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## The trends and problems in China's north to south grain logistics integration. A case study of COFCO & CM grain exchange Co.

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**WORLD MARITIME UNIVERSITY**



**MSc. in International Transport and Logistics**

**Class of ITL2016**

ITL06PRJ-INTEGRATIVE PAPER

ID Number S1613

TOPIC: The Trends and Problems in China's North to South Grain logistics integration.  
A Case Study of COFCO & CM Grain Exchange Co.

## **Declaration**

I, LIU MING declare that this research is my personal work under the supervision of the professor ZHENG SHIYUAN, has not been submitted in any form for another degree or diploma at any university or other institute. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given in the biography.

Signature:

Date:

## Abstracts

**Title of research paper:**

The Trends and Problems in China's North to South Grain logistics integration. A Case Study of COFCO & CM Grain Exchange Co.

**Degree:** M.Sc.

**Abstracts:** This research paper is an assessment about the trends and problems in China's north to south grain transportation in accordance with the integration of grain logistics in the macro view from the national perspective and the micro view from an enterprises perspective. The research comes into the details to discuss and study the past, current and future situation of our country's grain logistics, grain trade as well as grain storage and logistics infrastructure from a macro view. Challenges and prospects of the optimized grain logistics mode when integrate all related fields from the grain reserve companies, third party inspection companies, third party logistics providers, terminals, ports, shipping companies, truck companies, financing institution and so on from a micro view by using the AHP model to get the best logistics service provider. Additionally a case study and the building of AHP model about COFCO & CM Grain Exchange Co., Ltd in this paper shows the dynamic integration of a 4<sup>th</sup> party logistics company in the grain logistic supply chain, trading information flow as well as supply chain finance. At last we get the conclusion about the trends and problems in China's North to South Grain logistics integration, this conclusion can give the grain logistics market players a better understanding and method to figure out or build the grain logistics system in such situation.

**Key words:** Grain logistics, Northern to Southern grain circulation, 4<sup>th</sup> party logistics, multimode transport, and Internet plus.

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## **List of terminology**

**North to south grain circulation:** the circulation of grain in China from the main production area in North region to main consumption areas in South region.

**L18 type vehicle:** special type bulk grain transport vehicle.

**Northeast provinces:** refers to Liaoning, Heilongjiang, and Jilin three provinces.

**SHANHAI Pass:** Located in Heibei Province, it's an important link node between northeast regions to North China.

## 1.Introduction

### 1.1 Background:

#### 1.1.1 Background: the grain logistics in China.

Grain logistics refers to the physical movement of grain in the whole process of production, purchase, storage, transportation, processing and trading services, as well as all the value-added activities through the whole circulation. It includes food processing, packaging, transportation, reserve, loading and unloading, distribution, and information applications; it's a complete link chain. Grain logistics occupies a large proportion in the whole social logistics, and the volume of grain transportation and freight turnover volume is among the best in the China logistics market.

Since the founding of China's grain logistics, China's grain logistics mainly has experienced three historical periods, namely the planned economy period (1956-1989), the economic market transformation period (1989-1997) and the market economy period (1997-now).

After the founding of the PRC, we see a continuous progress in the establishment of food distribution infrastructure, especially the of storage facilities. After 1980, the level of infrastructure construction of grain circulation increased gradually. Especially after 1990, the central government use World Bank loan and the national bond funds, heavily investment in the construction of a great number of advanced equipment and high technology grain circulation infrastructure. During this period China significantly reducing gap in the world grain circulation facilities, technical level and management level between with the developed countries. The sustainable development of the grain circulation infrastructure has made progress in the construction of grain circulation system, especially the development of storage facilities. Through multi-channel financing, the government speed up the transformation and specification of the old national reserves grain storage facilities. In the last two decades, several provinces have built up many new grain silos, equipped with advanced equipment, with an improvement of the technical level and the management method.

After years of development, China's market economic system has been built. Especially after joining WTO in 2001, our country's "full market" has been recognized by most countries in the world. We have seen the grain circulation system to further promote the market, the market function of grain enterprises to further play an important role, the state's direct regulation and control functions are also turned through the policies and regulations, administrative law enforcement, national reserves and other ways to regulate and control the grain circulation system. In order to speed up the circulation and reduce the cost, the government and the food enterprises have begun to actively explore and study the new modern grain logistics mode to meet the market demand in Agricultural product logistics project. Strengthen the construction of grain storage facilities and maintenance efforts to meet the needs of grain storage. The introductions of advanced grain storage equipment and technology, and effectively improve the conditions of grain storage. Actively in promoting the modern grain logistics facilities, developing bulk grain storage, transport, loading and unloading and multimodal transport, the railway open bulk grain trains and bulk grain container class columns. Strengthen producing grain storage and distribution facilities, as well as bulk grain loading and unloading facilities construction in southern railways and ports, in order to solve the "grain north to south transportation" bottle neck "problem. (The state council of the people's republic of china, 2014)

### **1.1.2 Background: the North to South grain transportation in China.**

Grain production in the northeast china has a significant growth in the past 30 years. Heilongjiang, Jilin, Liaoning, Inner Mongolia, Shandong and other 13 major grain-producing provinces takes up the country's total grain output accounts for the proportion of 75% or more. Northeast China became a veritable "big barn", a steady stream of grain shipped across the country from north to south. However, grain production in the southern coastal provinces and cities gradually reduced while we also see an increasing demand for grain. Normally these grain flows consist of the purchase of commodity grain, government grain inventory updating by turns (GIUBT) and international grain trading. Then emerging a new grain transportation pattern: North to south Grain Transportation mode.

However, subject to geographical conditions, lack of modern logistics management and transportation infrastructure, this grain transportation mode is partly restrained and results in a high cost and low efficiency in grain transportation.

As fourth party logistics (4PL) has the power to integrate the supply chain, from the beginning of the 21st century, it has attracted more and more attention in many fields. 4PL organization acts as a single interface between the client and multiple logistics service providers. In recent days 4PL often have a closely relationship with e-commerce platform and taking the advantage of the Internet information and big data. By using Internet as a tool, the 4PL can have the abilities to be a supply chain integrator that assembles and manages the resources, capabilities, and technology of its own organization with those of complementary service providers to deliver a comprehensive supply chain solution. In this research the COFCO & CM Grain Exchange Co., Ltd. is a 4PL company focus in the grain logistics. Its vision is: By constructing integrate logistics, enhance all aspects integration in logistics & storage resources and improve strategic cooperation, in order to build a fast speed, low cost and safety grain transport channel subject to the main producing areas in Northeastern China and main purchasing areas in Southern China as well as international markets. This has a great strategic significance for the northern grain production region as well as the country's grain market.

## **1.2 Objectives of the study**

The first objective of this paper is to investigate and analyze the past, current and future of the grain transport system as well as grain market.

The second objective is to evaluate the shortcomings and weakness of the current grain circulation system.

The third objective is to set up solutions and methods to optimize the grain logistics system both from the national perspective as well as an enterprises perspective.

### **1.3 Methodology**

The purpose of this paper is to analyze the trends and problems in China's North to South Grain logistics integration through qualitative and quantitative analyze methods. AHP model: by using this model to analyze the logistics service providers for the COFCO & CM Grain Exchange Co., Ltd. And give suggestions or solving methods from view of the company. Case study: the case study of COFCO & CM Grain Exchange Co., Ltd. from its background, development, current conditions, the patterns it act as a logistics integrator in grain circulation and so on. Comparison: seaway and railway grain transport are studied to determine the different trends in grain logistics.

