The Animal Feed Chain in China
Opportunities to Enhance Quality and Safety Arrangements

Ina Enting, Berry Wang, Xiaoyong Zhang, Gert van Duinkerken

LNV BO-10-010-125
Ministry of Agriculture, Nature and Food Quality

August 2010

Acknowledgements

We owe a large debt of gratitude to the Beijing Orient Agribusiness Consultants Ltd (BOABC) for their willingness to cooperate and to provide essential data on import and export flows of raw ingredients and additives. Furthermore, we would like to express our sincere appreciation to Rabobank for their assistance with this project.

東方久物 BOABC

Rabobank

TABLE OF CONTENT

1 Opportunities in China for the Dutch Feed Industry

Under the authority of the Dutch Ministry of Agriculture, Nature and Food Quality a strategic analysis was made of the animal feed chain in China. The focus of the analysis was to disclose possibilities that would contribute to further improvements of feed safety in China. Such improvements would undoubtedly create new business propositions for Dutch industries and public-private organizations active in the Chinese feed chain. Moreover, a higher quality standard for animal feeds and feed ingredients produced in China would ensure food quality and safety not only in China and in the Netherlands, but worldwide as well.

This chapter provides a trend analysis of the feed chain in China and concludes with suggestions to strengthen the interest of Dutch companies in the Chinese feed production chain in relation to quality assurance and quality control management.

1.1 Trend analysis of the Chinese feed production chain

1.1.1 Feed production and trade

China has become a significant player in the world feed chain, with a ranking of third in the world in 2008 (after the United States and the European Union) with an annual output of 136 millions tons. Over the past fifteen years, China has increased their production capacity to 97 million tons, denoting an annual growth rate of 8.7%. Forecasts have shown that China will continue to expand their output and take hold of the number one position in compound feed within the next decade (Rabobank, 2008). The majority of the feed production in China consists of animal feed. Aqua feed makes up a share of 10% with an annual output of 14.2 million tons. Compound feed is the main type of feed, but over the past fifteen years, China's concentrates and premix industry has taken off with output in 2008 of 25.3 and 5.5 million tons, respectively. These numbers represent a share in total feed production of 19% and 4%, respectively. At the moment, the Chinese feed chain has become disintegrated, but the trend is moving strongly towards consolidation. In 2008, China had more than 13,000 feed companies scattered throughout the country. However, one third of the total feed production in China is produced by 16 large-scale industrialized companies each with an individual output greater than one million tons. Companies with an output of one thousand tons or more increased by 280% over the past five years.

With regards to raw ingredients, like soy and fish meal, China is a net importer. In terms of corn, the policy is changing from net exporter to net importer. China does not want to be dependent on food imports and rather imports feed than meat.

In terms of additives, China is by far the world leader in vitamin production. Vitamins B1, B3, B8, B11, B12, C, D3 and K3 are solely produced in China. On average, 60% of the vitamins produced in China are traded around the world. Vitamins C and E are the most important vitamins to be exported. Netherlands and Belgium are in the top seven of export hubs for Vitamins C and E. China is not as strong in the production of amino acids as they are in vitamin production due to the fact that the production of amino acids, especially methionine production, requires an advanced technology level that Chinese companies do not posses yet. However, foreign companies do have the necessary technology and have expressed intentions to start methionine production within the Asia Pacific region. China dominates the production of other additives like choline chloride and inositol. They account for nearly 100% of the world's supply .

The major international feed producers, including the Dutch companies, have offices and factories throughout China. In general, they began business in China via the sourcing of vitamins, amino acids and other additives to meet the domestic demand. Over time, those companies invested in China and established their own factories to blend vitamins and premixes. With increasing global business in feed production, international feed companies have often set up an export and import trading company for raw materials sourcing in China in order to serve a broader market than just for their own demand. Due to this, the standards for quality assurance and quality control management in China have become the norm for the safety of animal feeds in the Netherlands and worldwide.

1.1.2 Feed laws and regulations

Just before the turn of the millennium, the Chinese government had put in place regulations (Codex) for the administration of feed. Two years later, a revised

edition of the Codex came into effect with regulations concerning premix production. The overall purpose of the Codex was to improve feed quality, facilitate further development of the feed industry and to enhance public health safety. The melamine incident in 2008, which also occurred in feed, several clenbuterol incidents and other food contamination incidents exposed the fact that legislation was insufficient to guarantee feed and food safety throughout the entire production chain.

