8-27-2017

Research on the export mode of sinotruck and future prospect in Africa

Wei Zhang

WORLD MARITIME UNIVERSITY

Shanghai, China

RESEARCH ON THE EXPORT MODE OF SINOTRUCK AND FUTURE PROSPECT IN AFRICA

By

ZHANG WEI

China

A research paper submitted to the World Maritime University in partial fulfillments of the requirements for the award the degree of

MASTER OF SCIENCE

ITL

2017

Declaration

I certify that all the material in this research paper that is not my own work has been identified, and that no materials are included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):

(Date): 2017-07-05

Supervised by

Professor SHA Mei

World Maritime University

Acknowledgement

At first, I would like to show my deepest appreciation to Prof. SHI Xing, Ms. WEN Xiyuan and Ms. Hu Fangfang who are in charge of ITL program representing Shanghai Maritime University for the enormous contribution and full support in the time of master study. I achieved a lot from the trip to Sweden not long ago.

My supervisor Prof. SHA Mei guided me throughout my research paper, with her patience and valuable suggestions. Firstly, my topic is not the current one. It is about the analysis to competition between Singapore and Shanghai which is widely regarded as a generalized topic and there is already so much reference about it. As a result, my supervisor and I chose the current topic which we think it is full of value in research.

I wish to sincerely thank my friend Gavin, he is so kind and he helped me a lot on formatting and finding data.

Finally, I would like to express my gratefulness to my beloved family; my father and my mother. They give me full support and encouragement all the time during this studying at WMU and SMU.

In the near future, I am going to work and try my best to apply what I have learned in ITL.

Abstract

Title of Research paper: **Research on the Export Mode of SINOTRUCK and Future Prospect in Africa**

Degree: **M.Sc**.

As we all know, in Africa, the infrastructure is relatively backward. But it also means that there is full of potential. In the background of China's one belt one, one road, there will be a big demand for commercial vehicles as the infrastructure construction. This also brings a good chance to SINOTRUCK. Currently, the traditional export strategy is CBU export mode which is quite convenient to transportation. However, many Africa countries prefer KD export mode as it can provide many job opportunities to their local residents and increase the development of economy. As a result, many Africa countries provide low tariff such as Nigeria, their CKD mode import tariffs dropped to zero and SKD mode dropped to 5% which would bring a big profit to commercial vehicle companies. In this paper, I analyzed the specific economic income from CKD export mode according to a case study in Nigeria. At the same time, I made a research in South Africa and the result is totally different to that in Nigeria. Tariff is the key factor in it. We should make our export mode follow the local policy. Also, I put forward some suggestions to the packaging problem which aims to increase the container utilization. Finally, I made an analysis to inventory management method and think JIT is a good choice for SINOTRUCK.

KEYWORDS: CKD export mode, JIT, Packaging, Mathematical Modeling, Container Utilization, Inventory Management

Table of Contents

List of Tables

List of Figures

List of Abbreviation

CBU	Complete Built Unit
CKD	Complete Knock Down
DKD	Direct Knocked Down
EOQ	Economic Order Quantity
FAW	First Automobile Work
FDI	Foreign Direct Investment
GM	Grey Model
IPR	Intellectual Property Rights
JIT	Just In Time
KD	Knocked Down
LCL	Less Than Container Load
SKD	Semi-Knocked Down
TBT	Technical Barriers to Trade
WIP	Working In Process

Chapter 1 Introduction

1.1 Background

As we all know, Africa is a dynamic continent. It is also full of challenge and hope. At present, she is recovering. Just for its market scale and potential, we should not neglect this area. According to the forecast by "World Population Report 2010", Africa's population will grow from 1 billion to 1.9 billion. The growth of the population of Africa, it doesn't just mean that the increase of consumption market and quantity simply but means the increasing number of African labor injects new power to the Africa economy. At the same time, the consumer market will also be developed and expanded.

In view of the One Belt, One Road strategy proposed by president XI Jinping (its destination is East Africa country). In January 27, 2015, China and Africa Union signed a Memorandum of Understanding. Its aim was to help Africa to implement large-scale infrastructure projects. China was committed to helping African countries to build modern highways, airports, high speed rail, upgrading the transport system. All of this will make fifty-four countries in Africa Union achieve interoperability. This regional interconnection plan in Africa has two major roles, at the same time; it will also benefit both sides. Our China's import and export trade will be stimulated. In addition, China will be able to turn part of the manufacturing sector to Africa: China is undergoing economy reconstruction; the rise in domestic manufacturing

costs will inevitably bring about industrial transfer. Including LIN Yifu (vice chairman of China Chamber of Commerce), experts believe that this is the two key aspects in the future of China Africa cooperation. Actually, in recent years, China has invested in infrastructure projects in Africa to make a huge change in the continent. It turns out that Chinese enterprises are able to train and hire local people in Africa. There were so many successful examples such as Hisense, CITIC, Huajian shoe factory etc. They all expanded their business very well in Africa.

According to Nigeria, "criticized the newspaper" reported on January 27th, the Nigeria Minister of Public Works Mike said, due to the good funding condition, the total mileage of 127.6 kilometers of Lagos - Ibadan expressway is going smoothly, In accordance with the current situation, it can be completed by August 2017 and it is earlier than expected time. He also said that the federal government plans to build a national highway network. Then you can go straight from Lagos to Maiduguri, from Markku M Di to kalaba.

Under this situation, Africa needs a lot of commercial vehicles to support their infrastructure projects. It is worth mentioning that our China's commercial vehicle brands are very popular in Africa as theirs products are high quality and inexpensive.

The export mode is relatively single. At present, Chinese truck factory mainly choose CBU mode, and the KD mode take small stakes in the market. You have to admit that CBU mode in export is more convenient, but some African countries in order to develop the local automotive industry and promote employment rate by increasing vehicle import tariffs and implementing quota system etc, to limit CBU mode import. Taking into account the high risk of investment in Africa, large investment and long payback period, the majority of Chinese brands still take the CBU export model in current time. The single CBU export mode has been unable to meet the needs of the

customers and regulations of different Africa countries. According to the actual situation of different countries, we should adopt diversified export mode (including CBU, CKD, and SKD). On the one hand, we can improve the degree of acceptance of our products; on the other hand, we can reduce the cost of tariffs and regulations, thereby expanding the market proportion and sales.

In 2013, Nigerian Ministry of finance has issued a document, they decided to increase the passenger vehicle import tariffs by 20% to $70% (including an additional tax of 35%), the commercial vehicle import tariffs increased from 10% to 35%. On the contrary, the CKD mode import tariffs dropped to zero and SKD mode dropped to 5%[1], which aims to attract more foreign investment and encourage the development of the local automotive industry and employment rate. In Algeria, if you choose CKD export mode, then you can free from local import quota restrictions so as to expand the market share. In Egypt, South Africa, and some other African countries, they all have some favored policy to KD export mode, especially in CKD.

In 2017, SINOTRUCK group is planning to cooperate with AlikoDangote group, to invest $100 million to build a commercial vehicle assembly plant in Nigeria. The factory can provide 3000 jobs, at the same time, the tariffs will be decreased a lot and so does the export cost.

1.2 Objectives of the Study

The first objective of the paper is to analyze the advantages and disadvantages of the KD export mode. Secondly, I will analysis the appropriate export strategy to different countries in Africa on the basement of economic strategy. The third objective of the paper is to illustrate the packaging problem which is a bigproblem in KD export

[1] It is reported by Ministry of Commerce of the People's Republic of China

mode and find methods to optimize it. Finally, it is to seek out the appropriate inventory management methodand inbound logistics mode.

1.3 Methodology

The purpose of my paper is to analyze the export mode of SINOTRUK in Africa in the future. As to achieve the main purpose, at first, I will use PEST method to analysis export environment of SINOTRUKand SWOT analysis method to evaluate the feasibility of the KD export mode and give it a comprehensive analysis to find its strengths, weaknesses, opportunities and threats. Secondly, I will use Grey Model to predict the needs of Africa commercial vehicle market. This can be proved that SINOTRUK entered into Africa market is a good choice whether the result is positive. Next, according to some data from the CKD project in Iran of SINOTRUK, I will choose Nigeria and South Africa as two case studies to analysis the feasibility to CKD mode and CBU mode. At the third part,in the light of the one of the weaknesses “packaging", I will give some advices to optimize it. At last, I will discuss the appropriate inventory management method about it and inbound logistics mode by AHP.

1.4 Outlines of the Dissertation

Chapter 2, literature review, overview related researches and reports on the CKD parts packaging and method of mathematical model. Several studies are about the analysis of CKD export mode. **Chapter 3, research of the current export mode of SINOTRUCK**. In this chapter, I will use SWOT analysis to describe the advantage and disadvantage of CKD export mode. **Chapter 4, prospect Analysis of CKD Export Mode in Africa**. The selection of appropriate export mode strategy according to the cost and two case studies about Nigeria and South Africa to make

further analysis. **Chapter 5,packaging Research of SINOTRUCK's CKD Export mode**. In this part, I will illustrate the necessary process in packaging and find out the optimization method for it so as to increase the container utilization. **Chapter 6, inventory management**. The illustration of main inventory method and combine them in a reasonable way. Then the selection of inbound logistics to JIT based on AHP. **Chapter 7, conclusions.** The summary of findings and limitations in my dissertation and practical recommendation will be presented.

Chapter 2 Literature Review

2.1 Introduction

As we all know, exporting commercial vehicles by KD mode is only popular in recent years and we all still in exploratory stage. So there are not many monographs and academic papers about this subject. My literature reviews will be categorized into several parts. In this chapter, the investment mode and current KD project will be reviewed firstly. Secondly, the packaging optimization will be observed. At last, different methods and mathematical methods will be studied.

2.2 Investment Mode and Current KD Project

Most of the Western developed countries make the FDI as the key point to the research of the manufactured parts for assembly. Trace back to 1960s, many European vehicle factories started their FDI strategy, which means foreign direct investment. At the same time of capital injection, the technology, production, culture and management also are transferred into another country. Mudell (1957) put forward his viewpoint that the substitution relationship between FDI and trade from the angle of trade development. He said FDI is the advanced development stage in the trade; it can enter other countries' market instead of general trade thus bypassing trade barriers. Angela da Rocha (2015) made an analysis and research that Marco Polo vehicle company (Brazil) broke the trade barriers by FDI to launch

manufactured parts for assembly in China, India and Russia. He concluded that FDI is very important to promote parts assembly service. Bertil Ohlin (1930) said that every country has its own advantages. The products exported which are relatively cheap and have abundant resources to produce. In terms of this viewpoint, the trade between countries is determined by the difference of cost. Every country should play their comparative advantages to do international division of labor. Xu (2013) described the commercial vehicle current export situation by CBU mode and used SWOT model to analyze the advantage, weakness, threat and opportunity. Deng Ping (2004), based on the analysis of the data in China Foreign Trade Yearbook, she said that the reason for our China enterprise to take FDI strategy to diversify into technology, assets and funding. Elango (2005) had analyzed more than 682 overseas-funding enterprise and he said that the enterprise should combine their advantage with the market of the host country, their overseas-funding mode may influenced by themselves. Yang Zhong (2009) thought that Chinese manufacturing industry has developed a lot in the background of industrial transaction, they were at the maturity stage of the life cycle. If there is no advantage and innovation in our manufacturing industry, it is very hard to us to enter overseas market by FDI. Fan, as the executive vice president of the China Overseas Development Association, said that the Chinese manufacturing industry was undergoing a recession period. We should transfer these industries to a relatively low development area. As a result, the digestion of excess capacity in our country can be prompted, and make more products which made in China enter overseas market (FAN, 2010). Gong (2012) listed some data from the CKD subject in Iran from SINOTRUCK. Tian (2015) introduced the FAW independent brand automobile knockdown export strategy.

2.3 Packaging Process in KD Mode

We know that in the transportation of KD mode, the main difficult point is the package of parts. So I referred a lot of literatures about this. Yang (2016) analyzed the current situation of the vehicle parts packaging and made a research of the packaging design method, especially the packaging materials and dimensions. Dianjun Fang and Klaus Spicher (2012) analyzed the whole supply chain including the countries of origin and destination and proposed a scalable model-based approach. This approach offered the identification of cost drivers for each pre-defined supply chain module. All processes like loading/ unloading, repacking, container loading and warehousing are involved. The model allowed the impact analysis of individual variables and the optimization of the CKD-process. Kai (2013) gave an extensively references about commercial vehicles exports at home and abroad, and provided a lot of improvement schemes which were reasonable and comprehensive in the light of existing problems in the vehicle export. It included package design, logistics management. His literature will bring a huge help to the CKD mode export.

2.4 Predication and Target Cost for CKD Packaging

We know the cost for packaging is also very important, if we can predicate this in advance, we may have a better allocation of resources in the overall situation. Kai (2013) has also put forward his opinion.

Cost Predication of Packaging

According to the current economic and technical conditions, we use analysis and calculation of factors that affect the cost to make the predication of cost level and movement trend in the coming time. It can be divided into two groups, short-term

(month, season, year) and long-term (three years, five years, ten years).

(a) Impact of macroeconomic on logistic

The changes on economic structure. Also, the fluctuation on related materials' price will affect the cost to packaging.