### **1.4 Main content**

The first chapter mainly talks about the backgrounds of the history and the situation of the north to south grain transportation. The second chapter talks about the related research to the grain logistics field. The third chapter is to analysis the necessity of building this north to south grain circulation mode. The fourth chapter is the solutions to optimize this transportation mode and the best selection for a company's 3rd party logistics provider.

## 2.Literature review

*“The level of the supply chain integration of enterprises within the grain industrial chain is very low. Though influenced by other enterprises in and out of China, to meet the requirement of social economic development and the requirement of consumers in terms of product quality, some famous domestic grain enterprises have begun to apply supply chain integration to their practice. But there are some difficulties emerging. The authors believe that causes for these difficulties include the lack of acknowledges of grain supply chain, the lagged behind logistic infrastructure and IT, and the grain enterprises’ lack of understanding of supply chain management.” (HONG Lan, 2009)* However the article only lists the situation difficulties of the grain supply chain integration but didn't give the solutions of the problems.

*“The characteristics of food circulation and the features of food as a commodity require a matching industry structure to ensure a smooth connection between links in the food circulation and guarantee food security. The structure optimization of food industry is highly related to the development of food production and the guarantee of food consumption. This text elaborates on the relationship between the structure of the food industry and food security, analyzes the status quo of China’s food industry structure, identifies the impacts of the current unreasonable food industry structure on the food commodity circulation and safe food production, and proposes concrete recommendations on how to further optimize food industry structure and safeguard China’s food security in the new era.” (Lijun HOU, 2013).* This article explain and show the structure of the grain market structure, grain circulation structure however the perspective of this article mostly from the security, rather than logistics structure.

Solving the problem in "North to south grain circulation" has become one of the important methods in guarantee China’s food safety. "North to South grain transport’s prominent problems is analyzed in this paper, in consideration of the basis of the new changes of grain logistics in northeast area. Analyze from the aspects of infrastructure construction, integration of resources, transportation mode, and best route then address the corresponding solutions. In

this paper “The problems and solutions in north to south circulation (MoliZheng, 2010) ”We get a general view of the problems existed in the north to south grain circulation from a macro view but did not from a company’s micro view to discuss and solve the problem.

*”With China’s rising grain consumption, the supply and need of grain turns out to be tight balance, the effect of grain logistics becomes increasingly important. The paper based on the trend of "grain shipped from north to south" to analyzing the necessity of grain logistics development. Describing present situation and main problems during its development process, put forward some suggestions on enhancing China’s grain logistics.” (Chen Laibo, Cao Baoming, GaoLan, 2016 )* From the article we can get the knowledge of the grain logistics system construction methods and the difficulties and problems lies in the current grain circulation.

### **3.Necessity analysis of building grain integration logistics in China North to South Grain Transportation.**

#### **3.1.The history, current situation and the future development in North to South grain transportation in China.**

##### **3.1.1.Grain transportation situation in the planned economy period (the founding of PRC-1984)**

In the early days of the newly founding PRC, China's grain production cannot meet the demand. In order to solve the grain shortage problem, the Party Central Committee and State Council implement the policy of purchase and the centralized management wholly controls sale, production, purchase, transportation, storage and sales of grain. In order to save costs, the nation actively carry out the rational transport plan of grain, that's the early founding stage of modern grain logistics in China. Under the planned economic system, The rational transportation of grain is a special form of commodity circulation, according to the supply, demand and traffic conditions, through scientific division of economic region, choose the right direction of transfer, the most optimal transportation routes, the cheapest means of transport to transfer the commodity grain from the inventory area to the demanding area. The purpose is to ensure the timely completion of tasks at the same time, reaching the purpose of social labor saving, transfer capacity saving, grain loss saving and cost saving. The reasonable transportation of grain has experienced four stages:

1.The first stage: in the beginning of the 1950s. In order to avoid regional grain transportation occurred with a variety of convection, circuitous and un-rational transportation we see the implementation of the rational grain railway transportation, according to wide supply and demand sites over the whole country as well as the administrative divisions, implementation of grouping management. At first, in the trunk railway carried out collective assembly, operations, and other effective measures, accelerate the speed of grain transport, reducing transport costs.

2.The second stage: implementing the rational grain transportation by following the supply and demand balance and district partition over the country.It means on the basis of supply and demand balance over production and consuming areasover the country, set up provisions to manage the transit flow and transport range in each variety of grain, in order to limit and clear off the far distance, convection, circuitous and other unreasonable transport. From the beginning of March 1956 the wholecountry start trials on the main transportation routes with ten varieties of grain, laid the foundation for rational transportation of grain logistics development.

3.The third stage: carrying out the rational grain transportation in the grass-roots level. The two parts includes the purchase and storage of grain in rural towns and arrange rational transportation of grain. For the rural area, the government procurement all the grain from the farmers, store the grain in the local grain barns, leaving the local demand and transfer the rest out of the area. Follow the principle of rational grain storage and scheduled grain outflow transfer; while for the town is according to the plan achieves the grain allocation between stations, docks, factories and warehouses and fixed point and fixed line transportation.

4.The fourth stage: according to the economic regional organization set up grain commodity circulation. Commodity grain often takes a city, a region's consumption area or takes a transportation hub point as the center, and forms an economic zone, which is not restricted by the administrative division. Grain enterprises should setting management mechanism in accordance with this regional natural formation of economy. According to the rational grain flow direction; take the most economical method of commissariat purchase and sale, allocation, transportation and other business activities. This has played a positive role in promoting the healthy and stable development of the national economy.

### **3.1.2. Grain transportation situation during the period from planned economy transfer to the market economy (1985 to 1997).**

After the Third Plenary Session of the Eleventh Central Committee, our country implemented the policy of reform and opening to the outside world, The government decide to established grain market economy in accordance with the requirements of Chinese socialism characteristics, gradually introducing market mechanism, expanding the scope of market regulation, and implemented "double track system" (planned regulation and market adjustment), "dual business" (policy business and commercial business), as well as grain commercialization, market-oriented operation, market liberalization, price liberalization, business liberalization in the grain trading system. In order to achieve more profit, more and more un-rational grain trend to flow from the high price region to low price region, adding more uncontrollable factors and more difficulties in scientific grain logistics organized. Resulting in a waste of resources and cost. Grain logistics in this period has three characters: First is the coexistence of the regulating function of the state grain logistics and commercial grain logistics at the same time, state grain administration gradually get weaken in control of grain logistics, many problems cannot be settled even though they want to settle, management is in chaos, the state and grain logistics enterprises need a process of rethinking. Second is the commercial enterprise functioning as the main body of grain logistics began to appear, but the scale is small, the social benefit is not prominent. Third is the focus on the grain movement simply, did not consider the unity of the grain production, purchasing, trading and processing. In general, this period of grain logistics is disorderly, the original planned grain logistics model is breaking up; the new grain logistics model is in the beginning stage of exploration.

### **3.1.3. Grain transportation situation during the period of market economy. (1998-2001)**

In this period, we see a reform in the grain system. The market function of grain enterprises has been further developed, and the specific regulation and control function of the state has been further weakened. States have problems in the following points: not likely to fully plan and arrange grain logistics like the planned economy period, cannot arrange grain logistics like grain "double track system" transition period so as to adjust un-rational grain flow, and function as a single enterprise mainly engaged in grain logistics has great limitations. In order to speed up the grain circulation, reduce transportation costs, the state and enterprises are exploring a new mode of grain logistics, and take a series of measures:

1. First is national support on procurement varieties of grain at protective prices, promote the readjustment of the grain planting structure, in order to provide a guarantee of qualified grain for grain logistics;
2. Second is to increase investment. Built new grain barns equipped with advanced technology equipment and management methods. At the same time, perform necessary transformation of the old barns so as to coordinated with logistics operations and improve the level of mechanization and automation in grain storage and transportation.
3. Third is through the northeast region, the Yangtze River, southwest region, Beijing & Tianjin four major corridors construct the transport integration in highway, railway and waterway, directly improve the efficiency of grain logistics;
4. Fourth is through the restructuring of the grain industry resources, rebuild the grain companies. Eliminate the backward production capacity; at the same time optimize the efficiency use of logistics and storage resources;
5. Fifth is to continue promoting deep processing, add value on food processing and achieve the rational use of resources. Gradually accept some foreign advanced logistics concepts and practice, broke the single physical movement model, transferred to the production, purchase, marketing, processing, electronic commerce integration grain logistics mode and began to explore third-party logistics mode.

