

Thai Herb Development for Thai Health Stability and Economic Sustainability

“**Thai herbs**” are an identity that reflects Thailand’s culture that has been accumulated since ancient times. The country has the knowledge about herbal use for various purposes, including as ingredients in foods and desserts, medicines for treating ailments, and health-care products by the people in the communities, based on indigenous medicine (IM) principles, and as beauty products, wound-healing remedy or elixir. Such traditional wisdom has been passed on from generation to generation as the Thai people’s ways of life, creating a distinctive and interesting cultural identity.

However, a rather few actions have been undertaken regarding Thai herb development, unsystematically and inconstantly, while Thailand’s biological resources, in terms of plant and animal varieties, are abundant and among the top rankings in the world. The country has about 11,626 medicinal plant varieties, but only about 1,800 (or 15.5%) have been used for various purposes, which facilitates the accumulation of herb wisdom or knowledge that has been ongoing for a long time.

At present, the trends in herbal needs have risen rapidly in terms of people’s consumption for health promotion and health care. The rise has also been noted in herbal processing to create value addition, industrial use involving agricultural processing, Thai traditional drug industry, herb-derived drug production industry, and various herbal product industries (such as herbal extracts, cosmetics, and spa

products). Some herbs are in high demand among consumers and producers, generating huge revenues for the country. Thai herbs and herbal products are goods with the potential and can create economic sustainability as they are parts of the target industries – both as First S-Curve industries and a New Engine of Economic Growth – resulting in a New S-Curve growth with more incomes for the people and the country.

But currently, the operations on Thai herb promotion and development in various aspects are rather few and non-continuous, resulting in little development of herb industry and market. This is evident in the low industrial, market, and export values of Thai herbal products, which are very little compared with those in other countries. Besides, the proportion of production, consumption and export values is small as the herbs are mostly raw materials (spices, plants and fruits), rather than in the forms of extracts or manufactured products with much higher economic values. As for the herbs used in the medical and health-care sector, the amount or value is rather small, compared with that of the overall medical and health system of the country.

In the meantime, when considering the changes in social, cultural, environmental, and economic contexts, as well as the lifestyles of the Thai and global populations, the impacts are the rise in the prevalence of non-communicable diseases (NCDs). The World Health Organization (WHO) has forecast that, in 2050, half of the world population will suffer from at least one NCD. According to Thailand's NCD statistics for 2005–2012, the prevalence of NCDs rose nearly two-fold during the seven-year period (from 1,682,281 cases in 2005 to 3,099,685 cases in 2012). In addition, the Department of Disease Control, Ministry of Public Health (MoPH), estimated in 2015 that Thailand spent as much as 52,150 million baht (1.53 billion U.S. dollars, or USD) on NCD care. Moreover, regarding population structure, as the country has become an ageing society, the national health spending has been rising, and if the response efforts to such situations focused only on modern medical care, the country's health financing stability would be negatively affected.

Thus, promoting the use of Thai herbs for illness healing and health promotion in combination with modern medical treatment will be an important way of improving the people's quality of life, reducing overall health-care spending, and creating the country's economic sustainability.

Realizing the importance of herb development, the government has conducted studies and drawn up the National Master Plan for Thai Herb Development. This chapter presents the results of herb situation analyses and certain aspects of the Master Plan so that they can serve as the directions for all relevant sectors to implement herb development activities, involving both economic and social aspects.

2.1 Situations and trends of global herbs market

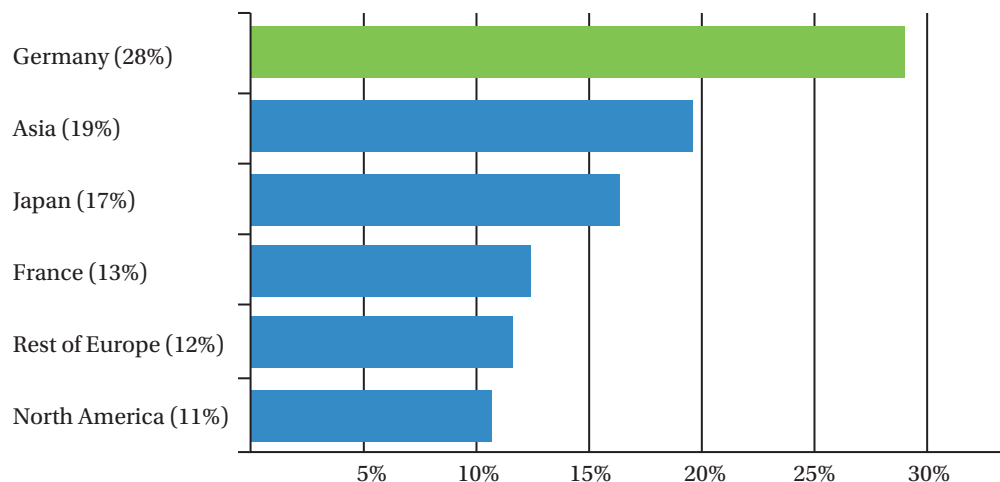
2.1.1 Situations of global market

A survey report by Nutraceutical World during 2007–2008 states that the combined herbal market (excluding soybean, seaweed, and fiber) was about USD 83 billion, and the growth rates for each type of products ranged from 3% to 12%. The proportion of herbal supplements and herbal foods was about 30% of the entire market, while the herbal drug market was about half of the overall market (USD 44 billion), and the rest belonged to beauty herbal products (USD 14 billion). As for the cosmetics market, the share of herbal cosmetics was around 6% of the entire market with an annual growth rate of 8–12%. The regions or countries with a large herbal market were Germany (28%), Asia (19%), Japan (17%), France (13%), the rest of Europe (12%), and North America (11), see Diagram 2.1.

Regarding the herbal market growth in the countries shown in Diagram 2.1 (in 2009–2010), the rates varied from more than 10% to below 0% – low or constant for developed countries, as they had issued rules and regulations related to the consumption of herbs and traditional drugs. Whereas developing countries began to realize the importance of such products, their better packaging efficiency had contributed to significantly higher use or growth rates.