(b) Comparable products cost predication

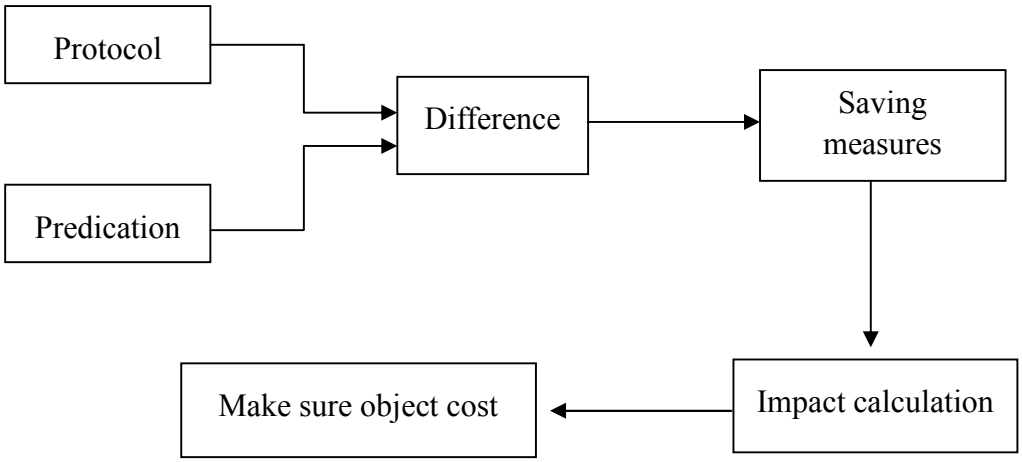

Figure 1 - Process of Commercial Vehicle Parts Cost Predication

Source: CKD Export Logistics Packaging Research.

First step: Protocol object cost

Make a certain advanced cost as the object cost (for example the standardized cost or lowest cost in history of one foreign similar product), or make sure the object cost according to the annual production and operation.

Second step: Preliminary calculation

(a) On the basement of the last year, we use its average unit cost to calculate the cost

of comparable products[2].

Estimated cost in last year	$\frac{\text{Actual cost from January to September + Estimated cost from October to December}}{\text{Actual production from January to September+ Estimated yields from October to December}}$

(2.1)

Total cost of comparable products	ΣAll kinds of products' average cost in last year * Yields in project

(2.2)

(b) According to the actual average cost in recent three years to predicate comparable products' cost:

Total cost of comparable products = Average cost in recent three years * [1±increase or decrease rate of yield in project] (2.3)

(c) Decompose mixed costs

Total cost can be differentiate into variable cost and fixed cost and we have two methods to decompose it.

High-low point method which is according to the highest yields and lowest yield in historical cost data to measure the fixed cost and variable cost

$y= a + b*x$

[2] Refers to the normal products of the previous year or in recent years which are continued to produce in the year or planned year, and the cost information can be compared

Where: x= Yields

y= Mixed cost

a= Fixed cost

b= Variable cost to per unit product

b= (Cost in peak yields - Cost in lowest yields)

/ (Peak yields - lowest yields) (2.4)

From above formula, we can conclude that x, y are all known number, the only one we should do is to calculate b follow variable cost to per unit product.

The second one is Least-squares method. This method according to yields and price data in some periods, then the regression line can be derived.

Variable cost: $b=\frac{n\cdot\sum xy-\sum x\cdot\sum y}{n\cdot\sum x^2-(\sum x)^2}$ (2.5)

Fixed cost: $a=\frac{\sum y-b\cdot\sum x}{n}$ (2.6)

Third step: Protocol measures which can save cost and increase production. We should apply the value analysis method to improve the product process and choose the best operation project. Finally, we can find out the specific measures to saving cost by the rational organization of production.

Fourth step: Measure the influence of saving cost and increasing production action to the cost (Kai, 2013).

2.5 Container Utilization

Lei (2016) through the comparative analysis, they said the container utilization of KD export mode is not very high in China, and listed the main factors to find out

some methods to optimize them. They proposed three improvements (a) packaging standardization; (b) design plan; (c) make better the ways of LCL. We usually choose the 40 feet high container (12000mm*2350mm*2563mm), provided by Kai (2013).

2.6 Inventory Management Method

(1) EOQ

We know the EOQ (Economic Order Quantity), it is to measure the order quantity. By using it, we can achieve the minimum sum of order cost and storage cost.

$$EOQ=\sqrt{\frac{2ds}{H}} \tag{2.6}$$

Q: order quantity

H: annual storage cost

D: demand

S: order cost

(2) JIT

JIT system is designed to manage lead times and eliminate waste. Many JIT systems place a high priority on short, consistent lead times; however, the length of the lead time is not as important as the reliability of the lead time.

JIT commitment to short, consistent lead times and to minimizing or eliminating inventories is JIT principal differentiator from the more traditional approaches.

JIT saves money on downstream inventories by placing greater reliance on improved responsiveness and flexibility (Song, 2016).

Table 1 - EOQ vs. JIT: Attitudes and Behaviors

Factor	EOQ	JIT
Inventory	Asset	Liability
Safety stock	Yes	No
Production runs	Long	Short
Setup times	Amortize	Minimize
Lot sizes	EOQ	1 for 1
Queues	Eliminate	Necessary
Lead times	Tolerate	Shorten
Quality inspection	Important parts	100% process
Suppliers/customers	Adversaries	Partners
Supply sources	Multiple	Single
Employees	Instruct	Involve

Source: Integrated Supply Chain Management.

(3) Inventory turnover

The inventory turnover ratio is an important indicator to measure the control of inventory which can be expressed by formula (Chengguo, 2009):

Inventory turnover ratio = Current sales/Current average inventory amount * 100%

(2.7)

2.7 Demonstration Method

Keller (2009) introduced SWOT analysis. It is the overall evaluation of a company's strengths, weaknesses, opportunities, and threats. They said that the good marketing is the art of finding, developing, and profiting from these opportunities. A marketing

opportunity is an area of buyer need and interest that a company has a high probability of profitably satisfying. Cui (2010) told us how to use GM (1, 1) model in Gray systems theory. He said it is more suitable to use in the growth sequence. On the usage of AHP, I referenced application research to MATLAB and AHP. The main advantage is AHP is to make the thinking of decision maker from qualitative to quantitative (Ming, 2004).

Chapter 3 Research of the Current Export Mode of SINOTRUCK

3.1 The Background of SINOTRUCK

SINOTRUCK was established in 1956, it is the biggest heavy vehicle production basement. Its predecessor was the Jinan Automobile Manufacturing which was the cradle of our heavy vehicle. Now, SINOTRUCK is one of the important state-owned enterprises in heavy vehicle industry, it has obvious advantage in technology and commercial. Its products exported to the more than 90 countries in the world. Now, SINOTRUCK is identified as an automobile export base by the National Development and Reform Commission.

3.2 Analysis of the SINOTRUCK Export Mode Environment (PEST)

This paper will use the PEST analysis method to illustrate the CKD export mode of SINOTRUCK in international situation. It points at the macro environment analysis and from the Politics, Economy, Society and Technology these four important elements to express the current situation for the company.

3.2.1 Analysis in Politics and Law

In the politics environment part, it includes political institutions and constitutions. Meanwhile, the law environment means the regulation designated by the government.

As the fast development and thorough of integration of world economy and liberalization of international trade. Export quota, export license and exchange controls are limited. On a world-wide scale, the subsequent impacts of financial crisis have been increasing gradually. TBT (Technical Barrier to Trade) becomes to one of an important methods to it, at the same time, it is also the advanced means of trade protection to some developed countries.

TBT, it is usually means the mandatory or non-mandatory regulations issued by government protect national security, mankind, environment and frauds. These regulations will become the main barriers to keep the foreign goods enter domestic market subjectively or objectively. Importer countries implement TBT followed by WTO's issues. And it is not hard to see that the major occurrences of TBT are technical regulations, technical standards and green trade barrier in post financial crisis era.

Currently, most of the countries in the world have their TBT which are with universality, complexity and controversy. Especially in post financial crisis era, many developed countries by people health and environmental safety to set up trade fortress. As a result, it will be much stricter in developed countries. The reason is that developed countries have good economic conditions and culture, art as well in general. So it is very hard to developing countries. On the other hand, it can reflect different trade discrimination in different degree from different countries' TBT.

SINOTRUCK has a rapidly development in whole vehicle export. But which cannot be disguised is the limits of TBT to vehicle export are increasing. How to solve this problem has become the common concern to scholars at home and abroad.

From the analysis to the TBT, it’s obviously to see that most medium and small

vehicle factories are hard to break into the national market; together with SINOTRUCK have obvious weakness in the national market as its low technology level. Internationally, SINOTRUCK influenced a lot by TBT. Studies show that SINOTRUCK faced with TBT mainly include as follow: (1) Environmental protection law (It mainly about EC mandatory technical order, ECE technical regulations, federal automobile fuel economy act, FMVSS[3] and some environmental protection law issued by Japan to EU countries.); (2) Automobile emission standard; (3) Waste electrical and electronic equipment directive; (4) Management certification system (ISO9000, ISO4001 and TS16949).

Meanwhile, IPR (Intellectual property rights) barrier is also a main obstacle to the export of SINOTRUCK, especially in the international aspect, an endless stream of intellectual property rights cases have given a lot of influence to the China automobile factory. So it's essential to SINOTRUCK to face up to this subject. Some trends are as follows: (1) Increasing content in intellectual property; (2) Intellectual property protection has been upgrade to national development strategy; (3) Decentralization of the ownership of intellectual property; (4) Increasing penalties infringement; (5) Diversified intellectual property protection.

In summary, the IPR in whole automobile limited a lot to SINOTRUCK to toward international market. Among the various emerging trade barriers, if SINOTRUCK want to occupy the market share, that is the general trend to export by KD mode. It not only avoids the trade barrier but also save the import tariff.

3.2.2 Analysis in Economy

The Chinese vehicle has always been protecting by different governments' policies.

[3]Federal Motor Vehicle Safety Standard

How to set up a competitive vehicle company is Chinese governments' dream. Before the China entered the WTO, the trade of most-favored nation is 100%, or it will be 240% it is not. In current economic situation, high tariff result in the high price for the vehicle. The same car imported into China is much higher than that in America in price. The big difference has made the smuggling become a good tool to avoid high tariff.

Once the China joined WTO, the export tariff of vehicles decreased a lot, and decreased to 50% from 2001 to 2004, and completely cancelled in 2006. The open of the market certainly decreased the price of the vehicle, customers should not purchase so much to the cars and many inefficient vehicle factories have to face severe market competition.

It is reported by World Economy Forum Newspaper in 2010, the financial strength and internationalization ranked middle lower reaches in the flexible economic indicators. Obviously, tariff is the key to restrict our economic opening degree. Our country's high tariff is much higher than that in other developing countries; we have to lower the import and export tariffs. As the main countries to export for SINOTRUCK, it is favor of KD strategy implementation by appropriately adjustment of tariff.

From the 1995, the vehicle export quantity increased a lot with the tariff decreasing gradually. In recent years, not only the customers will be the biggest beneficiary, imported cargos with low price will also curb the trend of rising domestic prices. In the international competition, the quality of exported vehicles from China does not win advantage. If SINOTRUCK want to maintain long-term and stable benefits, they have to input advanced technology, equipment and scarce resources. As a result, the company can achieve a sustainable development and benefit enhancement. Currently,

SINOTRUK should rely on advanced foreign technology and equipment to support innovation and updating. This also made a policy tilt. Compare with some developing country, our SINOTRUCK have the technological advantages. On the one hand, we should maintain the market of Iran, Pakistan, Russia, Vietnam and so on, on the another hand, we should be committed to new product research and development to enter the market of developed countries.

How to view a country's status in international trade? From the macroscopic view, it is determined by its international division of labor and trade situation. It is necessary to decrease tariff to expand market development degree. For the effect to the balance of payments, it can be concluded for some points:

Reduce the budget deficit. We have to admit that the revenue will be influenced a lot by decreasing tariff. But, actually, after relaxing import conditions and decreasing tariff, the quantity of import commodities will have substantial growth. By doing so, earnings will be greatly improved. Tariff are not the only way to government's tax, meanwhile, imported commodities also need to pay consumption duty and business tax.

Consumption stimulates. Through the price markup to the control import commodities is one of the notable features of tariff, it can also restrict the need from home to this kind of products. In view of this, broadly speaking, lowing tariff can make good to utilize foreign resources, balance the price level and meet domestic demand so as to curb domestic inflation.

Increase the trade relationship. It is not only improve the relations with developed countries and trading partner by decreasing tariff but also relieve the trade disputes which will easy to happen on the condition of high apparent tax rate.

3.2.3 Analysis in Society

Among many social, cultural and environmental factors, which influenced most is the population and environmental factors. As the main import areas are gathered in some developing countries. The following is the main research to developing countries' society environmental factor. SINOTRUCK should get a thorough understanding of population scale, age structure and income distribution to the importer. Moreover, SINTRUCK should take the religious belief into consideration. It has a big meaning to local customers. Besides this, there also many society factors can make influence to export situation. At first, SINOTRUCK should know the reaction to foreign products and services for local customers which is quite important. Customers will show conflict psychology to import commodities if they are very keen on domestic goods. In advance, the company should do some emergency measure to this kind of situation. In contrast, if local customers are very pleased to foreign services and products, then the export will be very smooth and easy. Thus, SINOTRUCK should choose the import country which they have advantage in and with an extensive understanding to local population environment. Secondly, as an automobile manufacturing enterprise, SINOTRUCK should also lay more emphasis on environmental protection. With the continuous improvement of people's quality, the awareness to environment problem of local customer still keeps increasing. What's more, many countries cooperated with SINOTRUCK successively put forward these requirements to protect environment. Thus, in this kind of country, SINOTRUCK should devote them to develop the vehicles which can reduce pollution. In other words, SINOTRUCK should the deeper spiritual need to the local customers with exporting vehicles through KD mode. Thirdly, language is also a problem which will affect export situation. Actually, the difference of language and cultural between both countries is the main barrier to communicate with each other.