### **3.1.4. Grain transportation situation after entering into WTO. (2001-Now)**

In 2001, after China's accession to WTO, the government began to implement the reform in the grain market, apart from the national central reserve grain and local governments reserve grain, the grain market gradually liberalized, and eventually goes into the market. Take the market as the lead, build the advanced grain logistics system was put on the schedule. During these years the seaway grain transport was gradually increased for the wide use of the multimode transport in the three northern provinces, the grain harvest from the inner three northern provinces transfer to the several ports in Liaoning Provinces through highway or railway then through seaway transport to transfer the grain to the other places. Compared to the highway and railway transport the seaway transport is the cheapest means of transport.

Entry into the WTO has formed impacts and challenges on China's grain logistics situation and the operation methods, we must emphasis on the operation of grain logistics in the new period also give new content on its meaning, take active measures to solve the contradictions and problems existing in the current grain logistics links, and promote the healthy development of China's grain logistics.

Overall, joining the WTO has benefits to the optimization and adjustment of the of China's grain industry structure, to promote the overall level of grain logistics and the rational allocation of grain resources.

1. China's entry into WTO has an impact on the traditional concept of grain logistics in China.
2. In the world, in the "scattered, weak, small" state of China's grain logistics pattern put forward to promote change requirements. The deepening reform in grain circulation system and the market operation of grain commodities has changed the traditional pattern of grain logistics.
3. China's entry into the WTO makes our country's existing grain logistics infrastructure and logistics technology conditions under great pressure.
4. In a certain extent, the difficulty of government's macro control of grain logistics has increased. Necessary macro control is the guarantee of rational organization of grain logistics.

**Table-1 National Seaway/Railway Freight Traffic of Grain Comparison****(Unit: 10000 tons)**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Volume of Out-port Grain Handled in Main Coastal Ports	3583	3117	3464	3299	3606	4036	4258	4710	5387	5323
Volume of Exports, Cereals and Cereals Flour	1014	605	986	181	132	120	116	96	95	71
Volume of Exports, Rice	69	124	134	97	79	62	52	28	48	42
Volume of Exports, Maize	864	310	492	27	13	13	14	26	8	2
Volume of Exports, Soybean	40	38	46	47	35	16	21	32	21	21
National Seaway Freight Traffic of Grain	1596	2040	1806	2947	3347	3825	4056	4528	5215	5187
National Railway Freight Traffic of Grain	11082	10111	10471	11470	9925	9692	9578	9981	10447	8260

**Source: National Bureau of Statistics of China.** From 2005 to 2014 (10 years)

(From the National Bureau of Statistics of China we can directly get the data of the national railway freight traffic of grain but we cannot directly find the data about the national seaway freight traffic of grain. So at first I find the data about the Volume of Out-port Grain Handled in Main Coastal Ports, this out port grain handled in main coastal ports volume consist of the domestic grain seaway transit volume as well as export volume. By conducting the export volume of Cereals and Cereals Flour, rice, maize and soybean, we can roughly get the National Seaway Freight Traffic of Grain. The National Highway Freight Traffic of Grain cannot be found or calculated due to the complicated facts and the lack of information.)

## **3.2. The current situation and the problems of the current logistic system in North to South grain circulation.**

### **3.2.1. The current situation and barriers in grain circulation.**

The "North to South grain circulation channel is a distribution channel between the logistics node from the north grain production area to the south region grain sales purchase area. The channels mainly start from Northeast, North and Northwest China, as well as the areas of Henan Province, Northern Jiangsu, through railway, highway and waterway and ended at South region of China. The backbone of the grain circulation channel with modernization level has the function of integrate surrounding logistics node, absorb the grain flow, resource integration and optimization.

In the North to south Grain circulation numerous channels, three northeast provinces' advantages mainly reflected in the following points:

Firstly is the grain production of 3 northeast provinces, namely Liaoning, Jilin, Heilongjiang, accounted for about 16% of the country's total grain production, the grain commodity rate was around 70%, inter provincial grain transit volume accounted for about 2/3, ranking the first place in the country, far greater than other northern provinces.

Secondly through railway, waterway and highway, grain silos, advanced grain handling equipment and port facilities as well as experienced grain enterprises, Liaoning province become the only large-scale multimode grain transport province in North area.

Thirdly is the achieving of four grain bulk circulation: bulk loading, bulk transportation, bulk storage and bulk unloading, compared with the traditional way of operation we see the advantages in time saving and cost saving. In addition, the natural flow, the market trend, and the actual grain flow, people flow are mainly from North region to the South region in China. At present, the northeast region 'north to South grain circulation' mainly has two channel, one is land transport go through SHANHAI Pass, another is seaway transport start from Liaoning ports cluster then transport to the southern regions, Compared between these two way, the seaway transport's advantage is obvious:

1. The advantage in volume. The Water channel grain transit volume weighting nearly 40% of the

North to South Grain circulation, weighting about 60% northeastern provinces grain circulation. More importantly on the other side of the water channel is China's southeast economically developed region -- the "Pearl River Delta" and "Yangtze River Delta" area, which has a huge demand increased year by year and closely to the main consume and purchase area. Overland channel grain transit volume accounted for about 40% northeastern three province grain circulation, mainly to the South inland region, and the hinterland in the southeast coastal provinces, (but this part of the grain circulation gradually replaced by the water way transport), inferior to the water way channel.

2. The advantage in logistics carriers. Water channel grain circulation has advanced logistics carrier, equipped with type L18 bulk grain transport vehicles, advanced bulk grain receiving, handling, and distribution as well as storage system. The northeast three provinces have already realized the grain bulk form operation and seamless docking in a large scale with high efficiency and low cost, bulk grain transport degree ranking the first in the country. In contrast, the land channel logistics carrier is relatively poor, due to the constraints of many factors; type L18 bulk grain transport vehicles cannot be widely used.

3. The advantages in transport capacity. Waterway channel transport capacity is sufficient, connect with developed railway, highway network can guarantee to the port capacity. At the same time, handling and throughput capacity of ports is strong in Liaoning province; many shipping companies can provide vessels to ensure waterway transport capacity. The land channel transport capacity is rather limited; the most obvious factor is the SHANHAI Pass railway and highway restrictions.

Thus, although the Water way channel transport has one more link in port transport than the land channel transport, but it has the advantages in its big volume, high degree of modernization of circulation, higher speed of handling, lower cost and more efficient.

Liaoning province has geopolitical advantages and prominent elements over other provinces in building China North to South grain circulation channel.

From the geographic we can see, the waterway channel in Liaoning province is the only way, which must be passed in North to south grain circulation.