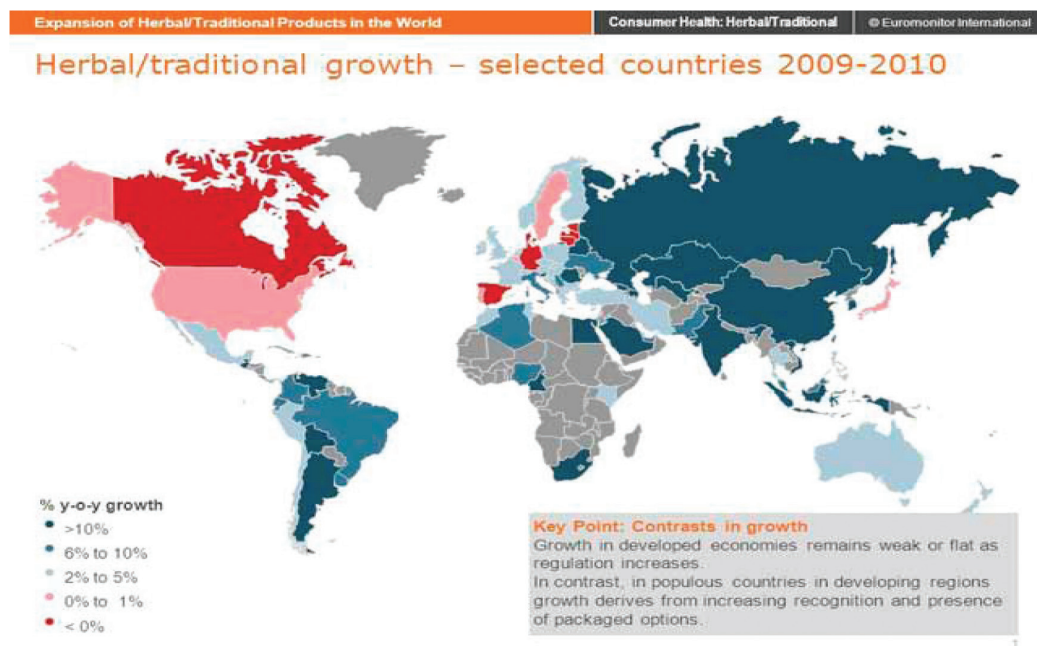
Regarding the types of herbs consumed, at present herbs are the goods with highest potential in the nutraceuticals and cosmeceuticals markets with significant growth rates during the last decade. As for herbal use, the market shares of herbal medicines mostly involve Western herbalism (50.9%), followed by traditional Chinese medicine (34.6%), and the rest are natural therapy (8.2%) and Ayurveda (6.3%), see

Diagram 2.1 Global herbal medicines and supplement markets by region, 2013



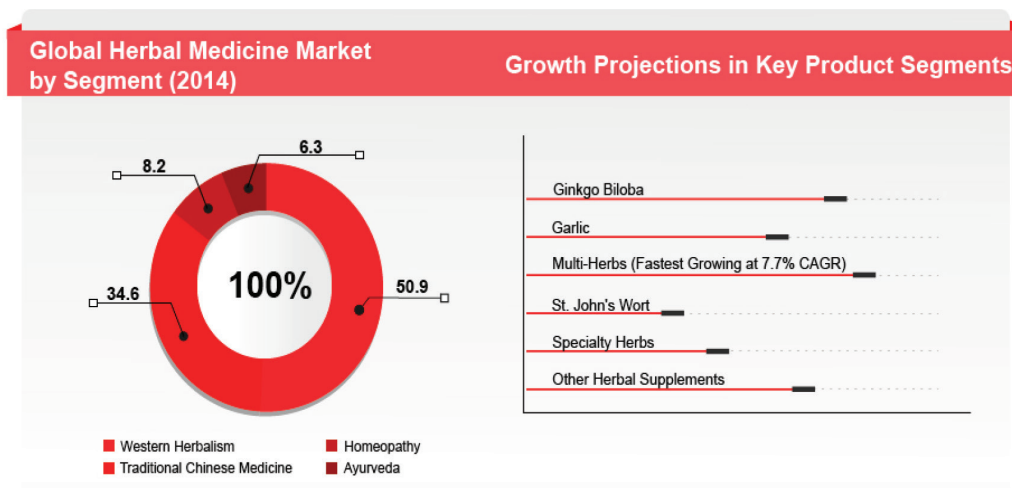
Source: Global Industry Analysts, Inc.

Photo 2.1 Herbal/traditional growth in selected countries, 2009–2010



Source: www.euromonitor.com

Diagram 2.2 Global herbal supplements and remedies market and projection



Source: http://www.strategyr.com/MarketResearch/Herbal_Supplements_and_Remedies_Market_Trends.asp (February, 2015)

Diagram 2.2. Concerning the amounts needed by region, the largest was European market, whereas the highest growth in herbal consumption was in the Asia-Pacific region (compound annual growth rate, or CAGR, 9.1%).

2.1.2 Trends in global herbs market

A market survey and projection by Global Industry Analysts, Inc. (2015) shows that the values of the world’s herbal supplements and remedies will be USD 115 billion in 2020 due to rapid expansion of the proactive strategy on health promotion and disease prevention to raise the global population’s health and well-being status in an efficient manner. The rapid and extensive health awareness of consumers as well as rising trends in health care and beauty, including consumers’ self-care, has resulted in a significantly increasing demand for natural and herbal products. Moreover, advances in relevant technological and scientific research and development (R&D) have increased the use of herbs and extracts for the care of neurocognitive condition and hormone functions. In addition, the popularity of organic herbal medicines for medical treatment has also risen rapidly as low-cost and safer alternative care related to hormone replacement and neurological system, compared with mainstream medical treatment.

The reasons behind such trends include the rapidly rising prevalence of cardiovascular disease, diabetes, hypertension, other chronic illnesses, and the high cost of medical treatments based on modern medicine. Besides, ageing society, decreasing household incomes, and non-coverage of health insurance benefits (run by the public and private sectors) have forced the people to manage their health-care spending to the self-controlled level. Moreover, the capacity of the Internet to quickly and extensively reach the target groups in the form of e-Shop online with websites showing video advertisements with product property descriptions, and online social networks is the channel for advertisements, marketing promotion, and distribution of herbal products.

Based on the aforementioned trends, it can be concluded that herbal use is on a rising health-care trend, and part of which that can generate a lot of income and profits is the use of herbs as food supplements, especially those that can boost immunity, enhance organ functions, give energy, and relax or reduce tension. Besides, herb business operators can also use herbs as supplements for women who wish to improve their fertility. Women tends to rapidly change their favourites, lifestyles, and interests, which are diverse, and the operators or producers can respond to such needs and make a lot of money by providing herb-related services in a suitable and timely manner, such as the care for pre- and post-menstrual conditions as well as menstrual symptoms. So it can be said that women are the group of consumers that is important for herb market development.

2.1.3 Potential global market

The aforementioned forecast of herb market trends shows that the Asia-Pacific region will have the most rapid growth rate (CAGR, 9.1%) for the period 2013–2020. That is a result of the region's cultural linkages with herbal use for health care and the confidence in the efficacies and safety of herbs and herbal ingredients of health products. In particular, the countries with a long history of herbal use, such as India and China, have already prepared their environmental conditions thoroughly to facilitate the modern use of herbs within the region. China is one of the suppliers of herbs for use as food supplements to the USA and western Europe.

Besides, regarding herbal use for health care, the Asia-Pacific region has got the largest market, including such use in China and India.

