Analysis of Logistics Factors of Route Selection for Fruits and Vegetables from Thailand to China

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Abstract

This research was depth-study insight logistic management in route selection of Thai fruit maritime logistics, purposing optimal maritime logistics route between Thailand and Southern China. Laem Chabang and Bangkok port as the starting point. With research methodology in quantitative method, by the conceptual framework for collecting data from which time and cost, while customs clearance and transport capacity were qualitative indicators, then analytic hierarchy process (AHP) method was adopted to establish the model.

Result of study showed that when an enterprise was making decisions about transportation mode and route, it needs to consider a variety of factors, including transportation cost, transportation time, customs clearance environment and transportation capacity.

Keywords: Route Selection; Thai Fruit Maritime; Analytic Hierarchy Process (AHP)

Introduction

The advancement of “One Belt And One Road” policy and the establishment of CHINA-ASEAN Free Trade Area (CAFTA), Sino-Thai bilateral trade has been increasing continual (Narintarakul, K., 2004). As fresh fruits and vegetables are perishable food with high requirement on temperature and humidity, refrigerated container shipping logistics is an important guarantee for the export quality of fruits and vegetables in Thailand (Defraeye T, et also, 2016). The main routes:

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1) Route of Laem Chabang-Hong Kong-Guangzhou Jiangnan fruit and vegetable wholesale market- fruit markets across the country-consumers

Table1 Thai Fruit Shipping from Laem Chabang Port via Hong Kong Port to Fruit Markets Cost

No.	Content	$/40 Feet TEU (About 20 tons)
1	Freight from Laem Chabang to Hong Kong	1150
2	Hong Kong service charge	658
3	Customs fees	440
4	Vat	1556
5	Freight from Hong Kong to Guang zhou Jiangnan fruit and vegetable wholesale market	700
6	Management fee for Guangzhou Jiangnan fruit and vegetable wholesale market	400
7	Freight from Guangzhou Jiangnan fruit and vegetable wholesale market to fruit markets across the country	500

Source: Report on the logistics system for Thai agricultural exports 2017

Table 2 Customs Clearance Environment

	Hong Kong Port
Work Mode	"Paperless" management, all service object
Declaration and inspection	Declare in advance, declare business, open box to sample check for many times, the customs and inspection quarantine are far apart from each other
Handle procedures	Different departments work separately
Customs	Declaration time: 3 hours

clearance time	Tax time: 1 day Quarantine time: 3 days Sanitary certificate: 1 day Goods clearance; 1 day
Total	Within six days

Source: www. Hong Kong custom 2017

2) Route of Laem Chabang-Shenzhen-Guangzhou Jiangnan fruit and vegetable wholesale market-fruit markets across the country-consumers

Table3 Thai Fruit Shipping from Laem Chabang Port via Shenzhen Port to Fruit Markets Cost

No.	Content	$/40 Feet TEU (About 20 tons)
1	Freight from Laem Chabang to Shenzhen	1300
2	Shenzhen service charge	842
3	Customs fees	780
4	Vat	1986
5	Freight from Shenzhen to Guang zhou Jiangnan fruit and vegetable wholesale market	330
6	Management Fee for Guangzhou Jiangnan fruit and vegetable wholesale market	400
7	Freight from Guangzhou Jiangnan fruit and vegetable wholesale market to fruit markets across the country	550

Source: Report on the logistics system for Thai agricultural exports 2017

Table 4 Customs Clearance Environment

	Shenzhen port Port
Work mode	"Paperless" policies, generally serve large enterprises
Declaration and	Declare ahead of schedule, need to submit two times to

inspection	examine two times to let go commonly, custom and inspection quarantine are far apart
Handle procedures	Multi-station type of procedures, enterprises to customs inspection and quarantine of the customs and excise department of the customs and excise department
Customs clearance time	Declaration time: 3 hours Tax time: 1 day Quarantine time: 5 days Sanitary certificate: 2 day Goods clearance; 1 day
Total	Within seven days

Source: www.Shenzhen Custom 2017

3) Route of Laem Chabang-Fang Chenggang-Nangning Haijixing fruit and vegetable wholesale market-fruit markets across the country-consumers

Table 5 Thai Fruit Shipping from Laem Chabang Port via Fangchenggang Port to Fruit Markets Cost

No.	Content	$/40 Feet TEU (About 20 tons)
1	Freight from Laem Chabang to Fangchenggang	1210
2	Fangchenggang service charge	774
3	Customs fees	624
4	Vat	1985
5	Freight from Fangchenggang to Guang zhou Jiangnan fruit and vegetable wholesale market	375
6	Management fee for Nanning Haijixing fruit and vegetable wholesale market	400
7	Freight from Nanning Haijixing fruit and vegetable wholesale market to fruit markets across the country	530

