

Cornology - Optimization for Market Entry

A Linear Programming Case Study

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Introduction to Thailand

Summary of the Provinces of Thailand

A Brief History of Thailand

Thailand was known as Siam until 1939 and was unified as the Kingdom of Thailand in the 14th century. To this day, it is the only Southeast Asian country that has never been taken over by a European power.

Thailand officially has 77 administrative divisions (provinces). Thai is the national language, and in 1283, King Ramkhamhaeng (Rama 5) developed the written form of the Thai language. The capital city of Thailand is called “Bangkok” in English or “Krung Thep Maha Nakhon” in Thai. The capital’s proper name in Thai is "Krung Thep Mahanakhon Amon Rattanakosin Mahinthara Ayuthaya Mahadilok Phop Noppharat Ratchathani Burirom Udomratchaniwet Mahasathan Amon Piman Awatan Sathit Sakkathattiya Witsanukam Prasit.”

Thailand is one of world’s only countries that is still governed under a constitutional monarchy system. The King of Thailand, King Bhumibol Adulyadej (Rama 9) is the world’s longest administrating monarch. The government of Thailand is made up of three branches: legislative, executive, and judiciary. Through a constitution, the king has given several powers and responsibilities to the working of government, although he additionally remains a figurehead and symbol of the Thai nation. He does not, however, have outright political authority.

Currency

Name

Thai baht (บาท)

Symbol

฿

Ticker Code

THB

Mean Buying Exchange Rate (TTM)

฿35.5879 = US\$1.00

Geography and Basic Demographics

Population

67,472,339 (2014) (0.93% of world population)

Bordering Countries

Myanmar (1,800 km.), Cambodia (803 km.), Laos (1,754 km.), and Malaysia (506 km.)

Climate and Biome

Very tropical: Rainy, warm, and cloudy. The Southwest has a monsoon season (mid-May to September) but outside of this season it is generally dry and cool. The Northeast also has a monsoon season (November to mid-March). The Southern isthmus is always hot and humid.

Chiang Rai

This area is surrounded by **high mountain ranges**. The borders to the **west** are the Kayin and Kayah states of Myanmar. The province is covered with **mist for the entire year** due to the high mountain ranges. Since it is set in a remote area surrounded by mountains, many travelers are attracted by its beautiful scenery. **From a foreign perspective, it is conceived to have the typical scenery of Northern Thailand.** Most of the areas of Chiang Rai province are covered in **rainforests** due to the multifaceted mountain ranges. November through February is the coldest time of the year. From June to October, it is relatively difficult to travel to remote parts of Chiang Rai due to the rain. From February to May, the weather in Chiang Rai province is hot, however, it is still cooler than other regions in Thailand.

Population: 248,178 (2014)

Nong Khai

Located in the **Northern part of Thailand**, this region borders with Laos. The neighboring Thai provinces are Bueng Kan, Sakon Nakhon, Udon Thani, and Loei. Nong Kai province is in the valley of the Mae Nam Kong, which is the Thai name of the Mekong River. It is connected to Laos with the Thai-Lao Friendship Bridge, which was built by the governments of Thailand, Laos, and Australia.

Nong Khai is part of a special area supported by the government where there is a particular focus on the agricultural sector (**non-heavy industry**) to **protect and preserve natural resources**. This also helps protect the region's migrant labor. In 2010, Thailand's Minister of Transport got approval from the Thailand-China Joint Committee on Economic Cooperation of the draft Memorandum of Understanding (MoU) for the construction of a Bangkok-Nong Khai highspeed train route. According to the agreement, the route is intended to connect with China in the city of Kunming, Yunnan Province.

In general, Nong Khai province has three seasons. It is very hot in the summer and it rains heavily during rainy season, partly due to the Mekong River. Due to the region's highland nature, the temperature during winter can drop to 11 degrees Celsius.

Population: 517,269 (2014)

Bangkok

Bangkok is the capital city of Thailand and a metropolitan region. The Asian investment boom in the 1980s and 1990s attracted many multinational corporations to found their Southeast Asian headquarters in Bangkok, helping to make Bangkok the economic center of Thailand. The city is the country's major hub for finance and business. Bangkok is vibrant in terms of cultural landmarks as well as fashion and entertainment. It is also one of the world's top tourist destinations. However, due to its rapid growth, its cityscape is disorganized and has insufficient infrastructure systems. Limited roads and a rapid increase in private car usage (partly due to the First Car Policy) have resulted in prolonged traffic congestion. The national government is trying to promote the use of public transportation, and is also planning more transport systems to address this critical issue.