As for this, company should cost more to analysis and achieve what is the importer want indeed. Introducing compound talents to communicate effectively with the local company is very essential.

In conclusion, every society has its core values, and it's hard to be changed because they are the precipitation of country's history and cultural. If one company wants to make their products enter another country's market, they must take this country's cultural and society into consideration. Sense of social responsibility, after-sales service attitude and purchasing habit may also give a big influence to KD export strategy.

3.2.4 Analysis in Technology

In the fierce competition of international automobile market, America, Japan, France and Korea this kind of automobile exporting countries, they all built their own development teams by analysis of market data. The technical environment not only includes producing and technology and artistry but also includes distribution structure and new communication way to customers which set up by research. In developed country market, the higher access threshold has been making our country's automobile factory hard to enter international market. For example, North Americans and Europeans with the increasingly higher demands to safety and exhaust emission technology. The speed of vehicle replacement will also be very fast. Thus, it's hard to renowned brands have made market reach saturation. Think of the difficult situation to the SINOTRUCK, SINOTRUCK should increase cooperation with developing countries and meet the demands to import countries so as to consolidate existing position in developing countries.

Recent years, many countries set a series of trade barrier to protect the development

of their own auto industry. Our Chinese auto industry such as SINOTRUCK will be restricted in export by more stringent standards and requirements in technology trade barrier. Our SINOTRUCK's KD export strategy always influenced a lot by this kind of technology trade barriers. Frankly speaking, we still have weakness in international competition. On the one hand, our technological level is not high, on another hand; the foreign customers do not like our export mode and product structure. As the big influence to our vehicle export from technology trade barrier, the KD export mode need to set up a new assemble factory in other country. Although the most automobile parts need to be produced in our country, we can't deny that it still an advanced export mode. In other word, KD export mode is an advanced mode which combines trade and production into one. Nevertheless, the complexity to make a commercial vehicle creates favorable conditions to KD export mode. As the development of technology, the traditional manufacturing technology cannot meet the customer's needs. As a result, SINOTRUCK should get a higher status by technological innovation. SINOTRUCK should consider that use their innovation technology to provide convenience and improve the quality of life.

As the environmental deterioration and consumer quality improvement, environmental protection technology has gradually become the consumer's focus. Our company should be aware of the importance of this problem and try to develop eco-friendly vehicle model. Moreover, artificial intelligence has also become a trend in international vehicle market which not only means saving cost, it can also provide high quality life to customers. Technical talents are a vital component before intelligent technology input to totally.

For example, in many Japanese 4S stores, the qualified rate of skilled workers above 75%. But in America, this number would be over 80%. In Russia, the marketing

talents occupied more than 40%. It is not hard to find out that the technical talents are quite same which can be divided into three groups through big data. There are manufacturing class, after-sale service class and marketing class.

The requirements for technical talents: They should have an extensive understanding to body work, chassis and engine. After the vehicle parts imported into foreign country, all the needs for skilled labor are to assemble all the parts into a whole vehicle. In the increasingly fierce market competition, compound talents would be needed to cope with every field. Those compound talents should know international trade, legal knowledge and marketing. As for SINOTRUCK, lack of high-level innovative people is a big barrier to get competitiveness.

In a word, the existence of technical factors gives a profound influence to SINOTRUCK's KD export strategy. Thus, before the export, SINOTRUCK should analysis the technical barrier totally. KD condition can not only increase the efficiency of technical labor in domestic production line, it can also set up an assembly factory to avoid the high import and export tax. As a result, more and more countries have been realizing the high return from KD export mode.

Table 2 - PEST Analysis to Export Mode of SINOTRUCK

Politics	Economics	Society	Technology
1. Existence of TBT 2. Quota restriction 3. Exchange control 4.Restriction of laws and regulations 5. IPR	1. Low tariff 2.Consumption stimulate 3. Input of technology and equipment	1.Local religious belief 2. Prefer the products in their own homeland 3.Concern of global environmental protection	1.Environmental protection technology 2. Lack of high-end technology 3. Lack of technical talents

Source: Own presentation

3.3 CBU Export Mode

For a long time in the past, the main export transportation mode is CBU export mode. General speaking, we SINOTRUCK exports our commercial vehicles by Ro-Ro ships. Ro-Ro ship is the specialized ship to use cars to carry goods. The powered vehicles go straight to the ships. All goods are packed in the cabin and very few cases of loading in splints. In the actual vehicle and mechanic trades and after the presentation of letter of credit, it's quite easy to negotiate and clean bill of lading. Its lading period and voyage are exact. As a result, the voyage time can be controlled effectively.

Table 3 - The Characteristics and Advantages to CBU mode

Characteristics	Advantages
convenient	efficient
quick	safe
high capacity in transportation	high adaptability
flexibility in loading	Independence of port crane equipment

Source: Own presentation

3.4 KD Export Modes

At first, we must know that what is KD export mode? Actually, "KD" is the abbreviated form of Knock Down and it can be divided into three parts of CKD, SKD and DKD. "CKD" represents the Completely Knock Down, which means scraping the vehicle completely and exporting these scattered parts to the importer. Next, these scattered parts will be assembly in local factory. "SKD" is the abbreviated form of Semi-Knock Down. Obviously, the rate of the fragmentation will be quite smaller than "CKD" mode. Generally speaking, most of the parts will be

semi-finished goods such as axle assembly, transmission assembly, engine assembly, tire assembly and so on. The last one is just the vehicle body export mode and it usually can be sold by only assemble tires in importer country. We call it Direct Knock Down. In addition, it is the quite direct way to export vehicles. But, currently, the major forms are SKD and CKD because of some economic reasons.

CKD mode is to export all the vehicle parts which were broken up as many as possible. Later, these parts will be assembled into the whole vehicles so that they can be sold in the market. In this case, the assembly process is very complex and the production cycle period is longer than SKD. In general, these parts should be through some process such as welding and painting when they arrive at the importer countries because of their delivery form which are mainly about the collective composition of the vehicle body and other parts.

Compare to the CKD mode, SKD is easier than CKD in assembly process and its operation cycle is short as the fittings are usually in semi-break state. However, those parts which should be assembled in the importer countries were all after the welding and painting process which is quite different from the CKD mode.

By breaking up the vehicle parts to export is one of the ways to import and export trade. As the labor and tax remained in the home market, it is necessary to build up an assembly factory in importer country most of the parts should be assembled in the overseas. It can be obvious concluded that this kind of investment mode is an advanced trade.

In summary, KD export mode increase the competitive advantage as its low tariff and freight rate. We also have to admit that the complex automotive manufacturing technology create an excellent condition to itself. Moreover, KD export mode can

meet the demand that make adequate production in a short time according to local conditions.

3.4.1 Existing Problems in Current KD Export Mode

1. Missing Parts

In early CKD export business; there was a big problem that the loss of parts often occurred in the past. At the same time, as the low accuracy rate of the cargo clearance and low work efficiency of the staffs, the cost will be very high. At present circumstances, as for the automobile parts manufacturing level and scale, it is difficult to realize that all the parts to each vehicle will be export to the destination correctly and completely. There were many reasons to account for all these cases: accuracy of packing list, defect in transportation process, and qualified rate of parts. It is necessary to do good jobs in basic management work so as to reduce missing parts.

2. Insufficient Capacity for Overseas Staff

All logistical support work will be very important because something unexpected happens frequently abroad. For example, some of the staff stationed abroad may not adapt to the local food and climate. All it will affect working progress. Actually, these staffs' work efficiency will make a big influence to the relationship between customers directly.

3. Low Quality of Parts

The highest complaint rate is the low quality of the parts which is a common problem in the Chinese vehicle export industry. Quality is the cornerstone of enterprise

survival; also, it will be influenced by workshop, equipment and material supply capability. How to increase the parts' quality and ensure the overseas production standards will not less than domestic so as to adapt to local environment. That's a big problem for us to solve.

4. Lack of Communication

All the companies have their own culture. Under some circumstances, because of the different idea from everyone, there will be different methods to conduct it when the problem emerges. We should do our best to reach a consensus with local partner.

5. Low Manufacture Level in Import Country

In the long term, the final aim of the import country is to realize the localization of parts production, especially in the later stage. But most of their technologies are not qualified. As the lack of the key part in the CKD assembly process, it is very easy to cause mechanical trouble.

3.4.2 The SWOT Analysis in SINOTRUCK Commercial Vehicle Export by KD Mode

1. The Concept of SWOT

A SWOT analysis helps you match your company’s resources and capabilities to threats and opportunities in the competitive environment. S means strength, W represents weakness, O means opportunity and T represents threat. It is an important analytical tool to strategy management. It is very practical and intuitional although without accurate data support. The result from SWOT is also very convincing.

2. The SWOT Analysis in KD Export Mode

(1) Advantage analysis

All the advantages of SINOTRUCK' KD export mode can be divided into three parts. The state supports provide the policy support to SINOTRUCK. According to the "development policies of automobile industry", it can be obviously concluded that China has centrally supported several influential vehicle company so as to realize global production, research and sale. SINOTRUCK is precisely among these which lay a solid foundation to good implementation of KD export strategy. In addition, the Ministry of Commerce and other departments have also issued some ideas to encourage ours auto exports and some related regulations to cut down export tax to developing countries. There is no doubt that good policy environment provide a good platform to international development of SINOTRUCK. As we all know, our China is big country with fruitful in resources, this leads to our labor cost is much lower than that in developed country. Actually, many companies in China are enjoying cheap resources. However, low labor cost is the basement to SINOTRUCK' KD export strategy. As the high requirement to labor and production craft, we SINOTRUCK all have advantages in this area which can save cost and increase our profit. After many years' experience, SINOTRUCK have gradually become a team which has a variety of professional skills, proficiency in shovel development and sale. Thus, SINOTRUCK have a relatively high quality brand image. In this strong background, SINOTRUCK can deal with all the difficulties in development and manufacturing. To sum up these three advantages provide favorable conditions to the long-term development of KD SINOTRUCK's export mode.

(2) Weakness analysis

There are four parts can be concluded for the SINOTRUCK's weakness in KD export mode strategy. At first, lack of investment in independent research and development. According to the international practice in vehicle industry, some famous vehicle companies invest about 3% in sale to their research. But, this number in SAIC which give the most in research in China is 2%, not to mention other companies. It must bring adverse effects to their KD export strategy by lacking investment in research. Secondly, the product quality and scale although have a big gap between some famous vehicle manufacturing enterprise. On the one hand, compare with VW, TOYTO and GM, their market coverage is relatively small, so the sales will be limited. On another hand, from the aspects of selection of raw materials and accuracy of production, SINOTRUCK all lags behind some famous vehicle manufacturing factory in the world. This narrow market range and low quality of the product will must limit the development of SINOTRUCK's KD export strategy. Thirdly, we lack compound marketing staff. As for the staffs which engaged in global sale, they also have to be capable of foreign language and know different countries' needs. Fourthly, our after service network are unsound. A company's after service network level can react the international reputation and brand influence. Through some comparative analysis with world famous companies, we can find out that SINOTRUCK still choose transaction marketing strategy which means only focus on single deal but ignore the long-term profit.

As a result, SINOTRUCK should set up prefect after service network in order to keep long-term cooperative relationship with importer. In this way, we can increase our brand influence and do better to our new export strategy.

(3) Opportunity analysis

External market environment has provided four opportunities to SINOTRUCK. At

first, national encouragement and support give a powerful opportunity to KD export strategy. Since 2009, government has successively issued some opinions to promote vehicle export, a large number of policy support are no doubt become the environment protection to KD export. Secondly, the huge needs in international market means SINOTRUCK still have growth space. Thirdly, as our China entered WTO and constantly decreasing international market trade barrier. Furthermore, Africa, America have a huge needs to the commercial vehicle to support their infrastructure construction. These countries' production technology are relatively low, we SINOTRUCK can also provide service to these countries to expand the market. Fourthly, the development of domestic vehicle market is good for SINOTRUCK's KD export strategy.

Currently, the automobile industry in our country is developing rapidly and it is stabilizing now, under the support of government' s policy, we SINOTRUCK will must achieve good development in KD export strategy by combining experience accumulation of self-development and good international trade condition.