Source: Report on the logistics system for Thai agricultural exports 2017

Table 6 Customs Clearance Environment

	Fangchenggang Port
Work mode	"Paperless" reform does not restrict large, medium and small enterprises
Declaration and inspection	Declaration in advance, one inspection and one release, customs and quarantine
Handle procedures	Promote the "one stop window" service
Customs clearance time	Declaration time (including tax) : 3 hours Quarantine time: 3 days Sanitary certificate: 1 day Goods clearance; 1 day
Total	Within five days

Source: www.Guanxi Custom 2017

4) Route of Bangkok-Shanghai-Shanghai Longwu Imported Fruit and Vegetable Wholesale Trading Market-Markets in Shanghai, Yiwu and Northeast Provinces-consumers

Table7 Thai Fruit Shipping from Bangkok Port via Shanghai Port to Fruit Markets Cost

No.	Content	$/40 Feet TEU (About 20 tons)
1	Freight from Bangkok to Shanghai	1350
2	Shanghai service charge	821
3	Customs fees	790
4	Vat	2015
5	Freight from Shanghai to Longwu imported fruit and	365

	vegetable wholesale trading market	
6	Management fee for Longwu imported fruit and vegetable wholesale trading market	420
7	Freight from Longwu imported fruit and vegetable wholesale trading market to markets in Shanghai, Yiwu and Northeast provinces	520

Source: Report on the logistics system for Thai agricultural exports 2017

Table 8 Customs Clearance Environment

	Fangchenggang Port
Work Mode	"Paperless" reform does not restrict large, medium and small enterprises
Declaration and inspection	Declaration in advance, one inspection and one release, customs and quarantine
Handle procedures	Promote the "one stop window" service
Customs clearance time	Declaration time (including tax) : 4 hours Quarantine time: 4 days Sanitary certificate: 2 day Goods clearance; 1 day
Total	Within seven days

Source: www.Shanghai Custom 2017

Research Questions

What are the key success factors of route selection in Thai Fruit Maritime Logistics between Thailand and Southern China?

How can innovate Thai fruit maritime logistics between Thailand and Southern China be more effectiveness?

Research Objectives

Finding out the key success factors of route selection in Thai fruit maritime logistics between Thailand and Southern China.

Finding out more effective ways to innovate route selection in Thai fruit maritime logistics between Thailand and Southern China.

Research Methodology

1. Research Design

This research was quantitative approach using survey questionnaire and Analytic Hierarchy Process (AHP) to collect data from select optimal route of fruit maritime logistics between Thailand and China.

2. Model Construction

1) Establish a Stepped Hierarchy

Decision makers should select the influencing factors according to the specific problems and construct the appropriate hierarchy.

2) Construct the Judgment Matrices

After establishing the hierarchical hierarchy, we can determine the subordinate relationship between the elements of the upper and lower levels, and then construct the judgment matrix from top to bottom according to the hierarchical hierarchy model.

Table 9 Meaning of each Scale in Scaling Method

Scale	Definition	Implication
1	Equal importance	Both elements are equally important to a criterion
3	Slight importance	Two elements are slight importance to one criterion, and one element is slight importance to the other
5	Obvious importance	Two elements are obvious importance to one criterion, and one element is obvious importance to the other
7	Strong	Two elements are strong importance to one

	importance	criterion, and one element is strong importance to the other
9	Extreme importance	Two elements are extreme importance to one criterion, and one element is extreme importance to the other
2,4,6,8	Median of adjacent scale	Represents the scale between two adjacent scales

3) Consistency Test

Due to the large number of paired comparisons, it is difficult to achieve complete consistency. AHP also provides a method for decision makers to make comparison to obtain consistency.

4) Determine the Best Solution

This process is calculated layer by layer from the highest level to the lowest level, the weight of relative importance of the same level element to the upper level is calculated.

Research Findings and Discussion

This research was divided the model into three layers: 1) target layer, 2) criterion layer and 3) measure layer. The target layer is the optimal choice of logistics channel.

Program one (with time as the main object)

In the AHP method, the scale chart below was used to describe the relative weight in people's mind.