Bangkok borders with Nonthaburi Pathum Thani, Chachoengsao, Samut Prakan, Samut Sakhon, and Nakhon Pathom, which altogether form the greater Bangkok Metropolitan Region. Like most of Thailand, Bangkok has a tropical savanna climate influenced by the Southeast Asian monsoon system. Bangkok experiences three seasons: hot, rainy, and cool. However, it is fairly hot year-round.

Since 2013, the FBI of the United States has been issuing a warning that Bangkok is ranked as one of most susceptible places to be targeted for a terrorist attack. On August 17, 2015, a bomb attack took place at a major tourist attraction, killing at least 20 people and injuring at least 140. Bangkok has also experienced a decade of a sometimes-violent rivalry between political factions. However, after the military took control of the country in May 2014, things have been less unruly.

Population: 8.5 million (2014)

Yala

Located on the southern tip of Thailand, Yala is one of four provinces with a Muslim-majority population. Yala province has a unique mixture of cultural heritage from several groups: Thai, Chinese, and Islamic. Its neighboring provinces are Songkhla, Pattani, and Narathiwat. It also borders with Malaysia.

The main occupations in Yala province are trade, agriculture, and governmental services. It has also been designated as a wildlife sanctuary and has a wealth of hot springs, waterfalls, and cave attractions. It is widely known that Southern Thailand is comprised of beautiful islands and beaches, while its interior is dominated by mountains and dense rainforests. This is due to the

fact that Southern Thailand experiences monsoons from both the Indian Ocean and the South China Sea. On the east coast of this region, it is summer from June to September. The rainy season typically begins in October and lasts until June. On the Andaman Coast, it is summer from November to April and then rain season from May to October.

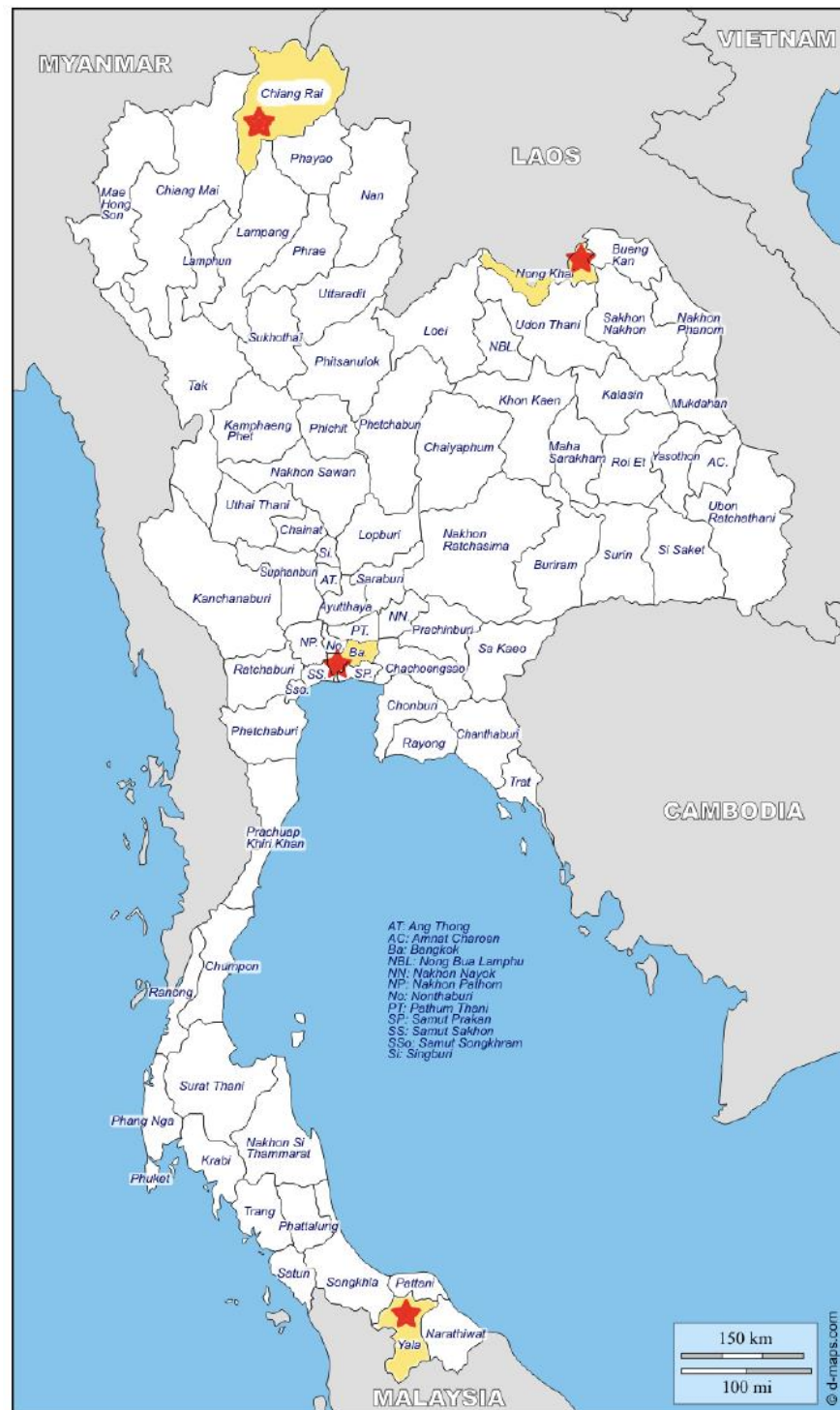
In 2004, Yala was in the direct path of a major tsunami. However, the storm landed in Sri Lanka before moving to Yala, and the disaster only caused damage to Yala National Park. Since 2004, Thailand began facing armed violence in three of its Muslim-majority provinces in the South. Serious bombing attacks have killed more than 5,000 people.