2.2 Herbs market in Thailand

The production of medicinal plants and raw herb material involves the following issues for consideration:

2.2.1 Raw herb material situation:

In Thailand, there are about 800–1,800 herbal species commonly known and used by the communities and about 20,000 species with known scientific names, or 8.1% of all plant species worldwide, of which 1,131 are rare and threatened species. If there are no good systems for the management of raw herb materials and herb growing or propagation, the herbs in nature may be threatened or endangered until extinction. There are three major sources of raw herbs in Thailand as follows:

1) **Herbs from herb gardening.** According to the Ministry of Agriculture and Cooperatives, currently there are herb gardens with a combined area of 48,727 rai (or 19,491 acres) scattered across the country and a total output of 190,166 tons, for herbs such as, black fingerroot or *kra-chai-dam* (*Kaempferia parviflora* Wall. ex Baker), turmeric or *khaminchan* (*Curcuma longa* L.), Asiatic pennywort or *bua-bok* (*Centella asiatica* (L.) Urb.), *roselle* or *kra-jiab daeng* (*Hibiscus sabdariffa* L.), *phlai* (*Zingiber montanum* (J.Koenig) Link ex A.Dietr.), *fa-thalai-jon* (*Andrographis paniculata* (Burm.f.) Nees), aloe or *wahn-hang-jorakhe* (*Aloe vera* (L.) Burm.f.), cardamom or *krawan* (*Amomum testaceum* Ridl.), safflower or *khamfoi* (*Carthamus tinctorius* L.), citronella grass or *ta-krai-hom* (*Cymbopogon nardus* (L.) Rendle), *phlu-khao* (*Houttuynia cordata* Thunb.), edible-stemmed vine or *phetsangkhart* (*Cissus quadrangularis* L.), Indian long pepper or *dee-plee* (*Piper retrofractum* Vahl), wild bitter gourd or *mara-khi-nok* (*Momordica charantia* L.), Javanese turmeric or *wahn-chak-mod-luk* (*Curcuma comosa* Roxb.), eagle wood or *kritsana* (*Aquilaria crassna* Pierre ex Lecomte), nutmeg or *jan-thet* (*Myristica fragrans* Houtt.), peppercorn (*Piper nigrum* L.), garcinia or *som-khaek* (*Garcinia atroviridis* Griff. ex T.Anderson), *ma-khwaen* (*Zanthoxylum rhetsa* DC.), betelvine or *phlu* (*Piper betle* L.), and other herbs. Overall, the total herb growing area is not a lot, compared with that for overall agriculture in the entire country because farmers have many options for growing other plants and are unclear about herbal market.



Moreover, most herbs are integrated as home gardening rather than commercial farming. So there are no reports on this aspect.

Herb growers. There are 12,476 households of herb growers, mostly small scale, and 115 community enterprises that process herbs and produce health products (221 products/services).

2) Herbs from natural sources. Many herbs used as ingredients of Thai traditional drug formulas are collected from natural forests. As there are no systems for land use or herb growing management, propagation, or replacement planting, the quantities of natural herbs have been declining; some are scarce and might become extinct in the future such as smilax or *khao-yen-nuea* (*Smilax corbularia* Kunth), smilax or *khao-yen-tai* (*Smilax glabra* Roxb.), liquorice or *cha-em* (*Glycyrrhiza glabra* L.), chingchee (*Capparis micracantha* DC.), jewel vine or *thaowanpriang* (*Derris scandens* (Roxb.) Benth.), sappanwood or *fahng* (*Caesalpinia sappan* L.), *samunlawang* (*Cinnamomum bejolghota* (Buch.-Ham.) Sweet), *sarapatpit* (*Sophora tomentosa* L.), *lampan-hangmoo* (*Enhalus acoroides* (L.f.) Royle), sea acorus or *lampan-daeng* (*Enhalus acoroides* (L.f.) Royle), *hua-roi-roo* (*Hydnophytum formicarum* Jack), and cinnamon or *ob-choei-thai* (*Cinnamomum iners* Reinw. ex Blume). Some of the herbs have to be imported as local herbs are scarce even though the plant varieties might be different from original ones and the drug quality might be affected. Thus, they need to be propagated and taken out of forest for replacement planting and sustainable use of herbs.

3) Herbs imported from overseas. At present, the quantities of herb imports are rather high - mostly raw medicinal herbs, some of which are non-native to Thailand, but can be grown in the country such as herbs in the *koat* or *kod group* and *tian group*. Some are unknown about their planting sources and from where they can be bought, but it is easier to get them imported, which can be handled by a middleman, and the prices are cheaper than buying them in-country. If a good raw material management system is set up, imports can be minimized.

4) Raw herb materials demand and scarcity. At present, more than 300 items of raw herb materials are circulating in the Thai market, especially for preparing formulated drugs, which are getting more important than single-herb drugs. Some herbs are used in small quantities, resulting in farmers' being

uninterested in growing them, but collecting them from natural forests. As there has been no replacement planting, coupled with decreasing forest areas and no studies on production development, many herbs have become scarce. Now six herbs are in high demand in the global market with potential growth in the future; they are: black fingerroot or *kra-chai-dam*, Indian gooseberry or *ma-kham-pom*, turmeric or *khaminchan*, white *kwao khrua*, Asiatic pennywort or *bua-bok*, and *phlai*. As there has been no suitable demand-supply management system, such raw herbs are scarce or some time of poor quality, resulting in a threat to the production industry and exports, which need to be resolved. However, some herbs are scarce due to higher demand for raw materials, higher production rates and rising exports, and there is no suitable production management mechanism, such as for *phlai*, which has only one harvest season a year, and its scarcity is still prevalent.

2.2.2 Qualities and standards of raw herb materials (herbal raw materials)

High-quality and standard raw herb materials are key factors for herbal products to be of good quality and stable properties. Nowadays, most raw herbs used in Thailand are collected from forests, however, some are grown in home gardens with planting promotion, but their quantities do not meet the market demand. Raw material production on a commercial scale for the industrial sector is still little, while the problems of raw material quality still persist, in terms of consistent chemical components and contamination with microbes, arsenic, heavy metals, as well as agricultural pesticides. Most raw herbs and herbal products do not meet the standards because of microbial contamination exceeding the maximum allowable limit, probably in the raw material preparation process (selection, washing, and drying) as well as improper containers and storage. Overall, the production of raw herbs does not satisfy the market demand, in terms of quantities and qualities, resulting in inadequate raw herb supplies for the industrial sector.

However, the trends in producing good quality raw materials have been rising according to trade rules and regulations. Using good raw herb materials will positively affect product development and consumers' confidence. As many as 1,185 herb growers have had their plots certified as using good agricultural practice (GAP), but many more have to improve their growing practices to produce quality raw

herbs with acceptable active ingredients, non-contamination with microbes, fungi and heavy metals, and acceptable levels of other impurities. Organic agriculture has also been promoted for small scale growers to use the integrated farming approach, not using chemicals, and moving towards achieving the organic farming standards.

With the reasons and trends mentioned earlier, relevant agencies need to give importance to quality control at all production stages, from upstream including the processes of planting, harvesting, processing and storing. Some herbs need specific harvesting methods to obtain herbs with specified quality. For example, sacred lotus or *bua-luang*, its pollen is to be harvested from full bloom flowers so as to have a quality herb in accordance with the traditional knowledge. But for commercial purpose, harvesters will collect the pollen from unbloomed flowers, whose qualities are lower. These issues need to be considered when preparing herb planting and harvesting standards to get high-quality raw materials. Moreover, more efforts need to be made to promote organic farming in herb production to minimize contamination due to the growing process, and to get raw herbs according to the raw material standards. Setting herb standards according to the TTM and indigenous medicine principles and the raw material standards in the Thai medicine production, according to the internationally recognized Thai Herbal Pharmacopoeia, is a basic and important action in creating raw material standards in parallel with the other suitable actions. That will help resolve the basic problem related to raw herb quality in the herb production.

2.2.3 Herb industry in Thailand

Herbs have been used in several industries, be they traditional drug production or herbal processing industries, such as producing herb extracts for use as raw materials in producing some modern medicines. Some are used as ingredients of cosmetics and spa products.