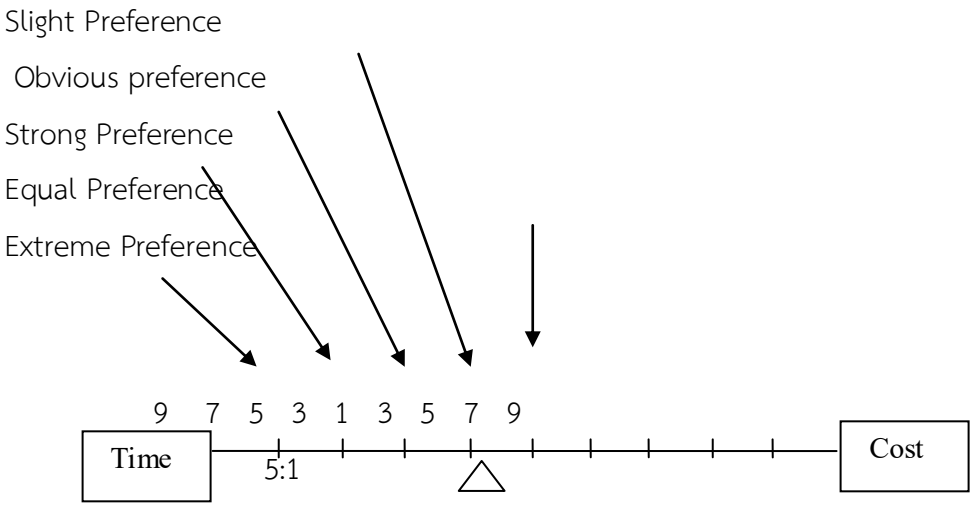

Figure 2 Meaning of each scale in scaling method

In the figure, the current degree represents the degree of preference. For example, 5:1 indicates a strong preference for time cost. When choosing the transport channel, it is more important to be short in time.

Table 10 Criterion Layer Comparison matrix

C	Transport Cost: C1	Transport Time: C2	Customs Clearance: C3	Transport Capacity: C4
C1	1	5	7	7
C2	1/5	1	3	3
C3	1/7	1/3	1/2	2
C4	1/7	1/3	1/2	1

After the matrix is sorted and normalized, the weight is:

W0 = (0.643, 0.194, 0.097, 0.067)T

In the analytic hierarchy process (AHP), the judgment matrix should satisfy the consistency test of the matrix. The consistency judgment indicator C1 is calculated as formula, and then the consistency rate (CR) is constructed as formula. Here, we bring in a measure. It's called the stochastic consistency index (RI) as follow;

Table 11 Stochastic Consistency Index (RI)

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.5	1.49	1.51

When n ≥ 3; CR< 0.10, the judgment matrix can be accepted; otherwise, the judgment matrix should be corrected.

$CI = \frac{\lambda max - n}{n-1}$ $CR = \frac{CI}{RI}$

$$CI = \frac{4.139-4}{4-1} = 0.046$$

$$CR = \frac{0.046}{0.9} = 0.051 < 0.1$$

Therefore, the judgment matrix of criteria layer C has acceptable consistency in China-Thailand maritime cargo trade and logistics channel.

Table 12 Calculation of Quantitative Index of Transportation Cost in Each Route (Unit of a standard container 40 feet)

	Transport cost ($)	Cost /Total	Reciprocal
Route1	3904	39040/199060=0.196	5
Route2	5638	56380/199060=0.283	3
Route3	4603	46030/199060=0.231	4
Route4	5761	57610/199060=0.289	3
Total	19906		

Table 13 Calculation of Quantitative Index of Transportation Time in Each Route

	Time (day)	Time/Total	Reciprocal
Route1	6.833	6.833/26.748=0.255	4
Route2	5.416	5.416/26.748=0.202	5
Route3	4.374	4.374/26.748=0.164	6
Route4	10.125	10.125/26.748=0.379	3
Total	26.748		

Table14 Calculation of Quantitative Index of Customs Clearance Time in Each Route

	Customs clearance(day)	Time/Total	Reciprocal
Route1	6	6/25=0.24	4
Route2	7	7/25=0.28	3
Route3	5	5/25=0.20	5
Route4	7	7/25=0.28	3
Total	25		

Table15 Calculation of Qualitative Index of Customs Clearance Environment in Each Route

	Port 1	Port 2	Port 3	Port 4	
Route1	1		3	3	1/3
Route2	1/3		1	1	1/5
Route3	1/3		1	1	1/5
Route4	1/3		1	1	1/5

Table 16. Calculation of Qualitative Index of Transport Capacity in Each Route

	Port 1	Port 2	Port 3	Port 4	
Route1	1		1	1	1/5
Route2	1		1	1	1/5
Route3	1		1	1	1/5
Route4	5		5	5	1

The fourth step is the weight of each index of P layer is calculated. Similarly, the judgment matrix of c-p layer can be constructed first to determine the weight of Pl, P2, P3 and P4 in the measure layer on transport cost, transport time, customs clearance environment and transport capacity. The results were calculated and summarized as follows:

The weight of C1 is W1 = (0.294 , 0.294 , 0.235 , 0.176)T ;

The weight of C2 is W2 = (0.267 , 0.267 , 0.267 , 0.267)T ;

The weight of C3 is W3 = (0.252 , 0.097 , 0.097 , 0.555)T ;

The weight of C4 is W4 = (0.125 , 0.125 , 0.125 , 0.625)T

Judging the consistency of indicators, as shown in the following table:

Table17 Judging the Consistency of Indicators

Judgment Matrix	n	λ max	CI	RI	CR
A0	4	4.139	0.046	0.9	0.051
A1	4	4	0	0.9	0
A2	4	4	0	0.9	0
A3	4	4.044	0.015	0.9	0.017
A4	4	4	0	0.9	0

It can be seen that CR< 0.10 for all the four judgment matrices can pass the consistency test

The fifth step is the comprehensive importance calculation

Route P1: Laem Chabang –HongKong Total Score is :

0.643 ×0.294+0.194×0.267+0.097×0. 252+0.067×0.1 25=0.274

Route P2: Laem Chabang –Shenzhen Total Score is :

0.643×0.294+0.1 94×0.2+0.097×0.097+0.067×0.1 25=0.246

Route P3: Laem Chabang –Fangchenggang Total Score is :

0.643×0.235+0.194×0.267+0.097×0.097+0.067x0.125=0.221

Route P4: Bangkok –Shanghai Total Score is :

0.643 ×0.176+0.94×0.267+0.097 x0.555+0.067×0.625=0.261

In summary, PI> P4 > P2 > P3 are optimal when taking time as the main consideration object, followed by P4 line, P2, and finally P3.

2) Program two (mainly focus on transport cost)

The Comparison Matrix of Each Factor is constructed:

Table18. Criterion Layer Comparison Matrix

0	Transport Cost	Transport Time	Custom Clearance	Transport Capacity
	C1	C2	C3	C4
C1	1	1/5	3	3
C2	5	1	7	7
C3	1/3	1/7	1	2
C4	1/3	1/7	1/2	1

$$CI = \frac{4.139 - 4}{4 - 1} = 0.046$$

$$CR = \frac{0.046}{0.9} = 0.051 < 0.1$$

Therefore, the judgment matrix of criteria layer C has acceptable consistency in China-Thailand maritime cargo trade and logistics channel. As the criteria layer has not changed the evaluation criteria for each scheme. Therefore, there are:

Route P1: Laem chabang –HongKong, Total Score is:

0.194 x0.294+0.643 x0.267+0.097×0.252+0.067×0.1 25=0.262

Route P2: Laem chabang –Shenzhen, Total Score is:

0.194x0.294+0.643x0.2+0.097x0.097+0.067X0.125=0.203

Route P3: Laemchabang –Fangchenggang, Total Score is

0.194 x0.235+0.643 x0.267+0.097 x0.097+0.067x0.125=0.235

Route P4: Bangkok –Shanghai, Total Score is :

0.194 x0.176+0.643 x0.267+0.097 x0.555+0.067x0.625=0.302

To sum up, P4> P1> P3 > P2 are optimal when cost is the main consideration object, followed by P1, P3 and finally P2.

When time is the main consideration object, PI> P4 > P2 > P3 are optimal, followed by P4 line, P2, and finally P3.When cost is the main consideration object, P4> P1> P3 > P2 are optimal, followed by P1, P3 and finally P2.Comprehensive program one

and program two: the optimal logistics channel for the goods trade of Thailand to China should be P1 (Laemchabang-Guangzhou) line and P4 (Bangkok-Shanghai) line (ranking the first two). If the time factor is taken as the main object of consideration, the P1 (Laem Chabang-Guangzhou) line is even better than P4 (Bangkok-Shanghai) line.

Conclusion and Recommendation

1. Conclusion

In summary, when taking time as the main consideration object, P1> P4 > P2 > P3 are optimal, followed by P4 line, P2, and finally P3.When cost is the main consideration object, P4> P1> P3 > P2 are optimal, followed by P1, P3 and finally P2.

2. Recommendations

1) China and Thailand government should intensify the construction of the port is put into the port infrastructure construction, in particular.

2) It is the key to enhance the market competitiveness of Sino-Thai logistics enterprises to actively promote the transformation of small and medium-sized logistics enterprises from traditional to intensive.

3) China and Thailand enterprises need to actively introduce excellent logistics management personnel, increase capital and technical input logistics enterprises.

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