On February 28, 2009, after five years of drafting, the China's National People's Congress passed the food safety law. The law was adapted from the food hygiene law, rather than being a completely new law. The new law provided a legal basis for the government to strengthen food safety after continuing concerns from Chinese consumers. The law, which went into effect on June 1, 2009, consolidates hundreds of regulations and standards covering China's 500,000 food-processing companies and promises tougher penalties for producers of tainted products.

A revised version of the Feed and Feed Additive Regulation was expected to be released in 2010 to remain on course with the requirements of the Food Law. However, as of now, only a draft has been published so far for public comments. The draft reflects the Chinese government's effort in tightening the reins on feed safety, but implementation is far behind the current demand of the Chinese society.

1.1.3 Feed safety supervision and assurance schemes

The Ministry of Agriculture (MoA) is in charge of the inspection and monitoring of feed quality and safety throughout China. Every year, they plan for materials to test on and the required sampling size. Each province works out their own individual testing plan and reports every six months to MoA on the results of the testing. The testing samples are analyzed by governmental accredited institutions. MoA pools the monitoring results and publishes it on their website, including the major problems identified and a black list of disqualified companies.

China has one domestic governmental based initiative on voluntary feed and feed additives certification. Besides this, HACCP, ISO 9001, ISO 22000 and FAMI-QS (only applicable for additives) are broadly applied as international assurance schemes. To a lesser extent, GMP+ FSA is applied by some trace elements producers. Especially for HACCP and the ISO series, the Chinese companies commonly use the certifications as a marketing tool and do not put much effort on the actual implementation of them nor compliance with the system.

1.1.4 Wrapping up

- China has a prominent world position in the feed production chain and for certain types of products is in a dominant, and in some terms monopolistic, position.
- China has experienced an increase in additive and premix production and there is a growing trend towards the production of high technology additives like methionine. The latter asks for a high level or technology, which China is (partly) lacking but will be handled by foreign companies.
- China faces an increase in the trade of additives and can be considered as a major supplier of (blend) vitamins to the rest of the world.
- The major international feed producers have their own factories for blend vitamins and premixes in China and they trade China-produced additives and premixes worldwide.
- The standards for quality assurance and quality control management in China have ultimately affected the safety of animal feeds worldwide.

- The Chinese government is responsible for laws and regulations, but they are behind the current reality of public perception of food and feed safety. New laws have been announced and in the near future there will be stricter regulations in China.
- Chinese producers of additives and/or raw ingredients are familiar with the market demand for feed safety assurance schemes, but they are more focused on the marketing value of these schemes than on the actual implementation of feed safety issues.

1.2 Opportunities in the Chinese feed production chain

The previous paragraph exhibited a rather fragile feed safety situation within the Chinese feed chain. There is an increasing awareness on the Chinese side with concerns to the quality assurance and quality control management in the feed chain. However, it is insufficiently implemented in order to give the necessary safety guarantees to the foreign and in particular the Dutch feed companies operating throughout China. This emphasizes the necessity for Dutch stakeholders to closely monitor feed safety within China and take the initiative themselves to make a positive change. As of today, they have done this for their own production, but on purchasing side it is less assured and not tailored to their needs. From the Dutch companies perspective their suppliers have a lack of financial resources to invest on the quality and safety side, a lack of dedicated suppliers for long-term relationship and a difference in the requirements of the company's standard and the legal standards of China. Furthermore, there is a lack of awareness and knowledge at the end user side, i.e. farmers in China, to justify sales of high quality feed products guaranteeing safe meat production. Last, but not least, is the most glaring omission is a whole chain approach for feed safety and a related chain inspection system.