Liaoning province is a coastal province locate in the south of northeast three province which has 2920 kilometers of coastline, From east to YALU River and West to SHANHAI Pass, there

distribute six major port namely Dandong Port, Dalian Port, YINGKOU Port, PANJIN Port, Jinzhou Port and HULUDAO Port, with 523.5 kilometers port coastline and 278.2 kilometers deep water port coastline. Over the years, Liaoning coastal port relies on the northeast hinterland economy, excellent geographical location and rich coastal resources, we see an accelerated development in the aviation network, railway network, highway network, waterway network coordinate with information network and the formation of water, land and air interchange, complete functions, coordination, and highly modernization infrastructure. Liaoning ports have 335 berths in total, of which more than 139 berths have the capacity over ten thousand, 25 container terminals, the annual throughputs over one billion tons. Liaoning province is a vital link between internal north region grain production area and external grain consuming and trading regions in domestic or overseas. That's the backbone for Liaoning Province to be the frontier of North to south grain circulation.

As we could see, although there are advantages for multimode transportation in water way channel transport, but there are still some problems to be solved. First Controllable grain flow scale is small. The total grain transit volume has a certain scale, but restrict by the factors of too many different grain traders, different modes of transport, different grain flow direction, different enterprises, cannot co-ordinate arrangements, integrated scientific operation in grain transit flow and make an optimal solution in economies of scale. And logistics is so-called "third party profit source", mainly due to its operation in economics of scales. The second is the low utilization of grain logistics facilities; bulk grain handling ability needs to be improved. Despite the northeast provinces ranking first in the country, still only account for 40%. During the idle time Type L18 bulk grain transport vehicle cannot get enough grain to transport but during the busy period, the number of Type L18 bulk grain transport vehicles is not enough; the transport situation is extremely uneven throughout the year. The third is the backward and lack of application in modern information technology, information network has not been yet wild established and covering grain circulation departments and enterprises. The fourth is the unreasonable distribution of resources, under the lack of unified and coordinated operation we see the disorder and competition between ports and lack of economies of scale, then caused a phenomena of duplication, convection, circuitous unreasonable in transport and a waste of logistics resources. The fifth is the function of logistics nodes and the network still needs to

improve.

At present, there are 3 main modes of grain logistics in China: the traditional grain sack circulation, the bulk grain circulation mode and the grain container circulation mode.

Sack form: In China's vast grain producing areas, the newly harvest grain can not transport out timely in the form of bulk grain, the majority of farmers can only choose to load the grain into package form then sell to the grain trader or store at home. Traditional grain sack circulation mode has disadvantages with high package cost, high labor costs, high grain breakage rate, low degree of mechanization, low warehouse utilization rate as well as the pollution of the environment and other defects, but at the present stage of our grain logistics system, traditional grain sack circulation way still takes up a large proportion. The reason mainly lies in the lack of infrastructure construction and logistics equipment in China's grain logistics system.

With the progress of the development of science and technology and logistics, nowadays, in most of the developed countries, the ratio of traditional grain sack circulation in grain transportation is gradually reduced, with an increasingly in bulk grain circulation.

Bulk form: Bulk grain circulation refers to the grain without any packaging, by using special machinery to load and unload, grain silos or warehouse to store.

At present, our country has become the scale of grain circulation in the northeast region, the bulk grain truck, bulk grain handling facilities have outstanding advantages in operation, has been recognized by the food enterprises

But China's bulk grain circulation in the grain purchase link also has the packing, unpacking it into bulk grain in storage and transportation links, is not the true sense of the bulk grain circulation

Compared with the grain sack circulation, Bulk grain circulation has the advantage in saving the packaging cost labor cost and high mechanization, convenient storage, etc.

At the beginning of 1990s, in order to catch up with the world's advanced grain logistics system, china vigorously promotes the bulk grain transportation. There are four circulation means of grain logistics. The realization of grain bulk, bulk uploading, bulk transport, and bulk storage is the important mark of the modernization realization for developed national grain circulation. The more regulated of the “four bulk” system, and the more advanced technology in the grain circulation, the less loss and the lower cost will be, which will bring huge economic effect and

social effect.

However, after many years of exploration, the bulk grain transportation also has problems such as grain handling moves frequently, increased grain damage, dust explosion, and not conducive to the classification of grain.

Container form: The method of food container circulation can be transport between highway and railway and waterway. The proportion of grain container transportation in the transportation of grain circulation is not high, but we can see an upward growing trend in recent years, it plays a major role in the grain export transportation market.

For recent years, China's DALIAN Port, YINGKOU Port, JINZHOU Port began to use grain container transportation, and achieved good results.

With the building of modern containerization, the use of container form grain transportation has rapidly increased in recent years for its advantages in safety, continent, low cost and other reasons.

Container form of grain transportation has huge logistics market potential in the future.

### **3.2.2.Lack logistics integration and a low degree of organization in the grain circulation system.**

At present, China's annual grain flow is around 2 million tons, inter provincial area grain transfer takes about 1.2 million tons and about 57 million tons grain outflow from Northeast District. However, most of these grains still use the sack grain transportation. This kind of problems resulting from China's grain logistics cost is higher than developed countries about 1 times. Moreover, due to the backward transport handling, we see loss of about 8 million tons of grain every year.

Transportation is the link between grain production and grain processing, and is also an important link in the grain supply chain, the cost of transportation accounted for a large proportion in grain logistics. At present, the domestic grain transportation enterprises mainly in sack grain transport, and transport of bulk grain circulation in the proportion accounted for only 15%, even in the main producing area of Northeast China also accounted for only about 40% of total cost. Sack grain transport has a lot of intermediate process in many aspects, there are many process in packing and unpacking, repeated loading and unloading, result in grain loss and high operation cost. Sack

grain handling time is the bulk grain transport in operation more than 5 times, the logistics cost accounts for a high proportion of 30% price of the grain. Compared with developed countries, the bulk grain transport ratio was significantly low in China. The United States sack grain transport volume accounted for less than 15% of the total grain transport system. The Australian bulk grain transport volume is accounted for 99% of the total national grain logistics.

Northeast district has the highest degree of bulk grain logistics transportation system, not only has 4000 specified vehicles to transport bulk grain to the railway, bulk grain warehouses, and perfect port transit equipment for bulk grain. But due to the large grain area is widely distributed storage, loading and unloading areas, transportation still accounts for a large proportion of grain bag, bag of grain and bulk grain logistics coexist, the bulk grain logistics advantage cannot be brought into full play, the bulk grain transportation is not to the total grain transportation. China's grain transport mainly depends on the social forces for packaging and transportation, professional and technical equipment of scattered construction is not perfect, cannot meet the requirements of the scattered operation.

At present, we can see a grain flow of corn, rice and soybeans mainly flows from the Northern to the Eastern China and Southern China. This phenomenon mainly due to the northeast region has become the main production base of Japonica Rice and corn, especially with a strong supply capacity in Northeast China. At the same time, with the development of China south region economic, population flows to the southern part of china, result in an increase food demand in the Southern china. The grain production in Northeast China accounted for 18% of the whole country, and the inter-provincial transportation per year accounted for 60% of the national grain transfer volume. In this situation, the limited railway transport will undoubtedly become a bottleneck restricting the transport of grain from the north to the south china. By using the advantages of the ports in Northeast China and develop seaway, highway and railway multimodal transport is an inevitable choice in the near future. However, there are still some obstacles in the development of China's rail transport at present:

1. North to South Grain Transportation has not yet formed a large logistics professional organization. In current situation lots of shippers with little shipment volume, low degree of organization, cannot meet the requirement of transfer in an entire vessel, due to this kind of lack of economics of scale, transportation costs cannot get effective control.

2. Lack of grain transport infrastructure in the main production areas. Infrastructure lags left behind not only reflected in the limited capacity of the railway transport capacity but also reflected in the lack of port construction and facilities.