(4) Threat analysis

The threat to implementation of SINOTRUCK's KD export strategy mainly can be included into four aspects: At first, increase in raw materials and labor costs. In recent years, the increasing price of steel, aluminum, nonferrous metal bring a big cost pressure to our domestic vehicle manufacturing factory. By the way, the increasing labor cost affect profitability of all the vehicle industry. This change will must increase the cost to the implementation of SINOTRUCK's KD export strategy. Secondly, the enhancement of social environmental awareness. The enhancement of this kind of awareness make our customers realize the dreadful effect of environment which brought by vehicle exhaust emission. Because of this, our company's profit

may be influenced a lot. On the other hand, many countries' government issued many higher technical requirements to commercial vehiclecompany so as to improve the social environment by increasing emission standards. Under this kind of condition, the only vehicle company can be survived will be those which possess strong technical advantages and higher brand cognition. Thirdly, the negative effect of low price strategy. Currently, many commercial vehicle companies take low price strategy to attract customers. Although this action will bring some new local customers, but it is temporary. The more serious matter is it will build up many enemies in the industry and lose good brand reputation. As a result, low price strategy may give a limit to KD export strategy. Fourthly, multi-channel exports and imperfect after-sales service system. At present stage, we SINOTUCK is still in initial stage on KD export strategy, some of the vehicle companies just focus on immediate interest but ignore the good chance to set up long-term cooperation with cooperative partner. This immature sale model may influence a lot to KD export strategy of SINOTRUCK in international market.

Table 4 - SWOT Analysis to KD Export mode

Advantage	Weakness	Opportunity	Threat
1. Support of government 2. Low tariff 3. Low labor cost 4. Brand recognition	1.Lack of investment independent research 2. Lack of after-sales service	1.High demand in Africa 2. Decrease in trade barrier 3. Support of government	1. Increase of resource cost 2. Lack of environmental protection technology 3. Increase in labor cost

Source: Own presentation

3.5 Summary

Through the analysis above, we can find out that SINOTRUCK has advantages and challenges in international market. We should make best of the advantages and

bypass the disadvantages. We have to spare no effort to overcome the weakness and threats. Although KD export mode is still in initial stage, we can find that it is full of potential because of the policy advantage and support of government. But as the traditional export mode like CBU also has a niche in the market. We should choose the right mode according to the appropriate policy.

Chapter 4 Prospect Analysis of KD Export Mode in Africa

4.1 Analysis of Commercial Vehicles demands in Africa

If one company wants to enter another area's market, the first thing they must to do is the analysis of marketing requirements and user requirements. It is obvious that we cannot get success if the market have reached saturation point. So it is necessary for us to do the analysis and forecast to a period of time in the future. In this way, we can do some strategic layout in according with data. The sales volume over the years is one of the most important historical data for us to work.

4.1.1 Grey-forecasting Model

Grey-forecasting Model, it depends on previously known information to conjecture and gain information in the future. Through the handle to known information and the set-up of Grey-forecasting Model, we can also find out the potential law and set up Grey-forecasting Model by Grey theory although the vague phenomenon and sophisticated data. By this way, we can have a more scientific quantitative forecasting. Its benefits are as follows:

1. No requirements of large sample.

2. No requirements of regular distribution to sample.

3. Little computational effort.

4. The quantitative analysis results are not inconsistent with the qualitative analysis.

5. Strong applicability.

6. High accuracy.

GM (1, 1) is a common forecasting model in Grey-forecasting Model, in the modeling process; we use initial data to do differential solution. Thus, an approximate differential equation is established. The construction process as follows:

First step:

Primitive Series in general form of GM (1, 1)

$$X^{(0)} = (x^{(0)}(1), x^{(0)}(2), ..., x^{(0)}(n)) \tag{4.1}$$

Second step:

One time accumulate

$$X^{(1)} = (x^{(1)}(1), x^{(1)}(2), ..., x^{(1)}(n)) \tag{4.2}$$

$$X^{(1)}(k) = \sum_{i=0}^{N} x^{(0)}(\mathrm{i}) = x^{(1)}(k-1) + x^{(0)}(k) \tag{4.3}$$

Third step:

$$X^{(1)}(k) = \sum_{i=1}^{k} X^{(0)}(\mathrm{i}) \tag{4.4}$$

Fourth step:

$$Z^{(1)}(k) = 0.5\, X^{(1)}(K) + 0.5\, X^{(1)}(K-1) \tag{4.5}$$

Differential equation model:

$$X^{(0)}(K) + az^{(1)}(k) = b$$

Regard as:

$$\hat{a} = (a,b)^T \tag{4.6}$$

The least squares estimation parameter:

$$\hat{a} = \left(B^T \cdot B\right)^{-1} B^T Y_n \tag{4.7}$$

Next:

$$B = \begin{bmatrix} -2^{(1)}(2)\,1 \\ -2^{(1)}(3)\,1 \\ \cdots\ \cdots \\ -2^{(1)}(n)\,1 \end{bmatrix}$$

$$Y = \begin{bmatrix} X^{(0)}(2) \\ X^{(0)}(3) \\ \cdots\ \cdots \\ X^{(0)}(n) \end{bmatrix}$$

Fifth steps:

$$\frac{\mathrm{d}x^{(1)}}{\mathrm{d}t} + ax = b \text{ 为 } X^{(0)}(K) + az^{(1)}(k) = b \tag{4.8}$$

$$\hat{x}^{(1)}(t) = \left(X^{(1)}(0) - \frac{b}{a}\right)\mathrm{e}^{-at} + \frac{b}{a} \tag{4.9}$$

4.1.2 Sample Data

According to the information on the internet, the commercial vehicle sales between 2006 to 2016 in Africa (in 1,000 units).

Table 5 - Commercial Vehicle sales in Africa

Time	Sales in thousand units
2006	331.51
2007	389.58
2008	386.11
2009	371.52
2010	336.45
2011	346.67
2012	399.69
2013	418.70
2014	460.29
2015	469.10
2016	424.72

Source: https://www.statista.com/statistics/473661/commercial-vehicle-sales-in-africa

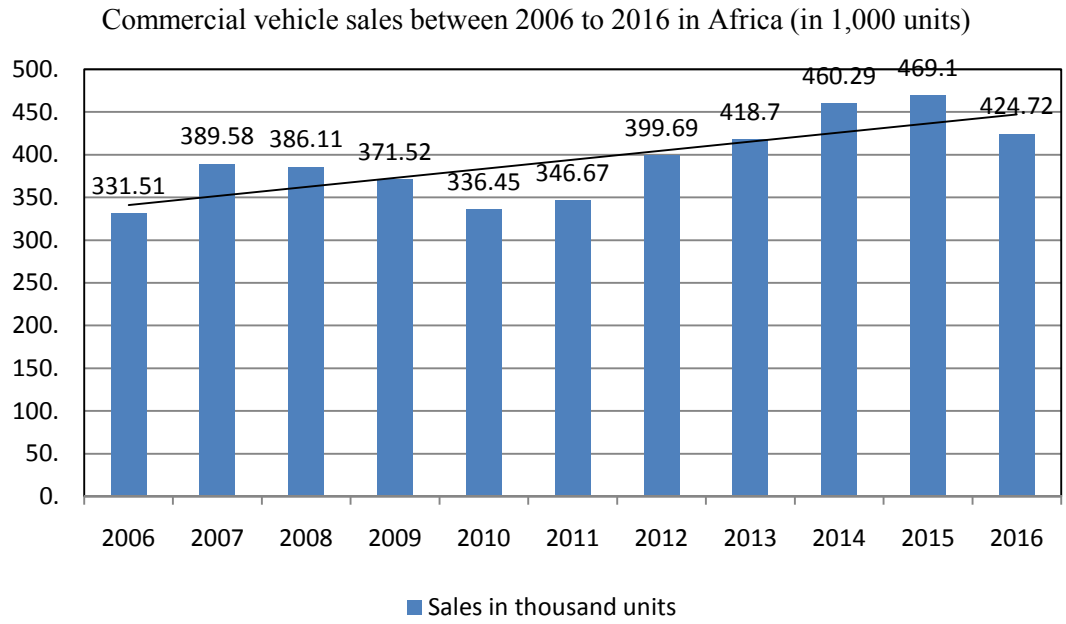

Figure 2 - Commercial Vehicle sales in Africa

Source: Own presentation

According to the data above, we can conclude that there has been a general uptrend in needs of commercial vehicle. So we choose Grey-forecasting Model to do forecasting is appropriate.

4.1.3 Predication of needs of Commercial Vehicle in Africa

Set up sequence:

X_0= (331.51, 389.58, 356.11, 371.52, 336.45, 346.67, 399.69, 418.70, 460.29, 469.10, 424.72)

X_1= (331.51, 721.09, 1077.2, 1448.72, 1785.17, 2131.84, 2531.53, 2950.23, 3410.52, 3879.62, 4304.34)

Set up matrix

$$B = \begin{bmatrix} -526.3 & 1 \\ -899.1 & 1 \\ -1262.96 & 1 \\ -1616.95 & 1 \\ -1958.51 & 1 \\ -2331.685 & 1 \\ -2740.88 & 1 \\ -3180.375 & 1 \\ -3645.07 & 1 \\ -4091.98 & 1 \end{bmatrix}$$

$$Y = \begin{bmatrix} 389.58 \\ 356.11 \\ 371.52 \\ 336.45 \\ 346.67 \\ 399.69 \\ 418.70 \\ 460.29 \\ 469.10 \\ 424.720 \end{bmatrix}$$

$$\hat{a} = \left(B^T \cdot B\right)^{-1} B^T Y_n \qquad (4.10)$$

This paper uses the MATLAB mathematical software to do calculation. The new prediction as follows:

$X_{(k+1)}$=13719.51*$e^{0.0256k}$ - 13388

By using this prediction, we can figure out the commercial vehicle needs in the future in Africa in the next ten years. As shown in the table:

Table 6 - Predication to Commercial Vehicle sales in Africa to next Ten years

Time	Sales in thousand units
2017	459.72
2018	471.46
2019	483.7
2020	496.84
2021	509.1
2022	522.3
2023	535.84
2024	549.74
2025	563.99
2026	578.6

Source: Own calculation

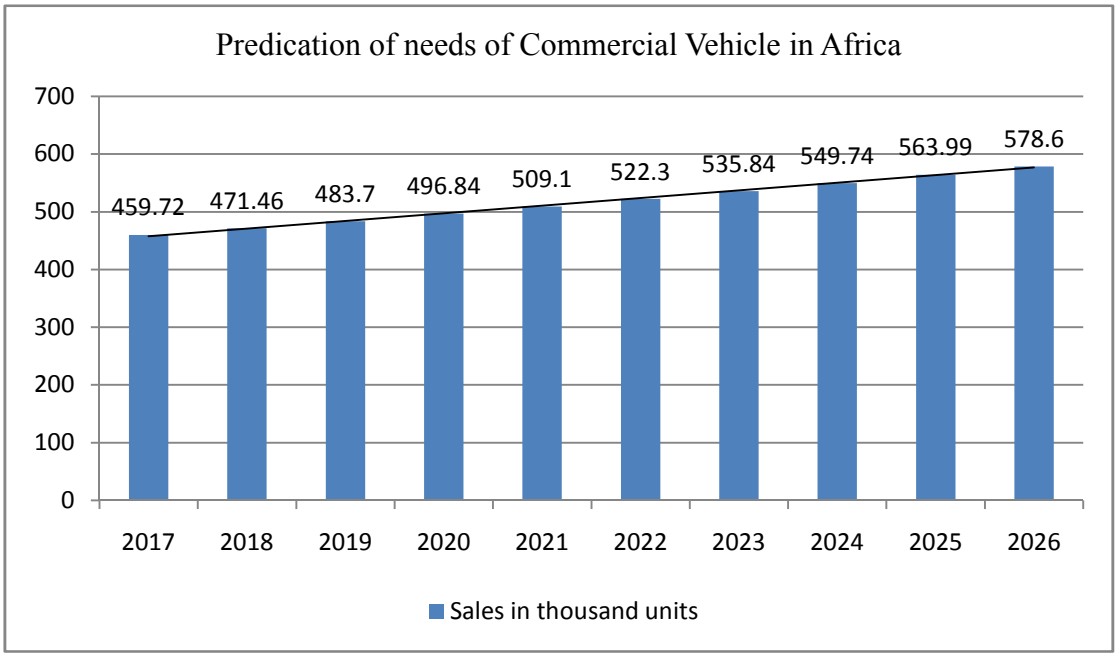

Figure 3 - Predication to Commercial Vehicle sales in Africa to next Ten years

Source: Own calculation

According to the graph and table, the total sales in the following ten years will be 5171290. It can be easily found that the needs of commercial vehicle in Africa will rise steadily which means this market is still not saturated and it will full of potential in the future for a long period of time. As a result, we SINOTRUCK should hurry up to make their layout in Africa commercial vehicle market. After all, in business competition, grabbing market is quite important in all the process.

4.2 Economy Benefits Analysis

In 2013, Nigerian Ministry of finance has issued a document, they decided to increase the passenger vehicle import tariffs by 20% to $70% (including an additional tax of 35%), the commercial vehicle import tariffs increased from 10% to 35%. On the contrary, the CKD mode import tariffs dropped to zero. According to the online information display, the market share of commercial vehicle import

volume to Nigerian is 8.45% in usual. On the basement of this situation, I think SINOTRUCK's decision which entering the Nigeria market for their CKD strategy because of the huge profit. This article will calculate a rough difference between CBU mode and CKD mode in Nigeria.

4.2.1 Main Factors to Cost of CKD Mode

1. Organizational structure construction

The organization team of SINOTRUCK needs the personnel in all fields, including designer, skilled technician, packaging designer and logistics personnel etc. The entire project’s benefit level will be influenced a lot by quality level of staff. For example, the rectification to optimize plan by designers would affect a lot to the equipment input. Meanwhile, the later packaging and transportation cost will also influenced a lot by designers' package optimization program.