1) Numbers of manufacturers/operators

According to data from relevant agencies, currently the numbers of producers of herbal products includes:

1. Herbal (traditional) drug manufacturers: There are totally 877 producers or places, including 296 in Bangkok and 581 in other provinces (source: Food and

Drug Administration, or FDA, September 2016). Of that number, 25 or 2.6% were certified to meet the Good Manufacturing Practice (GMP) requirements; but all have been revoked, according to the FDA notification on GMP certification for traditional drug producers, dated 22 December 2014).

2. Dietary supplement manufacturers: Totally there are 21 places, including 15 factories and 6 non-factories (source: Statistics on food producers/importers by food type, 2012, Food and Drug Administration).

3. Cosmetics manufacturers: There are 200 places (source: Thai Cosmetic Manufacturers Association, statistics as of 22 June 2016).

However, regarding the sizes of manufacturers, according to the database of the Industrial Works Department, Ministry of Industry, at present there are 106 industries or factories related to herbs, registered with the Department. The proportion of such industries is small compared with all industries, see Table 2.1.

Based on the aforementioned features of manufacturers, it is evident that Thai herbal industries are mostly medium- and small-sized (98%). So if there is a need to raise their competitiveness, as a whole, all agencies concerned have to push for changes and adjustments in their efficiencies and productivity, and the use of science, technology and innovation. Moreover, wisdom and creativity have to be deployed in creating additional values and diverse products, as well as responsiveness to contextual changes and demand as appropriate.

Table 2.1 Number of industries related to herbs by type and size

Type of industry	Number of industries by size			
	Small	Medium	Large	Total
1. Herbal drugs	6	23	6	35
2. Herbal drinks and foods	2	21	5	28
3. Herbal dietary supplements	-	5	2	7
4. Herbal cosmetics	-	11	5	16
5. Others	4	16	-	20
Total	12	76	18	106

Source: Document for a meeting of the Herb Working Group, under the Subcommittee on Accelerating the Implementation of Policy on Special Economic Zones: Medical Hub Cluster, 18 March 2016.

2.2.4 Certification of manufacturing standards

Most Thai traditional drug manufacturers are small household scale industries with outdated machinery, lacking R&D capacity and investment budget. Thus, to develop the standards of Thai traditional and herbal drug industries, efforts should be made according to their potential, namely:

1) Industries that have been GMP/herb-certified should be supported to develop further to achieve a higher level of GMP until they meet the Good Clinical Practice (GCP) requirements to prove drug safety and efficacy in humans.

2) Industries that have not been GMP/herb-certified, but have high potential to develop further, mostly are old medium- and large-sized, with difficulties to achieve the GMP certification, state agencies concerned have to provide them with more knowledge and advice on how to improve their production process to satisfy the GMP/herb requirements.

3) Industries that have not been GMP/herb-certified and have low potential to develop further are mostly small-sized or family scale with practices passed down for generations; and their drug formulas have been used and proved for a long time. Their efforts seem be difficult to reach the GMP/herb certification as they require a huge investment. If the government enforces the GMP/herb regulations, it would be a destruction of the old drug production system and some drug formulas might be lost. One way to resolve this problem is to hire a GMP/herb-certified factory or a herbal-drug producing hospital to produce such drug formulas through a joint knowledge management mechanism, involving the manufacturing process and raw material management. Meanwhile, a competent organization should be assigned to undertake knowledge management and development activities and assist them to move towards GMP/herb certification.

4) Community-level industries, especially those involved in the One Tambon One Product (OTOP) scheme. Sets of Community Product Standards (CPS) have been established for more than 2,000 products, and 687 products have been CPS-certified for 11,755 producers. So Thailand has been able to raise the qualities or standards of community herbs so that they are reliable for consumers within the country and enhance their competitive potential on a continual basis.

2.2.5 Export and import quantities of herbs in Thailand

The statistics of herb exports and imports in Thailand’s international trade system appear in the Customs Department’s database with Harmonized System (HS) codes. As for Thai herbs, they are recorded as plant varieties and parts of plants (including seeds and fruits) chiefly used for producing aroma substances in pharmaceutical or pesticide industries (HS 1211) and herbal saps as well as plant extracts such as pectic substances, pectinate/pectate salts, and agar from seaweed, etc. (HS 1302), whose export-import quantities are shown in Tables 2.2–2.5. However, it is noteworthy that the herbal characteristics shown in the database cannot systematically generate a herbal data system for the country to correctly reflect the overall picture of the herb industry.

Table 2.2 Values of Thai herb exports in the form of plant varieties and parts of plants (including seeds and fruits) chiefly used for producing aroma substances in pharmaceutical or pesticide industries (HS 1211), 2013–2015

Export market	Export values, million baht		
	2013	2014	2015
Global	432.2	440.6	431.6
Japan	118.7	118.2	130.2
China	149.2	157.7	114.4
Hong Kong	65.7	72.7	94.0

Source: Thailand Trading Report (<http://www2.ops3.moc.go.th>), document for a meeting of the Herb Working Group, under the Subcommittee on Accelerating the Implementation of Policy on Special Economic Zones: Medical Hub Cluster, 18 March 2016.

Table 2.3 Values of Thai herb exports in the form of herbal saps as well as plant extracts such as pectic substances, pectinate/pectate salts, and agar from seaweed (HS 1302), 2013–2015

Export market	Export values, million baht		
	2013	2014	2015
Global	211.9	226.5	206.1
Myanmar	82.2	89.8	90.6
U.S.A	28.4	25.5	30.2
Philippines	0.7	1.3	11.7

Source: Thailand Trading Report (<http://www2.ops3.moc.go.th>), document for a meeting of the Herb Working Group, under the Subcommittee on Accelerating the Implementation of Policy on Special Economic Zones: Medical Hub Cluster, 18 March 2016.

Table 2.4 Values of Thai herb imports in the form of plant varieties and parts of plants (including seeds and fruits) chiefly used for producing aroma substances in pharmaceutical or pesticide industries (HS 1211), 2013–2015

Import source	Import values, million baht		
	2013	2014	2015
Global	535.8	542.2	601.4
China	387.6	396.9	428.4
India	52.0	58.2	55.6
Laos	21.5	21.5	24.4

Source: Thailand Trading Report (<http://www2.ops3.moc.go.th>), document for a meeting of the Herb Working Group, under the Subcommittee on Accelerating the Implementation of Policy on Special Economic Zones: Medical Hub Cluster, 18 March 2016.

Table 2.5 Values of Thai herb imports in the form of herbal saps as well as plant extracts such as pectic substances, pectinate/pectate salts, and agar from seaweed (HS 1302), 2013–2015

Import source	Import values, million baht		
	2013	2014	2015
Global	2,834.8	2,971.3	3,058.6
China	545.9	825.5	741.3
Brazil	322.0	283.7	400.3
U.S.A.	286.6	248.9	290.1

Source: Thailand Trading Report (<http://www2.ops3.moc.go.th>), document for a meeting of the Herb Working Group, under the Subcommittee on Accelerating the Implementation of Policy on Special Economic Zones: Medical Hub Cluster, 18 March 2016.

However, according to the above data, it is noteworthy that Thailand's exports have not changed much each year. As for herbs in the HS 1211 group, most of their exports went to China, followed by Japan, while the HS 1302 herbs, exports were mostly directed to Myanmar, followed by the USA. Regarding imports, HS 1211 herbs were mostly imported from China, followed by India, whereas HS 1302 herbs were mainly imported from China, followed by Brazil.