Population: 511,911 (2014)

Agricultural Production of Corn

It has been discovered that almost every region of Thailand is ideal for growing corn. Corn is one of the most important crops for the country, generating approximately 10 billion baht in revenue every year. Corn is grown on roughly 11-12 million Rai of land throughout Thailand (1 Rai = 1,600 square meters), producing four to five million tons of corn. 65% of corn produced in Thailand is being consumed domestically, and the rest is being exported to China. China has proven to be a large consumer of Thai corn, generating between 5-6 billion baht in trade revenue. According to Thailand's Ministry of Agriculture, over the past 5 years there has been a tremendous increase in the demand for Thai corn in China. Therefore, Thailand is developing more efficient and higher-yielding farming techniques for this crop.

Regional Map of Thailand



Introduction to Cornology

A Brief History of the Company

Cornology was founded on March 11, 1992 in Bangkok, Thailand. Since its founding, its primary business has been to sell popcorn to cinemas throughout the country. In part, it has helped to develop the wonderful and unique cinema experiences that can only be found in Thailand. Before Cornology was founded, cinemas served only a handful of popcorn flavors and, consumers were thinking in terms of whether or not they wanted to buy popcorn. The strategy of Cornology, however, changed this mentality. With a product portfolio containing more than 300 flavors, popcorn has become a necessity as well as a tradition in Thai cinemas. Instead of deciding whether or not to buy want popcorn, consumers are now thinking in terms of how many flavors that would like. This success has granted Cornology with enough capital to expand into China, giving them an opportunity to take advantage of the country's ever-growing popcorn demand. They are planning to enter the China market with their two best-selling popcorn flavors: *Original* and *Flavor Blast*.

Popcorn Flavors to Enter China

Original

Cornology's upper management believes that its *Original* flavor of popcorn is will be well received in China. This flavor is considered a secret recipe developed by the founding scientists at Cornology. One consumer in a China focus group described *Original* as follows:

"The flavor is familiar but it's difficult to describe. What's even more difficult is trying to stop reaching into the popcorn bag to have some more. I hope it's healthy!"

To the luck of this consumer, this product is incredibly healthy and only contains organic ingredients. Demand has been anticipated and planning is underway.

Flavor Blast

It also came as no surprise when the market research results for *Flavor Blast* were strongly favorable. This popcorn is for the bold. In a focus group, one Chinese consumer exclaimed:

"This popcorn is super rich, but it doesn't make me thirsty. I'm not so sure I can eat a large serving by myself. However, this would be perfect if I was with another person."

Flavor Blast does not use all natural ingredients. Due to restrictions on imports of some food products in China, one of the ingredients used to make Flavor Blast will need to be substituted for an alternative ingredient. Scientists at Cornology have opted for *Ingredient X* to be used in the markets of China.

Optimization

Production and Market Entry

Part 1.1 - Setting up Production

Headquarters is considering four locations to build their factory: Nong Khai, Chiang Rai, Bangkok, and Yala. Each location has different characteristics in terms of education level, labor skill, land value, political risk, infrastructure, and weather severity. Each factory will be designed to be able to process the same amount of goods, regardless of location. Market analysts have taken these factors into account and have given the following reports on each location.