3. Due to the geographical restrictions that not all of the grain production areas are near the port. In the Northern main grain production provinces, only Liaoning province has several ports like Dalian Port, Jinzhou Port, Yingkou Port, Dandong port, etc. consist of a port cluster, for Jilin and Heilongjiang Province, they need multimode transportation to transfer the grain to the other provinces or ports by highways or railways. In the multimode transportation

The improvement of infrastructure is a prerequisite for the development of grain logistics, and the construction of grain logistics infrastructure is vital for achieving the balance of supply from producing areas and demand from consuming areas in China grain market, the stable of income for the farmers from main producing areas, the stable of grain market price and have a great significance to achieve the government macroeconomic regulation and control of grain market and ensuring national food security. In order to improve the efficiency of grain logistics system in China, the Chinese government needs to increase the construction of traffic facilities, food storage and handling facilities. That's the foundation for the realization of Chinese grain inner province and across provinces smooth circulation. First of all, through the use of the standard mode of transport and transport vehicles, to achieve effective convergence and cooperation of multi mode transportation, optimization of grain transport network, improve transport efficiency. Secondly, in China main grain logistics nodes need modern storage facilities, through mechanization and automation to improve food transfer ability. Third, the construction and improvement of the grain logistics information system, reduce the cost of the grain circulation by establish the logistics information system, improve the efficiency of grain circulation.

### **3.2.3. Market competition from the multinational food & oil company**

Multinational food & oil companies have already entered the era of occupying the fully integrated value chain. The method and security to achieve fully integrated value chain lies in the establishment of planting, warehousing, transit, processing, trading and others. The famous 4 multinational grain trading company: ADM, Bunge, Cargill, Louis Dreyfus known

as “ABCD”, their supply chain has already spread to the processing and marketing. Even some of these companies has already involved in the grain trading and logistics. As for the backwards of our nation’s grain logistics system, it provides a lot of opportunities for these multinational food & oil companies to build the strong supply chain and occupy our nation’s grain market. The competition has already begun and the Chinese local food & oil companies do not have advantages over the multinational food & oil companies. If the multinational food & oil companies becomes the strategic investors in the reform of our nation’s railway departments corporatization, it will be very tough for state owned food & oil companies to grow up as a modern grain logistics company.

The YIHAI KERRY (China) group is a joint venture company invested by ADM from USA and Singapore's WILMAR International Limited cooperation. It is the typical representative of foreign grain trader’s expansion in China.

YIHAI KERRY group is a diversified enterprise major in grain and oil processing, oil and chemical industry, warehousing, logistics, domestic and international grain trade.

Kerry Group was founded in 2001, headquartered in Shanghai. The group has direct hold 38 companies in the factory and trade company, also has shares in several famous domestic grain and oil processing enterprises factories throughout Shandong, Jiangsu, Fujian, Guangdong, Guangxi, and other east coastal provinces as well as Sichuan, Hubei, Hunan, Xinjiang, Ningxia, Heilongjiang, and other inland areas. Trade companies and offices have covered all provinces except Tibet, Hong Kong, Macao, and Taiwan regions in China. It has over 450 manufacturing plants and an extensive distribution network covering China, India, Indonesia and some 50 other countries. YIHAI KERRY group has investment holdings and the shares in railway, warehouse, purchasing and storage base, ship service, shipping agency, and other field. As a connecting link in the value chain, the Group attaches great importance to the development of the logistics. In 2007, the Group set up wholly owned subsidiary logistics company. As of now, Kerry Group has set up 19 holding companies, 4 shares of the company, and 6 branches in the country, forming a nationwide logistics network. At present, Kerry logistics management of modern logistics warehouse covers an area of 1368 acres, has 3500 units all kinds of controllable transport vehicles, 14 docks, self-owned vessel with a total capacity of 11500MT, railway special line 43KM and more than 1200 railway compartments,

and still invest in logistics resources.

Kerry Group set up modern logistics professional platform, in order to perform good service to YIHAI KERRY group's internal business, but also to adapt and lead the development trend of modern logistics industry and create a third-party intellectual logistics public information platform. Providing accurate, timely, economically and security of modern logistics service for customers.

## **4. Analysis the solutions in building grain integration logistics in China North to South Grain Transportation.**

### **4.1. Build the grain integration logistics based on state owned grain& oil enterprises.**

#### **4.1.1 COFCO acquisition CGOG in March 2006**

On March 14, 2006, SASAC issued an official notice of reorganization and CGOG was merged into COFCO as a subsidiary. China's two largest grain trade firms - COFCO and CGOG – have now merged under the approval of the State Council and State-owned Assets Supervision and Administration Commission (SASAC). SASAC is a ministry-level commission that directly controls China's 112 oversees central government-controlled conglomerates.

Established in 1994, CGOG has been engaged in the domestic trade of cereals and oils, warehousing and transportation, cereals and oils processing and the international trade in cereal and oil products. With grain reserve that can store up to 3 million tons of grain, five oil and feedstuff processing plants and five grain and oil research institutes, it is one of the largest grain traders in China. COFCO, on the other hand, is China's No.1 exporter and importer of grain and is a leading enterprise in the deep processing of oil, wheat flour and malt.

COFCO and CGOG therefore complement each other. To meet overall strategic needs, COFCO will overhaul the import and export, processing and logistic business of CGOG to create a more professional and market-oriented division. Great efforts will be made to coordinate in order to improve competitiveness as a whole and establish China's largest, most efficient and most dynamic bulk grain trade and logistics enterprise. On this basis, COFCO will become a main channel for the integrated operations of China's grain trade and a leader in grain trade and logistics as well as a grain trade giant in the domestic and international markets.

#### **4.1.2. COFCO merging CGLC in March 2013**

On March 28, 2013, COFCO Corporation and China Grains & Logistics Corporation (CGLC) held the merging conference in Beijing. COFCO integrated the grain purchase and storage system and supporting facilities of the latter into its strategic arrangements, improving and enhancing its integrated business model.

The two parties are complementary to each other in resources. They are both state-owned enterprises. COFCO transmitted from trader to producer successfully, playing a significant role in guaranteeing food sufficiency and safety. CGLC boasts the grain purchase and logistics system and supporting facilities. This merging will produce more efficient grain circulating and processing system, consummate the integrated business model and greatly enhance sustainability and influence of COFCO.

China Grains & Logistics Corporation (CGLC) is the largest cross regional state owned grain logistics enterprises. The company is an important carrier for the implementation of the national grain market adjustment, aiming at serve for the national macroeconomic regulation and control, serve for national food security services and provide universal service to society as a whole. Charged with the responsibility of transportation reform and modernization of grain circulation especially in promoting bulkloading, bulk transport, bulk storage and bulk unloading, undertakes the responsibility of maintenance and appreciation of state-owned assets and repay the world bank loan project.

##### **Grain transportation**

- a. The Northeast Corridor -- Take Dalian Beiliang port as the lead, three provinces northeast Region and Inner Mongolia as hinterland,
- b. The Yangtze River Cluster
- c. The Southwest Corridor
- d. The Beijing Tianjin Corridor
- e. The BeiliangCompany - are based on the port in the food industry, has become a leading enterprises in China's modern bulk grain logistics industry. The Beiliang Company has six large grain handling berth, nearly 2 million tons of grain silos group construction, 2400self owned bulk grain vehicles and container loading equipment, Beiliang Port is Asia's largest bulk grain port

Transport capacity: 5 berths include 3 grain loading berth, 1 grain unloading berth and 1 multi-purpose berth, 12 million tons of port throughput capacity include 11.1 million tons of grain throughput capacity; 186 bulk grain vehicles, 3400 railway grain compartment. 4 bulk vessels, bulk grain receiving ability 24935 tons / hour, and bulk grain dispatching ability 27388 tons / hour. 144km dedicated grain rail link.