2. Cost management

The final aim to the every project is to achieve the most society and economic interest. The cost management will mainly reflect in: (a) By the cost forecasting to breakdown the proportion of cost and arrange the funds reasonably to ensure the every process go smoothly. (b) By the calculating and analysis to each process to find out the existing shortcomings. Under this circumstance, we SINOTRUCK can strengthen our management and improve the efficiency so as to reduce the cost. (c) Through the control to cost in each process to make the reasonable resource allocation by the discovery of the possible cost variance in time.

3. Quality management

No matter what project, quality is the basic standard and the guarantee to the enterprise's survival, meanwhile, the quality problem would give a lot of influence to the overall cost. As the reason of the quality to cause project rework claims increase. This would increase the cost. We SINOTRUCK cannot decrease our quality standard because of the process and cost. Quality of the products is the big problem which we should take into consideration.

4. Safety management

The safety reasons will directly lead to the life casualties and economic loss. As a result, all the process will be affected which includes several parts: (a) Insurance and medical expenses for personnel. (b) Safety training. (c) Purchasing on safety facilities (d) Compensation and rehabilitation expenses of the accident. (e) Cost of project downtime.

5. Information management

Project information is the key resource and it is worth to think about how to manage it. Some of companies use information control system, other ones use the web serve to retain the important information.

No matter what kind of methods you use to retain information, you should ensure that you can retain them in the location which is easy to find and delete obsolete information in time so as to get the important information you want at any time.

6. Process management

Around the CKD project process, as the graph 6

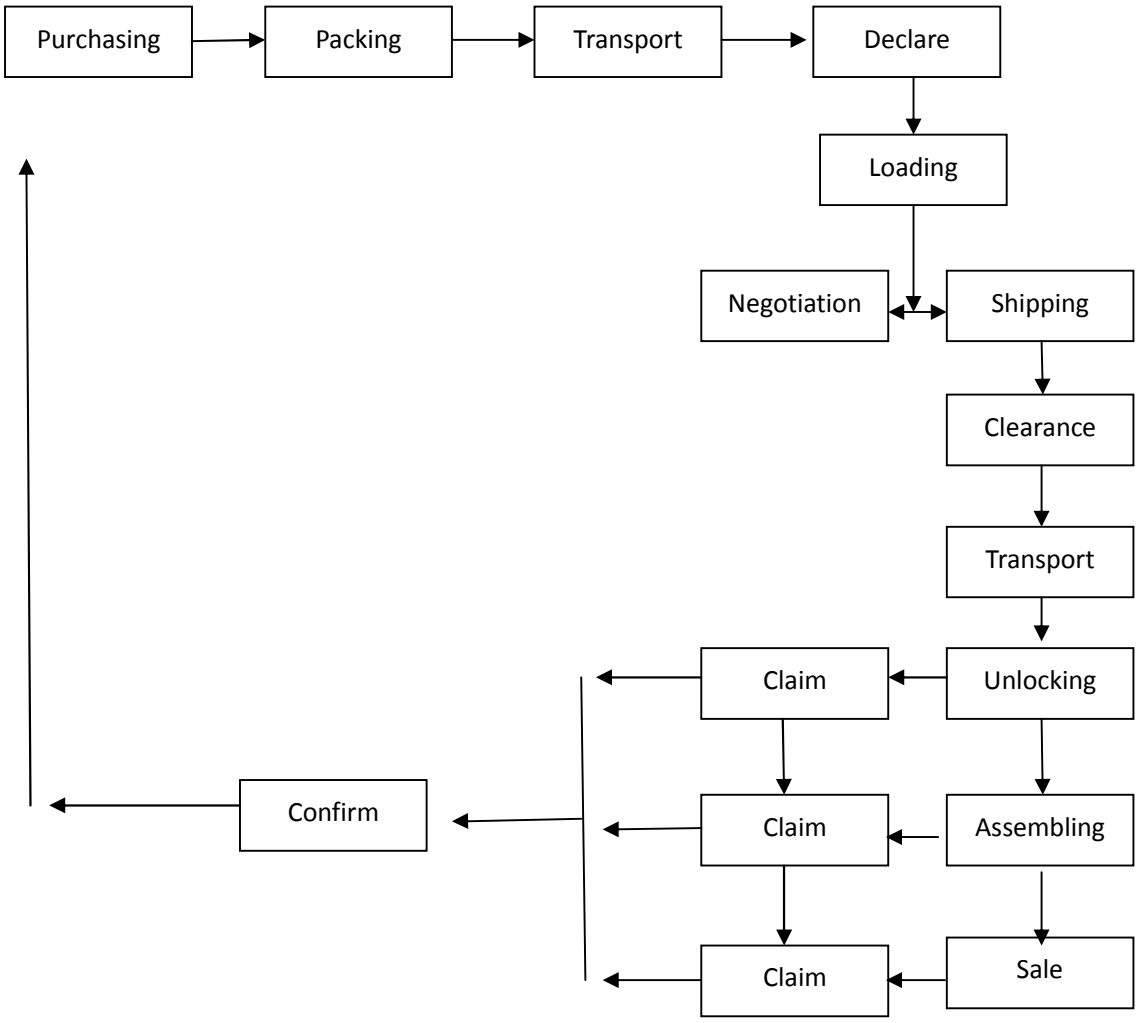

Figure 4 - CKD Project Process

Source: Own presentation

The resource purchasing, it means when SINOTRUCK receive the order, the KD departments will buy the vehicle parts followed by order; the value-added tax invoice price is the actual purchasing cost.

In international trade, most of the cargos all need packaging. The main packing methods for CKD goods are wooden, carton packing or plastic cases. So as to ensure the transportation process, we should take the packaging technology and optimized

packaging scheme to reduce container quantity and cost.

In assembly process, the parts size problems in the installation which cannot be assessed responsibility. After confirmed by both parties, we can enter the claim procedure.

4.2.2 Cost Analysis of CKD Mode

The cost in CKD export mode is determined by its project scope. According to the SINOTRUCK's CKD project in Iran, the cost can be concluded for five aspects as follows.

1. Purchasing cost. As a production unit, SINOTRUCK will follow the order to buy the vehicle parts resources. The after-tax price is the final actual price.

2. Packing cost. It means in order to be more reasonable, the resources consumed in the process of packaging to the CKD vehicle parts. It includes labor costs, warehousing cost and materials cost.

3. Transportation cost. The main cost in transportation is the container highway transportation cost which is most about loading and unloading, stockpiling and agency business.

4. Claim cost. Because of the deficiencies of the parts quality and the damage result in packaging. It includes cargo value, freight and customers clearance fees etc.

5. Equipment input. In order to start assembly line quickly and smoothly, we SINOTRUCK should invest more reasonable on the basement of production line capacity. The cost on this equipment should also be counted into the budget of the

whole project.

According to the previous CKD project in Iran by SINOTRUCK, the main cost for each commercial vehicle to set up and manage a CKD factory as follows:

Table 7 - Unit Cost to one Commercial Vehicle to CKD Factory

Manufacturing fees(average)	Cost($)
Investment on equipment	USD 385.825
Claim cost	USD 596.45
Packaging	USD 1887
Management	USD 58.5
Total	USD 2927.8

Source: Own calculation based on the data of CKD factory of SINOTRUCK in Iran

Generally speaking, currently, SINOTRUCK choose every 12 commercial vehicles for a unit in their CKD export strategy, and every unit use 9.5 HC (40 feet). According to the relevant business consulting, the freight rate for one 40HC is as follows:

Table 8 - Unit Cost to one 40HC from Qingdao to Lagos

Definition	Unit price	Amount	Cost($)
Shipping	USD 4009	1	USD 4009
Documents	USD 66.2	1	USD 66.2
Manifest fee	USD 22	1	USD 22
Port fee	USD 20.88	1	USD 20.88
Dock fee	USD 161.75	1	USD 161.75
Total	USD 4279.8	5	USD 4279.8

Source: Quote from freight forwarding company

Thus, the parts to each commercial vehicle in shipping may cost 3566.5 dollars.

(4279.8*9.5/12)

Presently, we suppose a commercial vehicle model from SINOTRUCK which is named HOKA H7, the cost price of it is about 22000 dollars. When it faces to the market, the price would be about 53000 dollars. As I said above, the import tariff in Nigeria to CBU export mode and CKD export mode. For the CBU export mode, the tariff will be 35%, for the later; this number will be decrease to zero. By access to information, the weight to one HOKA H7 is about 9 tons and each tons on Ro-Ro ships for shipping may cost 309 dollars. Thus, each HOKA H7 may cost SINOTRUCK 2780 dollars.

Let's make an account.

CBU mode:

Table 9 - Entire Cost for one Commercial Vehicle on CBU Mode to Nigeria

Cost price	Freight	Tariff	Initial investment	Total
USD 22000	USD 2780	USD 18500	0	USD 43280

Source: Own calculation

CKD mode

Table 10 - Entire Cost for one Commercial Vehicle on CKD Mode to Nigeria

Cost price	Freight	Tariff	Initial investment	Total
USD 22000	USD 3566.5	0	USD 2927.8	USD 28494.3

Source: Own calculation

The difference will be 14785.7 dollars, and this is just for one commercial vehicle. As the analysis said above, the market share of commercial vehicle import volume to

Nigeria is 8.45% in usual. According to the forecasting, Nigeria may need 436974 vehicles, if SINOTRUCK can take 30% share in Nigeria, the number will be 131092. We SINOTRUCK will have 13109 commercial vehicles market demands in Nigeria on the average per year. The profit difference in a year will be 193816565 dollars.

However, when we turn our eyes to other Africa countries such as South Africa, we can find that the result will be quite different. It is reported that the import tariff to CBU mode is 25%, while it is 20% for CKD mode, so the margin of preference is only 5%. Let's make another account to analysis it based on the former case.

Table 11 - Unit Cost to one 40HC from Qingdao to Cape Down

Definition	Unit price	Amount	Cost($)
Shipping	USD 2635	1	USD 2635
Documents	USD 66.2	1	USD 66.2
Manifest fee	USD 22	1	USD 22
Port fee	USD 20.88	1	USD 20.88
Dock fee	USD 161.74	1	USD 161.74
Terminal charge	USD 58.8	1	USD 58.8
Total	USD 2965	6	USD 2965

Source: Quote from freight forwarding company

On the basement of that we SINOTRUCK choose every 12 commercial vehicles for a unit in their CKD export strategy, and every unit use 9.5 HC (40 feet). After calculation, the transport cost for one HOKA H7 will be 2347 dollars. (2965*9.5/12)

We also use HOKA H7 as our example. After the inquiry to logistics companies, the freight rate for one HOKA H7 to Ro-Ro ship from Qingdao to Cape Down is about 2000 dollars.

As the basic conditions remain the same expect the import tariff in South Africa, we can make two tables to illustrate it:

CBU mode:

Table 12 - Entire Cost for one Commercial Vehicle on CBU Mode to South Africa

Cost price	Freight	Tariff	Initial investment	Total
USD 22000	USD 2000	USD 13250	0	USD 37250

Source: Own calculation

CKD mode:

Table 13 - Entire Cost for one Commercial Vehicle on CKD Mode to Nigeria

Cost price	Freight	Tariff	Initial investment	Total
USD 22000	USD 2347	USD 10600	USD 2927.8	USD 37874.8

Source: Own calculation

By rough calculation, in South Africa, CKD mode cost more than CBU mode; the result is quite different from Nigeria case. We can easily conclude that in freight aspect, CBU mode is cheaper than CKD mode. But tariff is the decisive factor. Only when the tariff varies greatly can we achieve a big profit on CKD export mode.

4.3 Summary

This chapter is the core in my dissertation. First, according to my predication, we can know that there will be a big demand in Africa in the near future. So how to enter the Africa market in a correct way is worthy our thinking. In this chapter, I choose Nigeria and South Africa as my two case studies to illustrate the strengths and weaknesses to CKD export mode and CBU export mode. As we can see, the import

tariff is the key factor the cost in all the process. In Nigeria, we find that the price for CKD export is expensive than traditional one in unit transportation cost. But in the whole process, especially after adding tariff, we find that the cost for CBU is higher than the CKD mode. But in South Africa, CBU mode is the final winner. The margin of preference is only 5% while that in Nigeria is 35%. As a result, the tariff plays a big role. Thus it can be seen our investment should follow the policy. Currently, many Africa countries all issue the preferential policies to CKD export mode and it is reported that this trend may become the mainstream. We should do some predication and investigation before our investment.

Chapter 5 Packaging Research of SINOTRUCK's CKD Export Mode

As a series of favored policies issued by many Africa countries, we can see that this is the future trend. So it is necessary for us to make a research to the packaging problem which is the main difficult in packaging.

5.1 The Step in Packaging Design

5.1.1 Parts Classification

We classify the parts according to the export list. Sometimes, they can be classified by weight and shape or types. In most cases, we must follow the packaging requirements. Our final purpose is to simplify the packaging design and standardize the packaging scheme. For example, we use foam to package fragile products. The general classification form as follows.