Herbs for exports are chiefly in the forms of dried powder, crude extracts, and herbal products. Their export value was 245.27 million baht for 2014, mostly for peppercorn and turmeric. In the same year, for herbal products, their consumption and export value was more than 80,000 million baht for the group of food supplements, about 10,000 million baht for herbal spa products, and about 10,000 million baht for Thai traditional medicines. Regarding herb imports, the trends have been rising for raw herbs and herbal extracts. In 2014, the import value of raw herb materials was 1,099.61 million baht, mostly including peppercorn, cinnamon, Chinese star anise (*janpaedkleeb*, *poi-kak*, or *Illicium verum*), herbs in the *koat* and *tian* groups, and others that are essential in the Thai drug industry. Such herbs are mostly imported from China, India, and Indonesia.

Regarding the values of traditional drug production and imports, Table 2.6 shows that the import value was lower than that for production. So Thailand has the potential to produce traditional drugs for domestic use, but the GMP certification for the herbal drug industry is at a low level. If the country wants to export such products, it needs to follow the GMP PIC/S (Pharmaceutical Inspection Co-operation Scheme) requirements, which need a lot of improvements.

Table 2.6 Values of Thai traditional drug production and imports, 2011–2013

Year	Traditional drug production (million baht)			Traditional drug imports (million baht)		
	Human use	Animal use	Total	Human use	Animal use	Total
2011	3,516.90	8.06	3,524.96	474.13	0	474.13
2012	3,703.60	10.321	3,713.92	500.43	0	500.427
2013	4,722.78	8.506	4,731.28	690.49	0	690.49

Source: Food and Drug Administration, 2016.

2.2.6 Thai herb market and herbal use in Thailand

In Thailand, the centre of herb market is in Bangkok, which has about 13–15 large traders in Chakkrawat subdistrict of Samphanthawong district, who are wholesalers, importers and/or producers of traditional drugs. As for raw herb material collectors, they are scattered in major herbal sources such as Songkhla, Ratchaburi, and Nakhon Pathom provinces; and there are herb-grinding factories in Bangkok's peripheral areas. Herb prices are unstable, varying with production quantities and demand. At present, some traders have begun classifying raw herbs and selling them according to herb qualities, but the farmers still have no price bargaining power.

The Thai herb market has faced major challenges after entering the ASEAN Community and bilateral agreements with many countries. Even though Thailand has had advantages regarding experiences in R&D on pharmaceutical industry and marketing, its upstream raw herb production sector needs to accelerate farmers' potential and capacity building, in terms of quality, costs and labour, so that its herbs are competitive with those from other potential countries in the region (Cambodia, Laos, Myanmar, and Vietnam). In the downstream production sector, the competition of herb products will be very fierce with those from Malaysia, Indonesia, the Philippines, China and India, which have invested in the production and trade in member states or bilateral partners.

Concerning the trends in herb market for each consumption objective, according to a survey on drug-use values for 24 herbal drugs in the National List of Essential Medicines (NLEM), the annual value is about 14,000 million baht, which has been rising steadily. Herbal drug production is undertaken in 70 state-run hospitals, of which 45 have been GMP-certified. That reflects the people's increasing awareness of health care with herbal medication in the Thai public health system. Besides, as Thailand has become an ageing society and will be an aged society in the near future, there will be opportunities and challenges in health care in the future, and the Thai traditional and herbal medicine sector has to respond to the needs arising from such contextual changes.

In regard to herbal use for health promotion and as beauty products, at present, as the people are more health-conscious, the statistics from the Thailand Health and

Beauty Confederation show that the market value of dietary supplements for health was approximately 80,000 million baht in 2011, whereas that for herbal-drink products, ready-made herbal drinks and spa products was more than 30,000 million baht, with a growth rate of 30%. A study on the consumption of foreign herbal products in Thai households in 2013, according to the 2014 data from the National Statistical Office, shows that among not-too-high income families (monthly income less than 10,000 baht), some of them (2.5%) tried to use foreign herbal products, and among middle-income families (monthly income 10,001–30,000 baht), 5% bought and used foreign herbal products, and such proportions are rising with higher economic status. The herbs that were consumed the most were ginseng and *lingzhi* or *ling zhi*. Regarding cosmetics, the export value was 140,000 million baht and 90% of the raw herb materials were imported for the manufacturing sector, and the value of herbal extract imports was 20,000 million baht for such purposes. Even though the proportion of herbs used in herbal cosmetic and food-supplement industries is smaller than that in the drug and extract industries, their higher industrial values are important options for promoting herbal industry development.

Besides, an important trend is noted in herbal use for animal production, which has been rising significantly as the producers realize the safety of consumers. That is a major request for animal feed producers to seek and use raw natural products, instead of antibiotics. Research studies have supported the use of herbs in lieu of antibiotics, such as *fa-thalai-jon*, turmeric, galangal or *kha*, and *phlai*, which can prevent and control animal diseases, and reduce the chances of having drug-resistant and certain illnesses in humans as a result of antibiotic growth promoter (APG) use in animal farming.

2.2.7 Research and development (R&D) on Thai herbs

Research on the body of knowledge about Thai herbs mostly focuses on seeking scientific evidence to support the improvement of herb quality, efficacy, and safety, which are important for manufacturing herbal products, including herbal medicines or other health products. During 2000–2004, an analysis of Thai herbal research papers published in technical journals showed that there had been 395 studies conducted by Thai and foreign researchers, of which 223 were published in

international journals and the rest (172 articles) in Thai journals, covering more than 200 herb species. It is evident that Thailand has a number of competent researchers who have conducted internationally accepted research studies.

Furthermore, reports on situations of research on Thai traditional medicine (TTM), indigenous medicine (IM), and alternative medicine (AM) have shown that the proportion of herbal studies was greater than 50% of all studies surveyed. For instance, a review conducted by Thawatchai Thien-ngam and colleagues on 1,476 TTM/IM/AM studies undertaken between 2000 and 2009, showed that 788 studies (53.4%) were on herbs, of which 517 (65.6%) were on identifying knowledge for producing human and animal drugs, cosmetics, food, and other products.

It is noteworthy that many studies focused on creating new knowledge for herbal development and moving towards innovations. However, such a report has shown that very few studies (only 37, or 4.69%) were on herb marketing and use behaviours. Overall, many studies have reflected the people's acceptance of herbal drugs. A report on the assessment of herbal drug use and safety in MoPH hospitals that produced herbal drugs according to the GMP requirements showed that more than 80% of herbal drug users were satisfied with such drugs, and more than 90% wanted to return and use such drugs again. The value of health service consumption related to Thai traditional and alternative medicine in 2013 was about 14,000 million baht, and 58% of Thais knew of herbal drugs, but very few (less than 1%) knew and actually used Thai traditional formulas.

Anyhow, overall research has not clearly targeted any herbs or herbal products, and research directions seem to be scattered, mostly according to researchers' expertise. That reflects the fact that Thailand is facing many aspects of herbal R&D, ranging from the lack of national research directions and having research work that does not respond to the needs of the industrial and production sectors, to redundant research funding and abundant basic research but lacking full-cycle research that leads to product development.