### **Grain storage**

Supply Advantage: the Northeast grain silos all located in major grain producing areas which has strong grain supply ability, convenient transportation, near to the local grain trading and shipping center.

Storage Advantage: There are 53 grain silos all over the nation with 43 out of them are located in the northeast grain main production area. The total storage capacity is 6.648 million tons, with 4.328 million tons capacity has the qualification for national grain reserve (The total grain storage capacity of COFCO is 3 million tons, the China Grain Reserves Corporation grain reserve capacity is 1.75 million tons.)

Drying Advantage: the Northeast grain silos has 72 sets of drying equipment, with a drying capacity of 4 million 456 thousand tons: 3 million 31 thousand tons of corn drying capacity, 1 million 425 thousand tons of rice drying capacity

Technical advantages: grain silos with advanced equipment, high level of technology and management, and actively in research development, and application of new science and technology in grain storage.

Management advantage: a complete management system and work specification, high grain storage management level

Talent advantage: outstanding professional skills, strong professional quality staff

#### **4.1.3 COFCO takes up HUAFU Group in November 2014**

On 26 November 2014, after submitted to and approved by the State Council, The China HUAFU Trade & Development Group Corp merged into COFCO Group Co., Ltd., becomes its wholly owned subsidiary. The China HUAFU Trade & Development Group Corp is a large-scale state

owned commercial enterprise group under the management of assets supervision and Administration Commission. 13.34 million registered capital is 13.34 million Yuan, mainly responsible for the management and operational implementation national sugar reserves and national meat reserves under the regulations and policies. At the same time run the business in edible sugar, meat, vegetables, wine and non-staple food production, processing, wholesale, retail, import and export, logistics, engineering design and contracting, food testing and R & D, and advertising.

As an important ENTERPRICES in commodity circulation areas, HUAFU group layout a construction covering most of the country's non-staple food reserve system and integrated logistics system, play an important role in the field of domestic trade and circulation.

The group has complete logistics facilities; format the radiation in the marketing channels and marketing network all over the nation.

#### **4.1.4 COFCO purchase NIDERA in February 2014**

**NIDERA:** NIDERA is a major international agribusiness and trading company with an annual turnover in excess of USD 17 billion. NIDERA was founded in Rotterdam (the Netherlands) in 1920, with its early activities focusing on grain and foodstuffs merchandising in the regions from which it took its acronym: Nederland, (East) Indies, Deutschland, England, Russia, and Argentina. Currently NIDERA has domestic and international operations in 18 major export and import countries and distributes its products to more than 60 countries in the world. On Feb 2014, a consortium led by COFCO Corporation acquired 51% stake of NIDERA.

#### **4.1.5 COFCO acquires Noble Group in December 2015**

On December 22th 2015, COFCO Corporation and Noble Group reached an agreement under which COFCO Corporation's subsidiary COFCO International Limited (hereinafter referred to as "CIL") will acquire Noble AGRI's 49% stake held by Noble Group for US\$750 million. Upon the completion of the transaction, CIL will hold a 100% stake in Noble AGRI, which will be renamed as COFCO Agri.

The acquisition will greatly accelerate COFCO's internationalization and global positioning.

Since its acquisition of 51% of Noble AGRI's shares in 2014, COFCO Corporation has been actively engaged in resource consolidation to optimize asset allocation and boost its profitability. Noble AGRI will become COFCO Corporation's 100% fully owned overseas purchase platform and contribute to further optimization of COFCO Corporation's global value chain configuration by linking its upstream origination and trading operations with the downstream processing and distribution capabilities of COFCO Corporation and its affiliates.

Noble AGRI: In 2014, a consortium led by COFCO Corporation acquired 51% stake in Noble Agri. By the end of the year, Noble AGRI had sales of \$14.9 billion, and delivered 46 million tons of products globally, with 45 asset locations and 9,500 employees in 29 countries. In May 2015, Matt Jansen, who had abundant experience in agriculture industry, was appointed as CEO of Noble Agri. Noble AGRI engages in agricultural trading and processing businesses, which it originates from surplus producing regions such as South America, North America, South Africa, East Europe and Australia, to supply regions with high demand such as China, Asia and the Middle East. Noble AGRI owns and operates logistics and processing assets in strategic locations within key global trade flows.

## **4.2 Build the grain integration logistics through commercial logic**

### **4.2.1. Supply Chain Management**

Today's competition is generated through collaboration between organizations, products do not compete as they did but supply chains do. As for grain logistics in our nation, the cost of transportation of grain commodities takes up a great proportion of value of the commodities, so how to collaborate with all participants engaged in grain transport market is a vital issue.

Supply chain management encompasses the planning and management of all activities involved in processing, procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and cross companies.

Supply chain management is an integrating function with primary responsibility for linking

major business functions and business process within and across companies into a cohesive and high-performing business mode. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and cross marketing, sales, product design, finance and information technology.” (As defined by the Council of Supply Chain Management Professionals, CSCMP, 2004)

The COFCO & CM Grain Exchange Co., Ltd aimed at five backward points in grain trading of the industrial supply chain:

1. The un-smooth flow of supply and demand information
2. Lack of near future arbitrage and hedge financial derivatives.
3. Lack of trading performance security and guarantee.
4. The insufficient turnover of the revolving fund.
5. Low logistics efficiency.

Based on the intermediate market, the company creates a set of trading, logistics, finance, information, and security in one station's AGRI grain business service platform. The company regard "online trade + offline delivery" as the core, providing a variety of online trading mode, not only to meet the customer transaction demand also meet the needs in hedging with futures trading. The company takes the advantages from the two strong state owned stakeholders in resources, aiming at provide full logistics integrate services, ensure the safety of quality and quantity of goods, low price, and gradually integrate resources towards wisdom logistics. The company is constantly promoting supply chain financial services, building a bridge as an intermediate for customers and financial institutions, to provide low cost, fast loans, easy loan and supply chain financing services; at the same time, pay more attention to the information network of grain market in-depth mining and professional analysis based on the data collect from the major customers, provide market information, report the profound price index guidance, market forecast to make sure the customers get the latest information and the original grain sources.

#### **4.2.2. 3<sup>RD</sup> Party logistics provider selection through AHP model**

When multiple objectives are important to a decision maker, choosing between alternatives can be difficult. If the logistics center are choosing a 3<sup>rd</sup> party logistics provider to transit cargo, one provider might offer the safest cargo transport but rate poorly on other objectives such as the speed of the transport and the bad service. Another provider offer might rate high on these latter objectives but have a relatively low safety and security level on cargo. In such case it can be difficult for the logistics center to choose between providers offers. The Analytic Hierarchy Process (AHP), developed originally by Thomas Saaty is a powerful tool that can be used to make decisions in situations where multiple objectives are present.

In this part we will use multiple-objective decision-making, the analytic hierarchy process (AHP) to analysis and assesses the different 3rd party logistics providers. Multiple objectives are important to make a decision, when having difficulties to choose between alternatives.

##### **Step1: Build AHP model**

The COFCO & CM Grain Exchange Company's logistics center (so called logistics center in the following) need to figure out which 3rd party logistics providers is the best service providers among other providers in certain perspectives (highway, railway, waterway) and what's the rank among all these 3rd party logistics providers. So we need to make an assessment for all 3rd party logistics providers. The assessment of the 3rd party logistics provider mainly focuses at 4 major parts: Safety, Speed, Cost and Service. We plan to choose and rank these 3rd party logistics providers by determining how well each job offer meets the following criterion:

##### **Criterion 1: Safety/Security**

For safety is about the safety and proper means of transport of the cargo in coordinate with the quality and quantity control of the cargo.