Table 14 - The Classification to Vehicle Parts

Sequence number	Classification	Name
1	fragile products	Lights, glass, driving mirror
2	Interiors products	Seats, carpets
3	Chassis products	Transmission shaft, frame
4	Easy to rust products	Break disc, sheet metal parts
5	Easy to nick products	Dashboard, headlights

Source: CKD Export Logistics Packaging Research

5.1.2 Measurement of Original Packaging

We should carefully measure the large-size products, these data can be used to design special packaging box. In SINOTRUCK's CKD project, we often use 12, 24, and 60 as the base to make sure the economic batch. For example, we have 60 lights to package; we can choose 12 lights as a unit to package or 30 lights as a unit. We can also package them one by one. It is worth mentioned that we must keep our choice on the number of units because the subsequent packaging box has been confirmed at first.

5.1.3 The Principle on Packaging Design

We design the container layout by measuring data. In general, there are 40GP (12000*2350*2280mm) and 40HC (12000*2350*2560mm). SINOTRUCK choose 40HC in our CKD export mode strategy.

The vehicle parts packaging should be simple and effective. For the protection aspect, moisture-proof and anti-rust should be taken into consideration. Also, we should try our best to control the packaging cost by making use of local conditions. The packaging method should be easy to carry and assemble. In packaging process, we should follow the identity. In order to keep balance, the weight for the entire box should be essentially the same and follow the principle that putting the weights under the light ones. Finally, we should make full use of the box. When loading these boxes, we usually vacate a distance of 100mm to 200mm in case of the loading failure caused by statistical error. Certainly, we must make sure the fixed work has done very well so as the boxes would not go wonky in the voyage.

5.2 Cost Management in Packaging

5.2.1 Main Tasks and Requirements for Packaging

What is the packaging cost management? The answers are the series of scientific works such as predication, plan, control, accounting and assessment. Its link and operation are showed as figure 2. Cost prediction is the premise in the plan. The plan is the basement to cost control and analysis. The accounting is a comprehensive and frequently supervises to implementation.

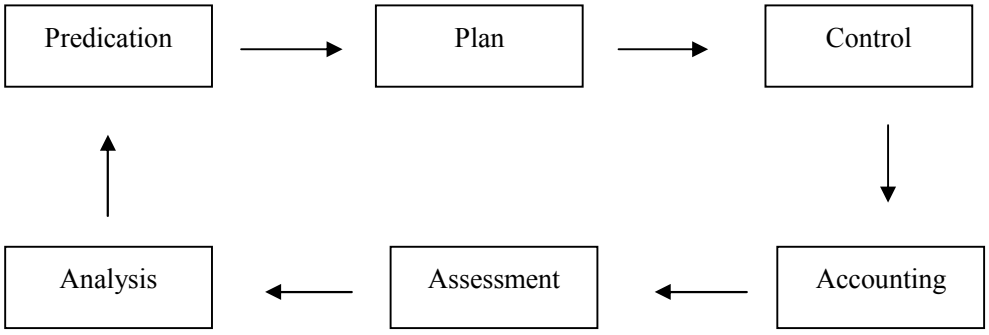

Figure 5 - The steps to Packaging Cost Management

Source: Own presentation

Main tasks:

1. Accurate cost forecasting. During the management decision, we SINOTRUCK must consider input-output ratio. Therefore, we should compare each project's cost with the predication.

2. Good projects. Packaging cost project is the advanced control to cost management which is also the basis to analysis and assessment.

3. Reduce logistics packaging costs. By reducing packaging costs to increase the

profit is the key task in our management, because it is the final purpose to our cost predication and control. By doing this, we can get increase in profit without changes in other conditions, which means reducing fund usage and improving competitiveness.

Main requirements:

1. Implement the standards of packaging cost strictly. We should draw a line between cost and investment. Those expenditures which are not belongs to cost cannot be counted into cost and no arbitrarily to increasing cost standard.

2. Correct accounting. Accounting is the basic link in packaging cost management which is correct or not will directly influence the final economic benefit. Because of this, we should distinguish this period cost and next period cost.

3. Implement comprehensive packaging cost management. All the relevant departments and links should pursue economic benefit and try their best to achieve high quality, high yield and low consumption. Our commercial vehicle packaging cost management should cover packaging design, raw material supply and production. Everyone in our company should be cultivated consciousness of saving cost avoiding waste.

5.3 Container Utilization

As the development of the science and technology, we SINOTRUCK's export volume are rising year by year. The main export mode will be CKD in the near future. We SINOTRUCK choose every 12 commercial vehicles for a unit in their CKD export strategy, and every unit use 9.5 HC (40 feet). As one 40HC cost us about 4000 dollars, than the container cost for one commercial vehicle is about 3500 dollars. If

we can increase 10% container utilization, than 350 dollars will be saved just for one commercial vehicle on logistics. As for the company which annual export volume is close to 10000 like SINOTRUCK, how to increase the container utilization is a quite meaningful question to them.

5.3.1 Existing Problems

As for the current situation to SINOTRUCK and any other commercial vehicle factories, our container utilization is considerably lower than Korea and Japan, there is still a lot of space for us to improve. The main reasons as follows:

1. We have no unified standard and overall management to CKD packaging mode. When we take decentralized packaging, a lot of space in box will be wasted. At the same time, too much packaging boxes means it will be hard to match in LCL process which leads to the container cannot be utilized effectively.

2. The purchasing parts and those made in our own plant are packaged by different suppliers, so it is also hard to match in LCL process.

3. Lack of professional design team or low design skill. We should also focus on the container utilization, not only focus on packaging quality.

4. Lack of optimization to batch

5. Lack of corresponding LCL software and analysis software. The result will be not very well if we only depend on manual LCL by technicians.

5.3.2Main Countermeasures

From the research, we can find out some ways to make full use of the container space and increase the efficiency.

1. Container normalization

Currently, we design the container and box according to the parts which means we need a lot of boxes to adapt automobile parts of different shapes. As this, the space in boxes will be utilized very well but it is difficult to match in LCL process and cause a big waste. At the same time, too many kinds of materials bring inconvenience in production and management which leads to increase in cost and resources.

The general containers in the market are 40HC, 40GP and 20GP. According to the container size to divide it 2, 3, 4, 5 parts and make sure the boxes' size at the same time (offset error). When inner packaging box has the modulus relation with outer container to make the former can fill container with the geometric relation.

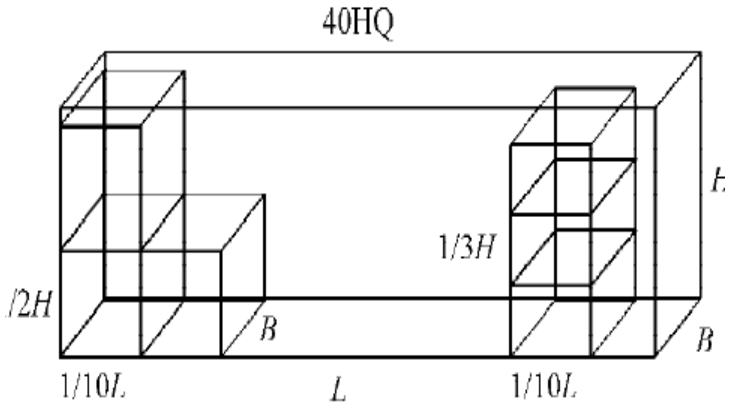

Figure 6 - Matching in Length and Height

Source: Study on Container Utilization Rate

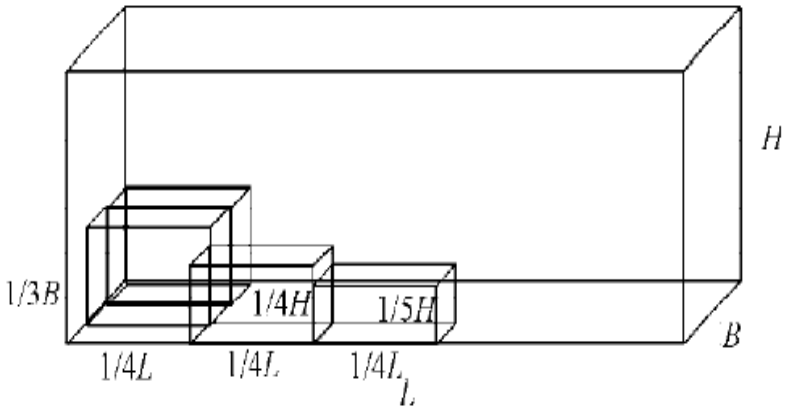

Figure 7 - Matching in Width

Source: Study on Container Utilization Rate

After using the standardized boxes, the outer space of boxes and container will maximum the use during the loading. However, the innermost box cannot be utilized most which can be solved by reasonable placement method and scientific collocation.

2. Matching relation

If we use standardized boxes to load, the container space can be certainly utilized perfectly. But, in actual operation, it is impossible to use standardized boxes to load in all the case. For example, an automobile's body side is 3327mm*494mm*1276mm. If we take one fourth container length box, we can't put our products in this box. If we take one third container length box, then too much space would be wasted. When in height aspect, if we take half container height box, it would be too high to load. As a result, in these kinds of cases, we must adopt box follow parts measures to make sure the size of box. After comprehensive consideration, the final box size in this case is 3400mm*2280mm*1500mm. When we make this kind of box do single LCL, there will be very low container utilization. If we have no good matching design, on

the one hand, too much space would be waste, on another hand, our packaging box would be damaged and collapse because of the unreasonable LCL. Another words, if we can design a packaging box can be also matched very well with other parts packaging box, then the desirable results can be obtained.

In consideration of the vehicle CKD parts have many varieties; we should design the packaging boxes to big parts at first. We can't do adjustment to first batch products because they are limited by project cycle. As can be seen, doing good matching to bulky boxes is better to utilize container space.

3. Parts Matching Relation

In previous chapter, I mentioned that we adapt parts follow box principle which should be considered at first. But, the varieties of standardized boxes are not very much, it is necessary for us to consider the complementarities between different kinds of parts on their size and shapes. Through the combination and collocation of different kinds of automobile parts, we can get good container utilization. What needs to be explained is that when we doing this combination, we should consider a variety of factors. On the one hand, we need to prevent the interference of different kind of parts' attributes. On another hand, we should consider the assembly workstation and try our best to avoid the damage in sorting process in overseas KD factory. If we can get the good matching between automobile parts and assembly workstation, the sorting work in KD factory can be omitted. Then the assembly efficiency and customer satisfaction will be increased.

4. Packaging and Design project selection

Whether selection to the cushioning design and packaging box is reasonable or not

may make a degree of influence to container utilization. We can divide the container into two aspects, one part to cargos, and one part to packaging boxes. If we can decrease the materials to packaging boxes, we may have much space to put our automobile parts. Thus, we should take the cheap packaging box with little space occupation. That is to say, we can choose large volume packaging box when all kinds of conditions are satisfied. For example, we should try our best to adapt eight rows packaging boxes (just fill one container) instead of ten boxes.

As for the high annual delivery volume commercial vehicle model, we should make sure the standard scatter state which not only increase the container utilization but also increase the generality for different packaging projects to the same commercial vehicle model. However, it should still do research and analysis to whether scatter the assembly parts or not. In general, after scattering, the space in container can be saved. But in some time, the container utilization may decrease. When one wheel is divided into two parts, which are tire and ring, then the packaging volumes increase instead. Moreover, we also have to invest equipment in overseas KD factory to assemble it.

5. Batch Adjustment

Commonly, the batch for CKD project is 24, 30, 60, and 120. Almost every batch has one odd box. Sometimes, one batch automobile parts would go to different ports, and then it would lead many odd boxes. As a result, large batch of transportation do better to container utilization. Certainly, limited by the requirements of overseas KD factory and logistics, we have to choose small batch transportation, under this circumstances, we can choose different batches and make multiple sets of projects to adjust dispatch batch.

We can also choose the combination of different batches. For example, if one container utilization rate is only 50%, we can put two odd boxes in it so as to save one container.

6. Optimization of LCL mode

The CKD commercial vehicle parts are usually limited by the conditions of the destination port and its size and container structure. Currently, the applicability of universal LCL software is not good or it will cost us a lot of money and labor if we develop the individual software. Therefore, we adapt manual consolidation generally. But, it is hard to find out the best LCL scheme. We use software for pre consolidation and manual adjustment can increase the efficiency and container utilization. As for the large export volume company like SINOTRUCK, I suggest that we should develop the corresponding software to for consolidation and analysis. Also, we should make this software embed into integrated logistics system so as to find a reasonable LCL project.

5.4 Summary

In chapter 4, I introduced the some steps of packaging for CKD export mode and the requirements to control the packaging cost. We should do these according to the actual goods situation. In the third part of this chapter, I put forward some advices to increase the container utilization by changing packaging form and storage mode. Currently, the overall utilization rate for container is not high, there are many factors should be accounted for it. The standardization for container and good matching scheme may increase the container utilization and decrease the logistics cost.

Chapter 6 Inventory Management for Overseas CKD Plant

In sum, the overseas CKD factory is imperative. So how to allocate the reasonable inventory and production pattern to improve efficiency and reduce cost is worthy thinking. This chapter is my analysis on inventory management under a CKD mode and some suggestions to SINOTRUCK.

6.1 Inventory Management Theory

Inventory is the idle resources for enterprise such as the raw materials, spare parts, WIP and semi-manufactured goods. In the process, in order to maintain continuity, we need a certain amount of inventory to be buffer. When in sale, we also need it to give our customers quick response. From this angle, the sufficient inventory is the essential condition to finish sale and production, the more inventory the better. But, if we focus our eyes on inventory value and fund usage, too much inventory means fund occupation and devaluation. It also gives burden to operation and management. From this point, the low our inventory level the better. As a result, inventory management is very important to SINOTRUCK.