It is difficult, not to mention impossible, for an individual feed company to dispel the above bottlenecks. Therefore, a collective approach to work on higher quality and safety standards within the Chinese feed chain is strongly advised. The Dutch government provides financial support to demonstrate Dutch excellence in a certain field and to strengthen the position of Dutch companies in foreign markets. Suggested activities for a consortium of Dutch feed companies to remove obstacles in enhancing quality and safety arrangements in the Chinese feed market are as follows:

- A comprehensive study on Chinese laws and regulations with regard to feed safety and how the Dutch chain approach on feed safety arrangements fits in this Chinese context.
- A G2G training to increase awareness and knowledge within the Chinese government.
- Seminars to increase awareness and knowledge within the end user side in China.
- An inbound mission of (potential) Chinese suppliers or clients to the Netherlands to display the added value of the Dutch chain approach with regard to feed safety.
- A pilot project to implement a chain-based feed safety arrangement in China.
- Periodical round table discussions to exchange experiences in quality assurance and quality control within the feed and food chain. Next, the Dutch feed companies and Dutch companies in the pig and poultry chains should participate to emphasize chain oriented thinking.

1.3 Outline of report

The following chapters of this report provide the foundations of the above conclusion. It contains an overview of current feed flows of major feed producers within the Chinese feed chain (Chapter 2), various feed safety arrangements in China (Chapter 3) and the current and future quality assurance and quality control management practices of feed companies within China (Chapter 4).

2 Current feed flows in China

2.1 Total feed production

China has a total of 13,612 feed companies. The total annual commercial feed production including compound feed, concentrates, premixes and additives reached 136 million tons in 2008. Currently, China is the third largest feed market in the world, after the United States and the European Union (EU-15). Fifteen years earlier, China only had an output of 39 million tons, denoting an annual growth rate of 8.7% up to the present time. Forecasts show that in 2020 China will be the world leader in feed production (Rabobank, 2008; Rabobank, 2010).

The majority of the feed production in China is focused on animal feed. However, the growth of the aquaculture sector in China is booming. The domestic production of aqua feed is showing an annual growth rate of 15.9%. The total output grew from 1.8 million tons in 1994 to 14.2 million tons in 2008, respectively. That number accounted for 10% of the total feed production within China in 2008 (ANFQ, 2010).

According to Rabobank (2010), even though the pork meat market is three times larger than poultry meat market, the poultry feed market has a much larger share in the production than the pork feed market (48% versus 34%). This is due to the fact that a very large number of backyard farms are still present in the pork production sector. Since the turn of the century, the production of aqua feed has been increasing at a rapid pace, with an annual growth rate of more than 10%, compared to a CAGR of a little bit less than 10% for poultry feed and close to 5% for pig feed. However, the CAGR of pig feed for the next five years is expected to rise above 10%. The growth in aquatic feed is destined for export, while the growth in feed production exceeds the growth in aquaculture production (Rabobank, 2008; Rabobank, 2010).

Compound feed is the main type of feed production, but the volume share is gradually declining from nearly 100% to about 75% of the total production. More specifically, the production of concentrate feed has increased over the past ten years to a share of around 20% of the total production. The share of premixes and additives in the total feed production volume is around 4%. In 2008, the compound feed production was 106 million tons, the concentrate production was 25.3 million tons and the premix and additives was 5.5 million tones, respectively (see Figure 2.2).

Feed production factories within China are mainly located in the coastal areas. Guangdong and Shandong are the main production provinces that account for a total output in 2008 of 19.0 and 15.9 million tons, respectively. The companies in these provinces are often specialized in aqua feed production, whereas companies in other provinces are more often active in animal feed production. The companies in Henan, Liaoning and Heilongjiang provinces have a relative large share in the production of concentrates (Figure 2.3).

In 2008, there were 16 feed companies that had a total output greater than one million tones of feed. The total output of the 16 companies was 45.6 million tons, which represents 33% of the total feed production in China. A number of these companies have their core business in aqua feed production and not in animal feed production. There were 187 companies that had a total output greater than one hundred thousand tons in 2008. This was an increase of 30 companies compared to the previous year of 2007, and was an increase of 120 companies compared to the year of 2003.