To respond to the country's herb development plan, keeping in mind the human resource and funding constraints to achieving concrete results, the directions and goals of such a plan need to be product-oriented and have tangible goals/targets. Moreover, resources have to be mobilized from all herb-related public and private agencies as well as educational institutions to collaborate in this effort. The

research concept needs to be drawn up, beginning from selecting herbs with various potentials (commercial, therapeutic or other), and then develop common goals/targets so that the R&D efforts will result in supply-chain development, covering R&D on raw herb quality development (seed selection, propagation, planting, harvesting, post-harvest storage – to ensure raw material quality), and R&D on industrial production, as well as demand creation. All such operations will result in full-cycle development efforts and it is expected that they will be successful at the national level and accepted internationally.

However, regarding the funding support for herbal R&D, to date it has been found that Thailand's overall research budget is approximately 25,000 million baht, or 0.2% of its gross domestic product (GDP). Such an R&D investment is rather low, compared with that in developed countries. As for herbal research budget, totally it is only 300 million baht, or 1.2% of the total R&D budget of the country despite the fact that herbal R&D is an important factor for the success of Thai herb development. In addition to specifying a clear direction for allocating more budget for full-cycle development and value creation as planned, the budgeting process has to ensure adequate research supplies and equipment. With more research investment, the herbal R&D process will be accelerated to more rapidly achieve the goals.

2.3 Problems of herbs in Thailand

In Thailand, many herbs are scarce and have to be imported. The scarcity is due to the lack of herbal farming support and knowledge about raw herb production for use in the manufacturing of Thai medicines. Moreover, its good management system is not in place to obtain correct herb varieties and knowledge of planting and harvesting; and a good raw material production process has to be deployed to ensure that the materials are not contaminated and adulterated. The quantities produced do not meet the demand due to inadequate support from relevant government agencies in promoting and protecting herb varieties, as well as the lack of standards for examining herb qualities, resulting in poor raw herb qualities and quantities, and ultimately poor quality Thai herbal or health products for exports and fetching revenues into the country. Such herbs

are turmeric, *phlai*, Indian gooseberry or *ma-kham-pom*, blady grass or *ya-kha* roots, smilax or *khao-yen-nuea* and *khao-yen-tai*. So the role of Thai traditional medicine is diminished.

According to the Ministry of Agriculture and Cooperatives, in 2013, the commercial herb growing area was only 42,553 rai (17,021 acres), and it dropped to 34,936 rai (13,974 acres) in 2014, which is very small compared with all the country's agricultural land. In herbal farming, there were only 9,015 households engaged in such activities, mostly small scale and clustered as 315 herb community enterprises. The trends in demand for herbal extracts have been rising, resulting in rising demand for raw herbs. In 2014, raw material and extract imports from China, India, and Indonesia for use in traditional drug industries were worth as much as 1,099.61 million baht.

Due to the lack of herbal R&D support, in terms of directions and systems, the capacity of the Thai drug and herb industry is still low, despite the country's abundance of biodiversity and herbs for therapeutic and health promotion purposes. The reasons are the lack of R&D to create modern technologies for producing new products, the lack of quality control measures and laboratories for raw herbs and herbal products that are internationally acceptable, and legal constraints in using new technologies and know-how for product development, and inadequate research for scientifically describing medicinal properties and treatment efficacies, especially in comparison with the number of herbs that require research support.

The criteria for herbal product registration are inconsistent with the context and directions for using herbal products and Thai traditional medicine. They are also obstacles to creating knowledge and new indications, timely registrations of herbal drugs, timely trade competition, and consumer protection, even for Thai traditional drug formulas.

The problems of Thai traditional drugs and herbal products. Such problems are related to the adulteration of products for sale as they are not legally registered. Oftentimes, some drugs/products are adulterated with unsafe chemicals such as steroids, weight-lowering substances, and vasodilators. Another problem involves false advertisements, over-claims and overpricing, particularly through direct sales, community radio, satellite or cable television, and the Internet.

In addition to wasting their money and time, the consumers might be adversely effected by the dangerous effects of such products and losing the opportunity to receive correct medication by tagging on the global and national trends in the use of Thai herbs and traditional medicine. Regarding the legal measures undertaken by state agencies, most cases were handled very slowly or untimely, and the consumers had become the victims or damaged. This is because most people do not have the correct knowledge of such products and are unaware of the distorted sales promotion tricks, so they cannot undertake self-care and protect themselves from such illegal herbal medicines and products.

When considering the supply chain of herbal development, the problems in each step of the entire chain can be summarized as follows:

Table 2.7 Problems in the value chain

Step in the value chain	Herb situations in Thailand
1. Relevant research and development (R&D)	
1.1 R&D and discovery of herbal drugs and products	<ul style="list-style-type: none"> - Rather small amount of budget is allocated for R&D in the country (in relation to GDP), less feasible for budget allocation for herbal research. - No clear directions for budget allocation (research topics mostly dependent on researchers' interests).
1.2 Clinical experiments	<ul style="list-style-type: none"> - Laboratories mostly belong to state agencies and educational institutions; some are substandard and inadequate in numbers.
1.3 Commercial scale development	<ul style="list-style-type: none"> - Operators of SMEs cannot easily access research results for use in commercial scale. - Operators of SMEs tend to be unable to transform research results into commercial products smoothly and go through the Valley of Death – due to financial and consultative constraints.
2. Procurement of raw material for production	
2.1 Herb growing and relevant operations	<ul style="list-style-type: none"> - Herb growing does not correspond with the needs for consumption and herbal product manufacturing. - No farming plans for systematically reflecting the manufacturing needs.

Table 2.7 Problems in the value chain (continue)

Step in the value chain	Herb situations in Thailand
2.2 Management of raw materials and storage	<ul style="list-style-type: none"> - Deforestation to obtain raw materials without replacement planting or reforestation, resulting in herbal non-existence in the forest and probably extinction. - Little understanding about standard raw material management, resulting contamination and poor storage, unable to retain herb qualities within the specified timeframe.
2.3 Imports of raw materials	<ul style="list-style-type: none"> - Many types of herbs are insufficient, or do not exist in country, or exist in country but are substandard, resulting in reliance on imports of raw materials or extracts in manufacturing industries.
2.4 Exports of raw materials and extracts	<ul style="list-style-type: none"> - Many types of herbs are needed in foreign markets; in many cases, in-country manufacturing is only for exports.
3. Registration and certification by relevant agencies	<ul style="list-style-type: none"> - Sluggishness in the registration and certification processes by state agencies, resulting in a bottleneck of further actions.
4. Manufacturing	
4.1 Quality control in manufacturing	<ul style="list-style-type: none"> - Production qualities are substandard, especially in SMEs.
4.2 Support for commercial manufacturing	<ul style="list-style-type: none"> - Support and privileges are inadequate to facilitate efficient competition.
5. Marketing and related processes	<ul style="list-style-type: none"> - Lack of knowledge about Thai herbs.
6. Transport	
6.1 Storage during transport	<ul style="list-style-type: none"> - Some parts of the transport are of poor quality or substandard, resulting in products' lower quality, lost saleability and competitiveness.
6.2 Transport management	
7. Consumers	<ul style="list-style-type: none"> - Consumers' lack of correct understanding about herbs, resulting in inappropriate consumption.
8. Mechanisms for monitoring and policy-making in the future	<ul style="list-style-type: none"> - There are no committee and substantive law on setting directions for herb development.