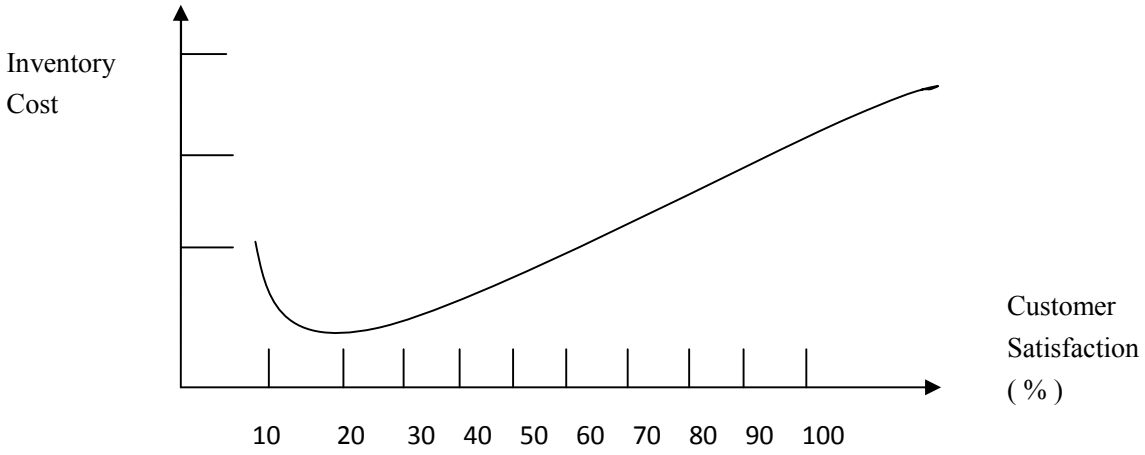

Figure 8 - Relationships between Inventory Cost and Customer Service Level

Source: Research on Inventory Management Model Based on JIT

As the graph shows, customers' satisfaction is really important for us, but in consideration of the cost, we should choose a suitable inventory management strategy to achieve balance between both of them.

The traditional inventory control model can be divided into three types. They are ABC analytical method, Quantitative Order Method and Periodic Order Method.

(1) Quantitative Order Method

When using this method, we should issue our order when the inventory level decreased to a certain point. We should make continuous monitoring to the inventory level, especially for those relatively expensive goods. In order to simplify discussion, we assume the variable is fixed. In project, the demand in each time (expressed in d) is the same, L is the lead time. When our inventory decreased by a stable speed and reach the point (R=dl), we will reissue our order.

(2) Periodic Order Method

Periodic Order Method is also called Periodic inventory system; we should check our inventory level regularly and supply the cargos in time to make the level reach a certain point. The actual order quantity Q is the amount which is used to recover expected number R. Its formula is:

Q=I

Q= Order quantity

R= Supply quantity

I= Inventory level in check

The increase in supply level can effectively improve the safety stock. The more input in supply, the lower possibility for running out of stock in next time. On the other hand, this method only have check inventory in fixed time which exist possibility that the shutdown because of running out of stock. Therefore, Periodic Order Method is more suitable for those cheap products but with high replenishment quantity such as screws and springs.

Periodic Order Method has following characteristics:

(a) With the fixed time interval for supply which benefits management a lot, the company can arrange delivery and make the transportation route standardized.

(b) We can combine the orders in fixed time interval which can achieve low order fees. By doing this, our purchasing staffs' workload can also be decreased.

(c) In Quantitative Order Method, we have to check the inventory level constantly to judge whether it reaches the reorder point and update the inventory record.

(3) ABC analytical method

The basic principle to ABC analytical method is that it divided the objects' value into three groups.

A groups: The variety in inventory occupies 10% of the total, which 70% of the value. It should be invested most to control and checked at least once a month.

B groups: The variety in inventory occupies 20% of the total, which 20% of the value which should be checked at least once three months.

C groups: The variety in inventory occupies 70% of the total, which only 10% in value.

Implementation steps:

First step: Sorting the products according to the value

Second step: Make the calculation of percentage of total value for each kind of products and accumulate them.

Third step: Classification by standard.

I think we SINOTRUCK should combine the self-develop demand and apply the inventory management tools comprehensively.

(1) Use Periodic Order Method to manage A products

Products A occupy 10% in total inventory, which 70% of the value. We should put our most energy to manage it and decrease the inventory level. We should also utilize

the sales information to make analysis and use Periodic Order Method to manage A products.

(2) Use Periodic Order Method and Quantitative Order Method to manage B products.

(3) Use Quantitative Order Method to manage C products. C products are large in inventory with low value; we usually just check it once or twice per year. So we can use Quantitative Order Method to manage it to save a lot of money as purchasing it in bulk.

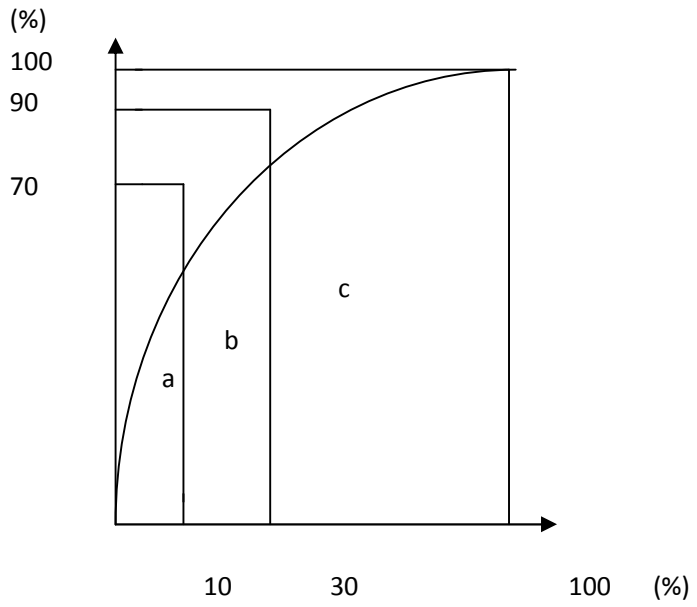

Figure 9 - ABC Analytical Method

Source:http://baike.baidu.com/link?url=sGhWgLCabzk37xs_8NB0A0YHGA-LEFKWZ_7tAvvMLRc6OYV5n0DgL4owyhGjT13UG0rEOAmR--2G27FdpsML1BiIZj4zzGsokApTuinf1mnfKiRdfhIDoqKG4XuIrxVIgnDgaC12x7asRxg8zBKs9wfMV2nOwR9xT9fW7cPqG4PluXWZlw6dMXhOLnuFUrTI

6.2 JIT Management Mode

JIT (Justin Time), it is an advanced management mode which was implemented and researched by Japan in sixties of 20th century. It means that we only produce

essential amount and perfect quality products in required time and place. After the second war, Ford had developed very well in market, they depended 'Mass production is single variety to decrease cost' strategy to kick off the curtain of modern large-scale production. But, in the latter half of the 20th century, oil crisis and the lack of natural resources influence a lot to Japan. Toyota use JIT strategy get through the crisis and benefits a lot from it. Subsequently, many Japanese companies all adapt JIT which aroused attention of West business circles. Since 80s, West developed countries laid more emphasis on JIT and apply it in the management of logistics and production.

In our country, Changchun FAW is the first one to apply JIT mode. We SINOTRUCK is also a vehicle company, I think JIT management strategy is also suitable for SINOTRUCK.

The basic principle for JIT is that you just produce required products in required time followed by required amount which means through the improvement on quality to decrease the waiting time and production cycle. Generally speaking, each working procedure is followed by next step.

In traditional manufacturing system, the production instructions are issued at the same time to each working procedure which means the parts will sent at fixed time and quantity according to the plan although the abnormal production occurs. This kind of production method is called 'push production system'. However, it is easy to make backlog of latter process and increase WIP[4] because of the neglect to parts run out or not. At the same time, most of the companies do not have means to handle unpredictable changes which lead to a lot of stock; as a result, many labor and space were wasted a lot. In 'push production system', our center department is responsible

[4] Working in process

for making projects and informing each production process at the same time. When the changes occur, we should inform each process at first which need a cycle.

On the contrast, the basic thought of JIT is totally different from the traditional one, the logistics and information shows opposite direction moving. We SINOTRUCK should organize our production according to market demand. JIT is the 'demand pull' management, Order → Finished goods → Assembly → Raw materials. In JIT strategy, we only produce what should be used in latter process which can avoid unnecessary production and stock.

Table 15 - Comparisons between JIT and Traditional Inventory Management

Item	Traditional inventory management mode	JIT inventory management mode
Quality	Some inferior products are allowed	Pursue zero defect or the process will be stopped
Inventory	Too much inventory and production continuity can be ensured	Low inventory level
Flexibility	Long delivery period	Short delivery period
Supplier	Many suppliers	Look them as the long-term cooperator
Purchasing batch	Mass batch and low frequency	High frequency and only produce required quantities
Impetus	Cost	Customer
Production preparation time	Low requirements	Make this time as short as possible
Waiting time	Necessary	No

Source: Own presentation

6.2.1 Goals of JIT

The final purpose for JIT is to achieve the maximum profit. We can accomplish it by eliminating waste. The main waste in it is the overproduction such as preparation time for machine, reprocess and stock. At the same time, in general, waste is usually caused by bad management which can be concluded as follows:

1. Overproduction and unreliable process design.

2. Waiting time

3. Unnecessary transportation

4. Unnecessary stock

5. Quality defects of production

6. Unnecessary action

7. Unnecessary process

6.2.2 Major Measures to Reduce Inventory

In order to increase competitive power, we SIONTRUCK should look for ways to reduce inventory.

1. Improving predication method

2. Elastic production

3. Rational distribution

4. Establish partnership with supplies

6.3 Selection of Inbound Logistics Mode

6.3.1 Comparison and Analysis of Three Inbound Logistics Operation Modes

As for the commercial vehicle manufacturing enterprise, if we only need logistics company to be in charge of the transportation and the reaction efficiency is relatively slow, we can consider that apply carriers to in charge our JIT logistics. Moreover, if we need a variety of automobile parts with small batches which makes the quality and date of delivery are hard to be guaranteed because of the difficult external logistics. Also, the supplier will be changeable and its quantity will be large which make it hard to set up long-term collaborative relationship. Under this circumstance, the management of supplier is difficult. Therefore, we can apply carrier to control our JIT logistics mode.

If logistics is not the core service to commercial vehicle manufacturing enterprise, but it still has high requirements which include transportation, inventory and sorting. We can use 3PL[5] to be in charge of our JIT logistics. 3PL has strong infrastructure and equipment. Also, they have advanced logistics information platform and abundant management experience. 3PL can provide integrated services to the supply chain. Thus, we can apply 3PL to complete logistics business in order to decrease the cost and increase the efficiency.

If logistics is the key factor for commercial vehicle manufacturing enterprise and the logistics cost occupy a lot which means logistics is very important to its success. Now, we can apply self-support JIT logistics mode.

[5] Third-part logistics

As for SINOTRUCK, it has variety of automobile parts. If we apply carrier to be in charge our JIT logistics mode which is hard to management. On another hand, if we choose self-support logistics to implement JIT inbound logistics, the cost will have an obvious increase. We SINOTRUCK should use fund to set up their own logistics company, it is necessary for SINOTRUCK which logistics it not their core service. On the contrary, 3PL has better equipment and they can provide integrated services to supply chain. In addition, we can get low logistics cost and high efficiency if we choose 3PL.

Table 16 - Comparisons of Three Operation Modes

Mode	Logistics phase	Cost	Efficiency	Variety and batch
Carrier	Only transportation	Low	Slow	Large variety, small batches
3PL	Integrated services	Low	Quick	Large variety, small batches
Self-support	Integrated services	High	Very quick	Small variety, large batches

Source: Research on Inventory Management Model Based on JIT

6.3.2 Analytic Hierarchy Process

First step: Establish hierarchy model

From the top layer (purpose) to the middle layer (criterion) and the bottom layer (program).

Second step: Comparison and mark

In the heart of the decision maker, the proportion of criterion is different to the purpose. We use 1 to 9 to justify defining matrix $A = (a_{ij})n \cdot n$ (6.1)

Table 17 - Definition to Scope

Scale	Meaning
1	Compared to two factors, the importance
3	Compared to two factors, the former is quite important
5	Compared to two factors, the former is clearly important
7	Compared to two factors, the former is strongly important
9	Compared to two factors, the former is very important
2, 4, 6, 8	Intermediate value between above

Source: https://wenku.baidu.com/view/21266dbaf121dd36a32d820d.html

Third step: Composite calculation

Normalize each column of the matrix A, we can get the matrix B and make the summation of each row

$$w_i = \sum_{j=1}^{n} b_{ij,i=1,2\cdots 1} \tag{6.2}$$

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n} \frac{[Aw]_i}{w_i} \tag{6.3}$$

Fourth step: Consistence test

(1)

$$c = \frac{\lambda_{max}-n}{n-1} \tag{6.4}$$

Where:

$\lambda_{max}$is the Maximum Eigen value.

(2) Find consistence index R

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RI	0	0	0.52	0.89	1.12	1.24	1.36	1.41	1.46	1.49	1.52	1.54	1.56	1.58

Figure 10 - ABC Analytical Method

Source: https://wenku.baidu.com/view/0fa59423336c1eb91b375d32.html

(3) Consistence ratio calculation$C_R = \frac{C}{R}$

It can be passed inspection when $C_R = \frac{C}{R} < 0.10$, or it should be corrected.