Nong Khai

The land value in Nong Khai is high. Building a factory in this region will have a base cost of \$11,252,161.

Chiang Rai

Chiang Rai is a moderately-developed area of Thailand. Based on the land value, the base cost of a factory built in this area will have a cost of \$10,998,001.

The weather in Chiang Rai is not optimal for construction. There is a 56% chance that construction will be delayed due to poor weather conditions. If construction is delayed due to weather, the cost of building the factory will increase by \$500,000. Due to the labor skill in the area, there is a 70% chance that the factory will fail inspection after being constructed at a delay cost of \$600,000. However, an inspection consultant may be hired at a cost of \$150,000, which would lower the chance of failing inspection to 10%.

Bangkok

Bangkok is the most developed area of Thailand. It has a very high land value, and the base cost for building a factory here is \$24,062,500.

Yala

Of the four potential factory locations, Yala is the least developed, making its land value very low. It will cost \$10,303,601 to construct a factory in this location.

Part 1.2 - Providing to Markets

Due to trade agreements between China and Thailand, each factory location has a unique port of entry which cannot be changed. Ports of entry are as follows:

Factory Location	Port of Entry	Maximum Production Runs*
Nong Khai	Northeast	5
Chiang Rai	North Central	5
Bangkok	Yangtze River Delta	5
Yala	Western China	5

Market Demand

The development of China over the past three decades has led to uneven demand for cinema popcorn throughout the country. Demand in each region of China is as follows:

	Northeast	YRD	Southeast	North Central	South Central	Western China
Original	0	180	127	90	118	90
Flavor Blast	70	112	37	70	74	0

In addition, Cornology's strategy dictates that a regional market may not be entered unless at least 90% of its market demand can be met. This is to prevent direct competition and is non-negotiable.

The factory constructed in Thailand has been designed to process a maximum of 1,350,000 kilograms of popcorn seeds and 1,575,000 bottles of flavoring per day. Production occurs 360 days per year. At this time, only two products will be marketed in China: *Original* and *Flavor Blast*. As its name implies, *Original* is Cornology's original popcorn recipe. *Flavor Blast* is a richer version of the original flavor.

It takes 15,000 kilograms of seeds and 12,500 bottles of flavoring to create one unit of *Original*. Additionally, for every one unit of *Original* produced, Cornology receives a profit of \$12,500. This profit includes all variable costs of production. To produce one unit of *Flavor Blast* popcorn, it takes 12,500 kilograms of seeds and 22,500 bottles of flavoring. For every one unit of *Flavor Blast* popcorn, Cornology receives a profit of \$7,500.

Transportation

Due to trade agreements, shipping costs are absorbed by the cinemas in different regions. They do not need to be accounted for by Cornology. Also, Cornology does not need to account for domestic shipping costs between markets in China. However, they must fulfill at least 90% of the demand of

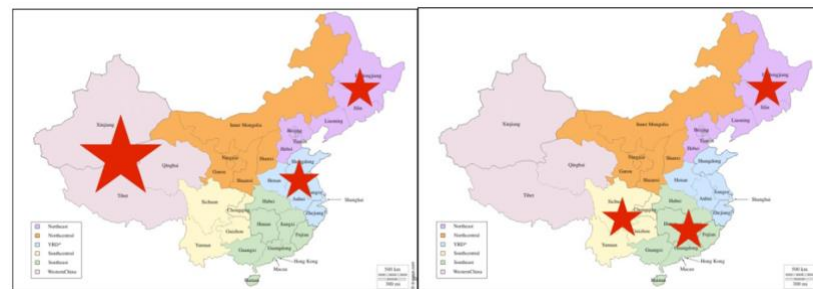
their port of entry region before attempting to satisfy the demand of other regions. Also, regions other than the port of entry region may entered only if they border either the port of entry region or a region that has already had its demand satisfied. In other words, entered regional markets must be touching. Please see the maps below as an example:



Feasible (markets are touching):



NOT Feasible (markets are not touching):



Notes

*One production run equates to one product being produced for a single, regional market. For example, one production run to be delivered to the Southeast region may consist of 127 units of Original (leaving four production runs remaining). Two production runs to be delivered to the Southeast region may consist of 127 units of Original and 37 units of Flavor Blast (leaving three production runs remaining). Production runs cannot be shared amongst more than one region.

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