These situations are to be considered when developing a National Master Plan for Thai Herb Development so that there will be suitable actions to address the situations and problems, leading to sustainable development.

2.4 National directions for Thai herb development



Thai herb development has been accorded importance constantly. During the General Prayut Chan-o-cha government, a directive dated 14 August 2015 was issued, assigning the Ministry of Public Health and other relevant agencies such as the Ministry of Agriculture and Cooperatives and the Ministry of Commerce to further develop Thai herbs so that they can be used efficiently and accepted, and to create additional values of the products derived from Thai herbs.

Besides, the Public Health Reform Committee of the National Reform Council has proposed six issues for the reform of Thai traditional medicine as follows:

Issue 1: Reform of management structure and mechanism for excellence in Thai traditional medicine

Issue 2: Reform of workforce education and development to “Create Thai Unity-Identity”

Issue 3: Reform of research and development of knowledge based on Thai traditional wisdom

Issue 4: Reform of Thai traditional medical services in parallel with modern medicine

Issue 5: Reform of Thai traditional and herbal drug industry towards “National Security and Drug Depot”

Issue 6: Reform of the protection of Thai traditional wisdom - “Thailand’s World Heritage”

Moreover, the Minister of Public Health’s policy related to Issue 6 specifies that research and development is to be undertaken to promote Thai traditional wisdom and Thai herbs in a full-cycle manner for boosting Thai economy.

2.5 First National Master Plan for Thai Herb Development, 2017–2021

Objectives: In preparing the First National Master Plan for Thai Herb Development, 2017–2021, the framework of the government policy on Thai traditional medicine reform was used in setting the following objectives:

- 1) Develop herbs further for producing therapeutic and other products.
- 2) Create added economic values of herbs with linkages between herbal industries and other economic sectors.
- 3) Drive plan activities systematically for Thai herb development with linkages in a full-cycle manner.
- 4) Facilitate collaboration among relevant public and private sector agencies.

Based on the aforementioned objectives, the Steering Committee and the Committee on Drafting the First National Master Plan for Thai Herb Development, 2017–2021, comprising representatives from various agencies working on Thai herb development, have drawn up the vision, mission, and targets of the plan as follows:

Vision

“Thai herbs for health and sustainable economy”

Mission

- 1) Develop Thai herbs so that they are accepted and used with full potential and efficiency.
- 2) Support the production of Thai herbs that meet the standards with good quality and added value for herbal products.
- 3) Enhance the competitiveness of Thai herbs in domestic and overseas markets.
- 4) Promote the knowledge and understanding about Thai herbs as well as their correct and appropriate use.

Targets

- 1) Thailand will be a country that exports high-quality raw herb materials and outstanding herbal products in the ASEAN region by 2021.
- 2) Values of local raw herb materials and herbal products increase at least twofold by 2021.

Strategies

The Master Plan specifies four strategies to achieve the objectives as follows:

- Strategy 1:** Promote the productivity of potential Thai herbs to meet local and overseas markets' demands.
- Strategy 2:** Develop the herb industry and marketing according to international standards.
- Strategy 3:** Promote the use of herbs for treating illnesses and health promotion.
- Strategy 4:** Strengthen public sector administration and policy for driving Thai herb development in a sustainable manner.

The details of each strategy as well as its strategic objectives, strategic targets, indicators, measures and programmes and Quick Win (short-term outputs) are as follows:

Strategy 1: Promote the productivity of potential Thai herbs to meet local and overseas markets' demands.

This strategy covers the management of herb farming, raw herb processing, raw herb quality, and raw herb marketing, research and development (R&D) on raw herbs, and protection of herbs and wisdom related to the use of herbs in Thailand, using the following three measures:

- 1) Management of supply chain
- 2) Research on, and setting up of, raw herb standards
- 3) Conservation and use of herbal plants from forests in a sustainable manner

Strategic objectives

- 1) To promote herb farming and basic processing according to the quality requirements.
- 2) To increase the quantities of high-quality raw herb materials to nearly meet the demands of herbal industry operators.
- 3) To conserve Thai herbs for use in a sustainable manner.

Strategic targets

- 1) A combined land area of 43,000 rai (17,200 acres) grows high-quality herbs according to the herb-growing standards.
- 2) 50 farmers' groups, cooperatives, and community enterprises promoted to carry out post-harvest processing in the growing areas and produce simple herbal products as well as extracts.
- 3) Guidelines for good agricultural practices or good agricultural and collection practices (GAP/GACP) or other standards prepared for at least 30 herbs.
- 4) One land use database established on land areas with herb cultivation.
- 5) Land suitability maps drawn up for at least 30 herbs.
- 6) Number of ISO 17025-certified laboratories for herb quality inspection increases by at least 15 (10 in the Ministry of Agriculture and Cooperatives and 5 in universities).
- 7) Four central market systems and one e-market established.
- 8) Thai Herbal Pharmacopoeia covering an additional 75 herbal products prepared.
- 9) One National Database of Thai Medicinal Plants and Traditional Knowledge established.
- 10) 30 R&D projects conducted each year on herbal varieties and raw material production technology.

Strategic indicators

- 1) At least 50% of all herb-farming areas grow high-quality herbs.
- 2) At least 50% of all herb-farmers/processing groups follow the GAP/GACP guidelines.

Quick wins (short-term outputs)

- 1) At least 5,550 rai (2,220 acres) of herb-growing areas (1,920 acres in herb plots and 300 acres in community forests) follows the GAP/GACP guidelines.
- 2) One Land Use report (situation and database) prepared on herb farming in Thailand.
- 3) GAP/GACP standards (on herb growing and harvesting) prepared for at least 2 important herbs.
- 4) Raw medicinal herb or material standards (materia medica) established according to the TTM principles for 300 items.
- 5) At least two central herb markets and one e-market established.
- 6) An additional eight ISO 17025-certified laboratories established for examining the qualities of raw herb materials.
- 7) Standard substances in place for quality control of at least two raw herb materials.
- 8) Herb standards established according to Thai Herb Pharmacopoeia for an additional 15 items.

Strategy 2: Develop the herb industry and marketing according to international standards.

This strategy covers the development of factors related to the herb industry, extended R&D on utilizing research results, and the creation of reliability and sales promotion of herbal products, using the following three measures:

- 1) Development of Thai herb industry
- 2) Research and development on Thai herbs
- 3) Development of Thai herb marketing

Strategic objective

- 1) To produce high-quality herbs with competitive potential in domestic and overseas markets.

Strategic targets

- 1) Market values of herbs and herbal products in Thai and foreign markets increase by 15% per year.

- 2) Productivity of herbal extract industries enhanced: sales value increasing by 15%
- 3) At least 50% of herbal extract industries in each group pass the production upgrading programme.
- 4) Herbal products with a quality certification logo recognized in the ASEAN region.
- 5) At least 30% of herbal products certified according to the herbal product quality standards.
- 6) At least one Thai laboratory certified according to the OECD GLP standards by 2019.
- 7) A National Institute for Herbal Innovation Development established.

Strategic indicators

- 1) Herbal product values at home and overseas increase by at least 15% per year.