Fifth step:

$$w_i = \sum_{i=1}^{m} a_j b_{ij,i=1,2\cdots n} \tag{6.5}$$

6.3.3 Selection of Operation Mode of Inbound Logistics Based on AHP

(1) Establish hierarchical structure

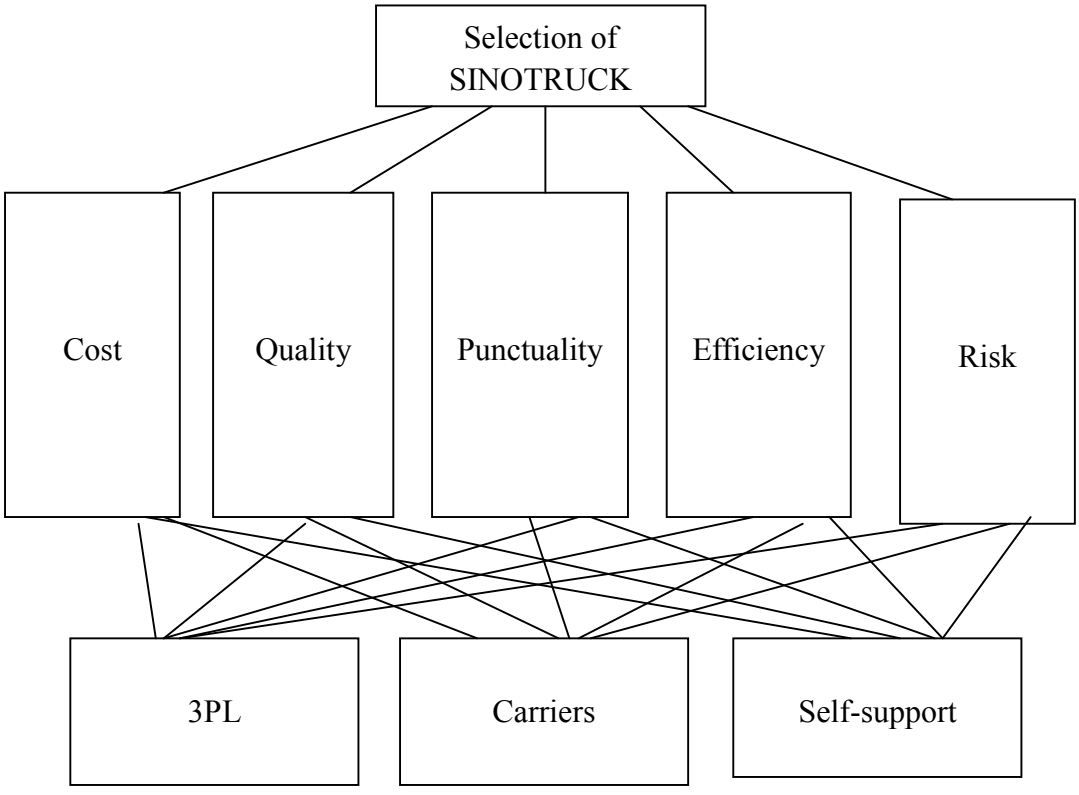

Figure 11 - Hierarchy Structure

Source: Own presentation

(2) Matrix construction

Table 18 - The Matrix including Target A and Criterion B

Performance (A)	Cost(B1)	Quality (B2)	Punctuality(B3)	Efficiency (B4)	Risk (B5)	Weight coefficient
Cost(B1)	1	0.42	4	0.5	3	0.1848
Quality(B2)	2	1	4.3	4	5	0.4443
Punctuality (B3)	0.25	0.2383	1	1/3	1/4	0.0561
Efficiency (B4)	2	0.25	3	1	3	0.2143
Risk(B5)	1/3	0.2	4	1/3	1	0.1006

Source: Own presentation

$\lambda_{\max} = 5.4356,\ \mathrm{C}=0.1089,\ \mathrm{C_R} = 0.0972 < 0.1$

Table 19 - Logistics Cost Matrix

Cost(B1)	3PL(P1)	Carriers(P2)	Self-support(P3)	Weight coefficient
3PL(P1)	1	2.35	0.25	0.2215
Carriers(P2)	0.3375	1	0.2817	0.1253
Self-support (P3)	4	3.7	1	0.6532

Source: Own presentation

$\lambda_{max} = 3.066,\ C_R = 0.0635 < 0.1$

Table 20 - Logistics Quality Matrix

Quality (B2)	3PL (P1)	Carriers (P2)	Self-support (P3)	Weight coefficient
3PL (P1)	1	5.5	4	0.6817
Carriers(P2)	0.1833	1	0.3583	0.0979
Self-support (P3)	0.25	2.95	1	0.2204

Source: Own presentation

$\lambda_{max} = 3.0832,\ C_R = 0.08 < 0.1$

Table 21 - Just In Time Matrix

Punctuality (B3)	3PL (P1)	Carriers (P2)	Self-support (P3)	Weight coefficient
3PL (P1)	1	3.7	6	0.6705
Carriers (P2)	0.2817	1	4	0.247
Self-support (P3)	1/6	0.25	1	0.0825

Source: Own presentation

$\lambda_{max} = 3.1017,\ C_R = 0.0978 < 0.1$

Table 22 - Logistics Efficiency Matrix

Efficiency (B4)	3PL(P1)	Carriers(P2)	Self-support(P3)	Weight coefficient
3PL(P1)	1	5.3	3	0.6318
Carriers(P2)	0.1984	1	0.2692	0.0941
Self-support (P3)	1/3	3.85	1	0.2741

Source: Own presentation

$\lambda_{max} = 3.0910,\ C_R = 0.0875 < 0.1$

Table 23 - Logistics Risk Matrix

Risk(B5)	3PL(P1)	Carriers(P2)	Self-support(P3)	Weight coefficient
3PL(P1)	1	1/3	4.85	0.2851
Carriers(P2)	3	1	6	0.6350
Self-support (P3)	0.21	0.1705	1	0.0799

Source: Own presentation

$\lambda_{max} = 3.1026,\ C_R = 0.0987 < 0.1$

The weight of P1:

0.1848*0.2215+0.4443*0.6817+0.0561*0.6705+0.2143*0.6318+0.1006*0.2851

=0.5455

The weight of P2:

0.1848*0.1253+0.4443*0.0979+0.0561*0.2470+0.2143*0.0941+0.1006*0.6350

=0.1646

The weight of P3:

0.1848*0.6532+0.4443*0.2204+0.0561*0.0825+0.2143*0.2741+0.1006*0.0799

=0.2900

Compare with the weight result above, we can conclude P1>P3>P2, so 3PL is more suitable for SINOTRUCK's JIT inbound logistics.

6.4 Summary

After the analysis, I think we SINOTRUCK should combine three traditional patterns to manage our inventory and adapt JIT strategy for our production mode. Through the AHP methods, we can know that 3PL is a good choice to our inbound logistics as they can provide integrated services to supply chain.

Chapter 7 Conclusions

7.1 Main Findings

The main purpose for this article is to make comparison and analysis for CKD export mode and traditional export mode of SINOTRUCK. According to the Chapter 4, we can conclude that CKD export mode is more positive from the case study of Nigeria. But, when it in South Africa, we can find that CBU export mode is more suitable because of the low cost. There is one big factor among it. That is the tariff. If we cut out the tariff, we can see the freight rate of traditional is quite cheaper than CKD mode. As a result, we should consider it a lot in future investments and conduct our investment according to policy orientation. There is also an initial investment to CKD, which is overseas assembly plant. For the long-term, it is just a small part for the whole project. According to my predication, Africa commercial vehicle market is full of potential, but we still should do some analysis before our investment as the local policy. Also, packaging is a big problem in CKD export mode, so I put forward some advices to solve it. A good packaging can increase the container utilization effectively. Finally, as many automobile choose JIT strategy, I think we SINOTRUCK should also use this strategy. Through the AHP method, we can find that it is better for us if we choose 3PL to operate vehicle parts logistics as they can provide integrated logistics services.

7.2 Limitations of Research

In this dissertation, I predicated the commercial vehicle demand in Africa in next ten years and I did the economic analysis to the SINOTRUCK on the basement of these data. As the reason of trade secrets, we can't achieve the specific sales data about SINOTRUCK. Our predications are not always accurate. On another hand, although I asked some logistics company to get the related freight, it still has some deviation to the real data, not to mention data related to commercial vehicles. But to a certain extent, the general direction is correct. Secondly, as we all know, the biggest problem in CKD export mode is the packaging, if we can handle this problem, our cost will be down. I provide some suggestions to it. But, many parts' specification were unknown, I can't do some targeted suggestions for it. Thirdly, we know we can get low inventory level and low cost in JIT production system. But, low inventory level means we cannot provide after-sales service in time. We should do further research to get the balance between both.

Bibliography

Alizadeh, A. H., &Nomikos, N. K. (2007). Investment timing and trading strategies in the sale and purchase market for ships. *Transportation Research Part B: Methodological, 41*(1), 126-143.

Batchelor, R., Alizadeh, A., &Visvikis, I. (2007). Forecasting spot and forward prices in the international freight market. *International Journal of Forecasting, 23*(1), 101-114.

Berg-Andreassen, J. A. (1997). The relationship between period and spot rates in international maritime markets. *Maritime Policy & Management, 24*(4), 335-350.

Dickey, D., & Fuller, W. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometric, 49*, 1057-1072.

Dong, Y. (2000). *Just-in-time purchasing and supply: A supply chain analysis*.Maryland: University of Maryland.

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing.*Econometrica, 55*(2), 251-276.

Eriksen, K. S. (1997). *Environmental impacts of intermodal freight transport*. New York: Free Press.

Feng, L., & Li, Y. F. (2010). The China factor in recent global commodity price and shipping freight volatilities. *China Economic Journal, 33*(1), 351-377.

Frankel, R. (2006). The role and relevance of refocused inventory: Supply chain management solutions. *Business Horizons, 49*(4), 275-286.

Harrison, A. (2001). Perestroika in automotive inbound. *Manufacturing Engineer, 80*(6), 247-251.

He, G. Y. (2009). *The applicability research of the portfolio investment in shipping market*. Shanghai: Shanghai Jiaotong University.

Hu, M. F. (2004). Application Research on AHP and MATLAB

Iijima, M., & Sugawara, S. (2005). Logistics innovation for Toyota's world car strategy. *International Journal of Integrated Supply Management, 1*(4), 478-489.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control, 12*(2-3), 231-254.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models.*Econometrica: Journal of the Econometric Society, 59*, 1551-1580.

Johansen, S. (1992). A representation of vector autoregressive processes integrated of order 2. *Econometric theory, 8*(2), 188-202.

Johansen, S. (1992). Cointegration in partial systems and the efficiency of single-equation analysis. *Journal of Econometrics, 52*(3), 389-402.

Kavussanos, M. G., &Nomikos, N. K. (2003). Price discovery, causality and forecasting in the freight futures market. *Review of Derivatives Research, 6*(3), 203-230.

Kavussanos, M. G., &Visvikis, I. D. (2004). Market interactions in returns and volatilities between spot and forward shipping freight markets. *Journal of Banking & Finance, 28*(8), 2015-2049.

Koopmans, T. (1939). *Tanker freight rates and tankship building*. Netherlands: Haarlem.

Kwiatkowski, D. P., Phillips, C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationary against the alternative of a unit root: How sure are we that economic time series have a unit root. *Journal of Econometrics, 54*, 159-178.

Li, R. H., & Song, B. L. (2013). *Influence factors and countermeasures of shipping market price changes*. Beijing: Capital Economic & Trade University.

Liu, J. L., & Shi, X. (2005). The price model and co-integration research of Baltic freight forwarding index market research. *Journal of Dalian Maritime University, 31*(2), 23-27.

Lv, J., & Chen, Q. H. (2003). Regularity in fluctuation of shipping price index. *Dalian Maritime University Journal, 11*(2), 55-56.

Phillips, P. C. B., &Perron, P. (1988). Testing for a unit root in time series regressions. *Biometrica, 75*, 335-346.

Song. (2016). Integrated supply chain management, pp. 165-172.

Stopford, M. (2009). *Martime economics*. London: Routledge.

The Google Maps. (2017). *Federal Republic of Nigeria*. Retrieved July 12, 2017, fromhttp://www.google.cn/maps/@?dg=dbrw&newdg=1

Veenstra, A. W., &Franses, P. H. (1997). A co-integration approach to forecasting freight rates in the dry bulk shipping sector. *Transportation Research Part A: Policy and Practice, 31*(6), 447-458.

Wang, J. H., Lv, J., Tan, W., & Chang, Z. (2009). The analysis of the price fluctuations in Panamax shipping market based on VAR modeling. *Journal of Shanghai Maritime University,* 30(2), 78-83.

Xue, Z. G. (2005). *The international dry bulk fleet capacity development trend of research in the future*. Dalian: Dalian Maritime University.

Zhang, T. (2009). Analysis of supply chain model for automobile parts. *Journal of Dalian Maritime University, 4*(1), 39-42.

Zhao, X. Y. (2013). *The relationship research between world trade and world shipping based on co-integration theory*. Dalian: Dalian Maritime University.