the direction of the Ministry of Industry is working closely with foreign chambers of commerce in Thailand to build international investment confidence. BOI is a main leader responsible for the business-to-business meetings, road shows, and international seminars such as the BIO international convention. The participation of BIO2006 has made Thailand internationally known in the area of biotechnology business.

CONCLUSION

In summary, it is without doubt that Thailand is taking initiatives to advance the country's biotechnology capabilities. Initiatives such as the National Policy Framework, and the various infrastructures and supporting agencies have aided in placing Thailand on the biotechnology map. New emerging biotechnology companies and joint research

collaborations have increased tenfold in the last few years. If this trend continues, seeing Thailand as the 'Kitchen of the World' and the 'Healthcare Centre of Asia' is certainly an achievable goal.

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