Quick wins (short-term outputs)

- 1) A Competency Model exists for five industrial groups: medicines, food supplements, cosmetics/spa products, extracts, and animal-use products.
- 2) 50 new premium herbal products manufactured.
- 3) International recognition logos received for Thai herbs.
- 4) Recognition logos received by three groups of herbal products: food supplements, cosmetics, and spa products.
- 5) At least 10 new herbal products are in the process of applying for Geographical Indication (GI) registration.
- 6) Marketing channels for herbal products extended to overseas markets such as health or medical tourism promotion and international trade exhibitions.

Strategy 3: Promote the use of herbs for treating illnesses and health promotion.

This strategy covers the development of TTM service system, research on herbal drug formulas and herbal food, TTM workforce, and access to herbal drug formulas at health-care facilities, and the promotion of indigenous medicine wisdom and proper herbal use, using the following six measures:

- 1) Development of service structure, and promotion of service delivery and use of herbs at health-care facilities.
- 2) Research on knowledge creation, standards, quality and risks.
- 3) Development of technical strengths of Thai traditional medicine.
- 4) Management and accessibility of herbal drugs in the National List of Essential Medicines.
- 5) Use of herbs for health promotion and disease prevention in the communities, and roles of indigenous or folk healers.
- 6) Communications to create correct knowledge, understanding and confidence.

Strategic objectives

- 1) To increase the use of herbs in the health system for treating illnesses and health promotion.
- 2) To establish the foundation of TTM and Thai herb development as part of the country's health system in the long run.

Strategic targets

- 1) Number of herbal drug items in the National List of Essential Medicines increases by at least 10 per year.
- 2) Systems for drug and herbal drug registration revised to meet market demand in a timely manner.
- 3) Modern doctors' prescriptions of herbal drugs increase by at least 20% per year.

Strategic indicators

- 1) Values of herbal drugs used at health-care facilities increase by 10% per year on average.
- 2) An additional 50 herbal drug items included in the National List of Essential Medicines by 2021.

Quick wins (short-term outputs)

- 1) Values of herbal drugs used at health-care facilities increase by at least 10%.
- 2) Full-cycle Thai traditional and alternative medical clinics established in 80% of state health-care facilities (regional, general and community hospitals).
- 3) Clinical practice guidelines (CPG) using Thai traditional medicine prepared for four illnesses.
- 4) Research undertaken on Thai traditional formulas to add 10 drug formulas to the National List of Essential Medicines.
- 5) Thai Preparation Herbal Pharmacopoeia prepared for at least 5 drug items.
- 6) Communities empowered to run a programme on health promotion with herbs in at least 1,000 subdistricts.

Strategy 4: Strengthen public sector administration and policy for driving Thai herb development in a sustainable manner.

Under the National Master Plan for Thai Herb Development, this strategy covers the development of administrative structure, laws on herbal products, and herb database, the assessment of herb-related competitiveness, the management herb R&D, the designation of herbs with potential for promotion, and the implementation of the Master Plan at the provincial level, using the following six measures:

- 1) Development of herb administration structure
- 2) Development of laws for herb promotion and product control
- 3) Development of herb databases and systems for assessing herbal competitiveness
- 4) Establishment of management mechanisms for herb research and development
- 5) Promotion and development of herbal Product Champions
- 6) Development of Herbal Cities

Strategic objective

- 1) To set up a mechanism for Thailand to develop herbs with potential to create more economic values for the country.

Strategic targets

- 1) Thailand has principal laws on herbs and a National Committee on Herb Development.
- 2) Budget for herb research rises to 5,000 million baht during the 5-year period.
- 3) The proportion of private sector investment on research rises to 50–70% by 2021.
- 4) Thailand has at least 10 herbal Product Champions.
- 5) Thailand has indicators for measuring herbal competitiveness.
- 6) Thailand has a programme to promote and support herb development for integration into the Thai health and economic systems, on a full-cycle scale, at the provincial level, using the *Pracharat* (civil-state) approach or partnership mechanism.

Strategic indicators

- 1) A National Herb Policy Committee and related subcommittees can function by 2017.
- 2) Sales of herbal Product Champions increase by at least 2,000 million baht.

Quick wins (short-term outputs)

- 1) Establishment of a National Herb Policy Committee.
- 2) Proposition of draft bill (act) on herbal products B.E.
- 3) Establishment of a database on economic values of herbs in Thailand.
- 4) A clear Herb Research Plan drawn up with a mechanism for allocating a budget of 5,000 million baht.
- 5) Herbal Product Champions designated and measures existing for promoting each of the Product Champions.
- 6) Herbal Cities exist in four provinces.

Investment budget

The First National Master Plan for Thai Herb development, 2017–2021, to be implemented with the four strategies, will lead the country to being a herb leader in the region. The plan aims to further develop Thai herbs, based on the country’s accumulated wisdom, diverse natural resources, geographical advantage (being centrally located in the region), and industrial strengths.

Moving towards such a goal, the country needs cooperation from both public and private sectors under the *Pracharat* (civil-state) partnership mechanism with the investment budget of 18,499.95 million baht for the five-year period of the First National Master Plan. This is to ensure plan implementation according to the established directions, seriously and continuously, by the National Herb Policy Committee, as detailed below:

Table 2.8 Budget for the First National Master Plan for Thai Herb development, by strategy, in fiscal years 2017–2021

Strategy	Budget type	Fiscal year and budget (million baht)					
		2017	2018	2019	2020	2021	Total
Strategy 1	Operating	134.02	116.14	97.81	107.98	125.53	581.48
	Investment	60.70	61.00	62.50	63.50	65.00	312.70
Strategy 2	Operating	87.90	91.20	92.60	98.10	102.50	472.30
	Investment	20.00	20.00	20.00	10.00	10.00	80.00
Strategy 3	Operating	31.00	31.00	31.00	31.00	31.00	155.00
	Investment	1,000.00	1,520.00	1,520.00	1,520.00	1,520.00	7,080.00
Strategy 4	Operating	879.82	1,260.28	1,446.86	1,851.49	1,640.02	7,078.47
	Investment	640.00	450.00	500.00	550.00	600.00	2,740.00
Total	Operating	1,132.74	1,498.62	1,668.27	2,088.57	1,899.05	8,287.25
	Investment	1,720.70	2,051.00	2,102.50	2,143.50	2,195.00	10,212.70
Grand total		2,853.44	3,549.62	3,770.77	4,232.07	4,094.05	18,499.95

2.6 Conclusion

As a result of the aforementioned factors, namely the population structure changing to become ageing and aged societies, global population's trends in chronic illnesses, people's awareness about health care with natural products, and a 9.1% rise of Thai herbs in the Asia-Pacific market, it is Thailand's opportunity to accelerate Thai herb development. That is to improve the qualities and create added values of Thai herbs, based on the five capitals: natural capital and cultural capital (having jointly generated valuable national wisdom), human capital plus social capital (linking each other in the entire value chain, upstream, midstream and downstream, and creating the forces for knowledge sharing and market linkages at the national, regional and global levels), and physical capital, all with government support regarding infrastructure, legal advice, and facilitation related to herb development. Thus, collaboration is seriously needed from all relevant public, private and civil society agencies/organizations in a continuous manner, with government support through the civil-state partnership approach, to implement the First National Master Plan for Thai Herb development, 2017–2021, at the local and national levels. This is to drive the nation forward from a middle-income country to a high-income one, or Thailand 4.0, in the future according to the government's policy.