The first issue is about the control of the cargo: the 3rd party logistics provider must have the ability to control the owner's cargo during the whole process of the transportation, response and operate with high efficiency under the command of the cargo owner. Under these conditions, the cargo won't get shifted, theft, tampering, sabotage, lost or any other unexpected lost during the period of transportation.

The second issue is the 3rd logistics provider should be capable to manage the emergency accident or incident and tackle the problems as soon as possible.

The third issue is to secure the quality and quantity of the cargo, when compared with other general commodities, we can easily figure out that grain commodity have some special properties such as a rather high value, undergoes deterioration, sensitive to the temperature and humidity and so on. It is a big issue to make sure the grain commodity cargo meet the proper transport and storage conditions. The safety of the cargo can be considered as the most important factor among all the factors.

Criterion 2: Speed/Transit time.

For speed, firstly is about the speed to quoted price, when the logistics center need the 3rd party logistics providers to offer the price of local charge, port surcharge, storage fee, trucking fee, the ocean freight, terminal handling cost, booking fee, amendment fee, container stuffing charge, demurrage charge and so on, they need to offer the price as soon as possible.

Through comparing, calculating and judging these information collected from 3rd party logistics providers, the COFCO logistics center can integrate the whole process in a most optimal way and give a most effective method both to the customer and to the company itself. It is important to have a timely and efficiently communicate between the shippers and carriers. Secondly is the speed of cargo transportation. Whether the cargo is handling or transfer punctual as schedule, how well the 3rd logistics providers perform at on time rate and detention rate should be taken into consideration when judging the speed.

Criterion 3: Cost.

For cost, the lower the cost the more attractive for the customer, cost structure is rather simple. Whether the cost is reasonable and has advantage over the market or over other logistics/ storage service provider.

Criterion 4: Service/Capability.

What kind of service do they provide, how they performed, what kind of value added service do they provide, how's their reputation these factors should take in to consideration. Corporate credibility is the extent to which customers believe a firm can design and deliver products and services that satisfy their needs and wants. It reflects the supplier's reputation for a strong relationship. Corporate credibility depends on three factors: 1. Corporate

expertise—the extent to which a company is seen as able to make and sell products or conduct services. 2. Corporate trustworthiness—the extent to which a company is seen as motivated to be honest, dependable, and sensitive to customer needs. 3. Corporate likeability—the extent to which a company is seen as likable, attractive, prestigious, dynamic, and so on. (KOTLER, KELLER, 2014)

Different time phases of customer service: pre-order service, service from order to delivery, service during delivery, post-delivery service.

**Step2: Determine each criterion’s weight**

**Step 2.1: Build pairwise comparison matrices**

In order to obtain the weights, we begin by forming a matrix “A”, known as the pairwise comparison matrix. Then entry in row i and column j of “A”, labeled  $a_{ij}$ , indicates how much more important objectives i is than objective j. “Importance” is measured on an integer-value 1-9 scale with each number having the interpretation shown in following table:

**Table-2Value Interpretation**

Value of $a_{ij}$	Interpretation
1,2	Objective i and j are equally important
3,4	Objective i is slightly more important than j
5,6	Objective i is strongly more important than j
7,8	Objective i is very strongly more important than j
9,10	Objective i is absolutely more important than j

Source: own source

The rows and columns of “A” each correspond to our four criteria: Safety, Speed, Cost and Service. Then we can get the following pair wise comparison matrix.

**A=**

	Safety	Speed	Cost	Service
Safety	1	2	4	5
Speed	1/2	1	2	4
Cost	1/4	1/2	1	2
Service	1/5	1/4	1/2	1

**Step 2.2: Normalized pairwise comparison matrices A to get the A \***

For each of the columns of A, divide each entry in the column by the sum of each entry in the column; this yields a totally new matrix in which the sum of the entries in each column is 1:

$$a_{ij}^* = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}}$$

**A norm\*=**

0.5128	0.5333	0.5333	0.4167
0.2564	0.2667	0.2667	0.3333
0.1282	0.1333	0.1333	0.1667
0.1026	0.0667	0.0667	0.0833

**Step 2.3 Estimate the weight for criterion i,**

Estimate the weight for criterion i as the average of the entries in row i of A\*

$$W_i = \frac{\sum_{j=1}^n a_{ij}^*}{n}$$

$$W_1 = 1/4 (0.5128 + 0.5333 + 0.5333 + 0.4167) = 0.4990$$

$$W_2 = 1/4 (0.2564 + 0.2667 + 0.2667 + 0.3333) = 0.2808$$

$$W_3 = 1/4 (0.1282 + 0.1333 + 0.1333 + 0.1667) = 0.1404$$

$$W_4 = 1/4 (0.1026 + 0.0667 + 0.0667 + 0.0833) = 0.0798$$

**Wi=**

0.4990
0.2808
0.1404
0.0798

**Step3: Checking for consistency**

Any pairwise comparison matrix can suffer from inconsistencies. So we need to follow the procedure to check for inconsistencies. We illustrate this on the A matrix and its associated vector of weights w. The same procedure can be used on any of the Ai matrices and their associated weights vector:

**Step 3.1 Compute AW**

$$AW = A \times W_i =$$

2.0212
1.1303
0.5652
0.3200

**Step 3.2 calculate  $\lambda_{max}$**

$$\lambda_{max} = \sum_{i=1}^n \frac{AW_i}{nW_i}$$

$$\lambda_{max} = 2.0212/4 * 0.4990 + 1.1303/4 * 0.2808 + 0.5652/4 * 0.1404 + 0.3200/4 * 0.0798 = 4.0278$$

**Step 3.3 Computes the constancy index (CI)**

Compare CI to the random index (RI) in the following table for the appropriate value of n. It is suggested that if  $CR = CI/RI < 0.10$ , then the degree of consistency is satisfactory, whereas if  $CI/CR > 0.01$ , serious inconsistencies exist, and AHP may not yield meaningful results (Albright, Winston)

**Table 3 -Random indices for consistency check for the AHP example**

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Source: Management Science modeling revised 3<sup>rd</sup> edition.

$$CI = \lambda_{max} - n / (n - 1) = 0.0093$$

$$CR = CI/RI = 0.0093/0.90 = 0.0103$$

$$CR < 0.1$$

So the pairwise comparison matrix does not exhibit any serious inconsistencies

**Step4 Determine the scores of each alternative**

For the 3<sup>rd</sup> party logistics or providers, we can judge and score them in different sectors through KPIs collect from daily operation.

Safety KPIs: cargo quality, cargo quantity, cargo damage rate, cargo control capability, accident rate, etc.

Speed KPIs: The response speed, on time rate, etc.

Cost KPIs: cost reduction rate,

Service KPIs: customer satisfaction rate, customer turnover rate, customer complaint cases, etc.

Through these KPIs the logistic center can grade the 3<sup>rd</sup> party logistics provider.

Determine the scores of each alternative on each criterion

	Safety	Speed	Cost	Service
COSCO	5	5	3	3
CSCL	5	5	2	4
SINOTRANS	3	3	5	2

Source: Own source

### **Step5 Calculate an overall score for each alternative determining the best alternative.**

Given the weights for the objectives and the scores, we can now determine which 3rd party logistics provider to choose. For each 3rd party logistics provider we calculate an overall score that is a weighed sum of the scores for that 3rd logistics provider.

$$\text{COCSO: } 5*2.0212 + 3*1.1303 + 3*0.5652 + 3*0.3200 = 16.1525$$

$$\text{CSCL: } 5*2.0212 + 5*1.1303 + 2*0.5652 + 4*0.3200 = 18.1679$$

$$\text{SINOTRANS: } 3*2.0212 + 3*1.1303 + 5*0.5652 + 2*0.3200 = 13.8805$$

China Shipping is the best 3rd logistics provider among others.

### **4.3. Integrate resources & strategic corporation**

#### **4.3.1. 4<sup>th</sup> party logistics provider**

The COFCO & CM Grain Exchange Co., ltd. as introduced by itself is a 4PL company focus in the grain logistics. The concept of 4PL firstly introduced to public in 1998 by Anderson Consulting (now: Accenture). The definition given by Anderson Consulting is (Bumstead and Cannons, 2002): An in integrator that assembles the resources, capacities and technology of its own organization and other organization and other organizations to design, build and run comprehensive supply chain solution. Most 4pl companies they don't own assets like warehouse facilities, handling equipment, trucks, fleet and so on. They provide services to the customers in the form of responsibility and knowledge of how to fulfill the customer requirements. The physical transportation and handling of cargo is outsourced to other 3rd party service providers and administrate the different logistics activities. In addition to the administration, they design logistics setups, implement the setups, design information systems to administrate the operations, etc. (Delfmann et al., 2002; Skjoett-Larsen et al., 2003) A 4PL can also be regard as logistics service intermediaries.

A fourth party logistics provider is a supply chain integrator that assembles and manages the resources, capabilities, and technology of its own organization and other complementary service providers to design, deliver and run a unique and comprehensive supply chain solutions with the ability to unlock value in its principal's supply chain by offering solutions to modern supply chain challenges (Gattorna, 2003).

Today some companies are extending their reach outside of traditional supply chain boundaries and engage in activities that go beyond their own sphere of control. To do this,

they organize in and form competitive networks of companies to develop and access supply chain capabilities for the organizations that are part of such value-adding networks (J.Gattorna, R.Ogulin, W.Selen. An empirical investigation of 3rd and 4th party logistics provider practices in Australia)

The COFCO & CM Grain Exchange Co., Ltd. is a subsidiary state owned company, which manages and integrate the resources, capabilities, and technologies of its stakeholders: COFCO Trading and China Merchant International in Grain trading, grain silo storage, grain transportation. And set up strategic cooperation with shipping companies like: China Ocean Shipping Cooperation, China Shipping, SINOTRANS, local ports all over the nation, Grain storage and logistics companies like SINOGRAIN, Inspection companies like SGS, China Standard Inspection Company, and other 3rd party logistics providers. The company integrates the whole value chain from information, financial, logistics, security and so on. In logistics part, the company has a significant growth since the founding of the company:

**Table-4 Logistics Center Cargo Transit Volume**

	Container Form	Bulk Form	Cereal oil	Total
2015/06	516.31	/	/	516.31
2015/09	6372.53	/	/	6372.53
2015/10	15091.02	64580.13	500.00	80171.15
2015/11	39962.59	48201.24	1100.00	89263.83
2015/12	33059.41	74405.54	204.00	107668.95
2016/01	19647.43	73766.69	/	93414.02
2016/02	15282.42	29225.45	921.74	45429.61
2016/03	23547.45	14011.52	2857.06	40416.03
2016/04	40352.34	26791.52	4892.83	72036.69
2016/05	84506.70	129325.38	1811.72	215643.80
2016/06	118093.55	110482.33	2581.32	231157.20
Total	365955.11	648673.89	15724.39	1030353.39

Source: own source.

### **4.3.2 Internet plus**

With the development of China's economy step into the new normal, grain logistics industry is facing a new opportunity for innovation and development, the new generation of information technology provide a new way for innovation to accelerate the development of grain logistics. At present, in networking, cloud computing, mobile Internet, big data as the core of the new generation of information technology is developing rapidly; in the field of logistics some of this new technology has become increasingly popular and widely used, making a profound change in grain logistics resource allocation mode. The top priority is to grasp the three keys:

The first is by establishing the "Internet plus grain logistics" to improve the function of logistics. In the profound changes in China's grain production and consumption structure, improving infrastructure and the promoting of the development of a new generation of information technology, innovative logistics has started and the diversification of new service mode and new kind of logistics organization continue to emerge. The grain logistics development to the "Internet plus grain logistic" to form a series of new services, new technologies, new organization, new ways to promote structural adjustment and upgrading of the logistics industry, achieve rapid increase logistics efficiency, and gradually formed the modern logistics system with intensive knowledge and technology capital and efficient logistics operation. We should vigorously develop the third and fourth party logistics, including multimodal transport and logistics supply chain management model, has introduced to promote the modern information technology has become the leading logistics technology innovation initiatives, these technologies can optimize the allocation of resources of grain logistics in a large extent, continuously and steadily improve logistics efficiency and reduce grain logistics cost level. At the same time, regard "Internet plus gain logistics" as a major driving force and core to promote the logistics innovation and strategic development of grain logistics industry,

The second is to "Internet plus gain logistics" to enhance the logistics efficiency. Logistics innovation is the inherent requirement of economic development and transformation, and it is also the driving force to improve the quality and efficiency of grain logistics industry. "Internet plus" triggered by the new technology, new organization and new ways, especially

the information level of logistics and to improve the field of information technology as the core technology innovation, has become the main driving force and the way to create new services, foster new organization, the formation of new business models and service mode. The new logistics service is bound to meet the support and promotion of technological innovation, and then it needs the support of new logistics organization and even the new integration of resource elements and configuration mode. Therefore, to the "Internet plus food" to speed up the grain logistics industry transformation from traditional resources and labor-intensive to knowledge and technology intensive, accelerate logistics adjustment and upgrading of industrial structure, optimize the allocation of resources of grain logistics in a large extent, accelerate the formation of a new pattern of logistics development in information and modernization.

The third is through "Internet plus grain logistics" to get the extension of the logistics chain. Conform to the profound changes in the business model and consumption patterns, new trend to speed up the development of e-commerce, forming online trading, warehousing and logistics terminal distribution and integration business, realize the integration and development of online and offline, so as to promote the food logistics industry to speed up the transformation and upgrading, for them to realize the innovation driven development to provide a powerful driving force.

## 5. Conclusion

In this paper I come into the details to discuss and study the past, current and future situation of our country's grain logistics through the assessment about the future trends (the steady growth in north to south grain circulation) and existing problems (resources allocation un-rational, logistics capacity unbalance, etc) in China's north to south grain transportation experienced through these years.

Main findings:

1. In macro view from the national perspective in analyzing market demand and supply, grain infrastructure building, renew storage facilities, logistics integration and optimization we have already focus a lot on the building of the bulk grain mode transportation in bulk loading, unloading, storage and transport in waterway, highway and railway but the measures and procedures of smooth connecting these link still have so many problems.
2. Ports cluster located in Liaoning although function its geographical advantages in north to south grain circulation but cannot avoid the cutthroat competition between these ports. We get the policy from the nation in promoting this transportation mode.
3. A micro view from an enterprises perspective in to build up a sufficient supply chain management system, the selection of 3rd party logistics provider through AHP model can be used to get the optimized grain logistics mode when integrate all related fields from the grain reserve companies, third party inspection companies, third party logistics providers, terminals, ports, shipping companies, truck companies, financing institution and so on by using the AHP model to get the best logistics service provider and the best service in cost, time, safety and other aspect. This method has already been used among 4th party logistics company.
5. The country has set up strategy through building up a strong state owned grain company, COFCO, to optimize the market resources allocation in all aspect, compete with the famous four big grain trading companies. COFCO & CMGrain Exchange Co., Ltd in this paper shows the dynamic integration of a 4<sup>th</sup> party logistics company in the grain logistic supply chain, trading information flow as well as supply chain finance.

This conclusion can gives the grain logistics market players a better understanding and method to figure out or build the grain logistics system in such situation.

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