Figure 2.1: China annual feed production per animal species, in million tons (Source: Rabobank)

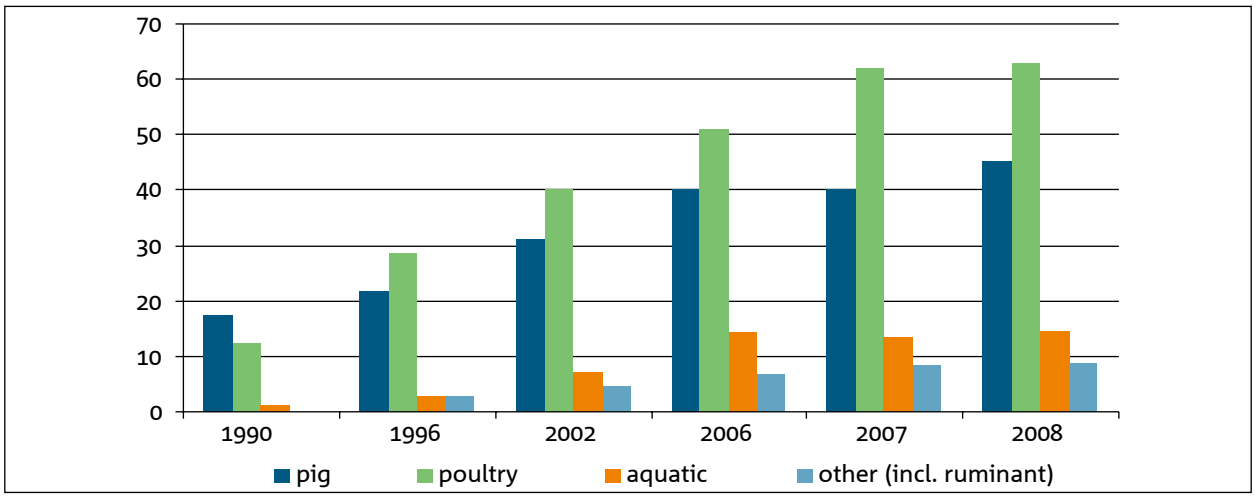


Figure 2.2: China annual feed production per feed type, in million tons (Source: Rabobank)

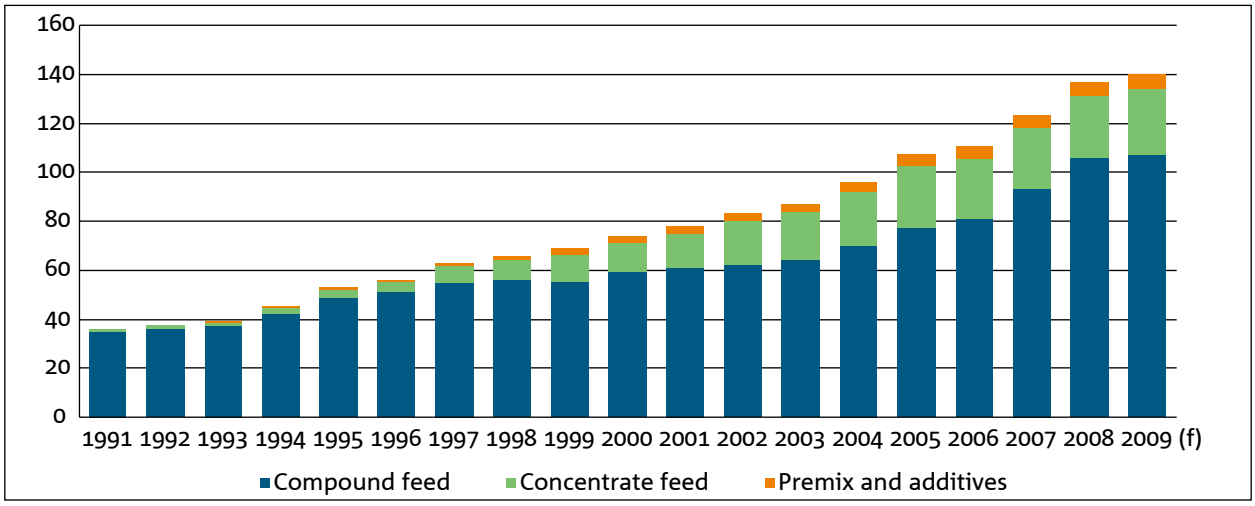


Figure 2.3: Feed production per feed type in major production areas, in million tons (Source: Rabobank)

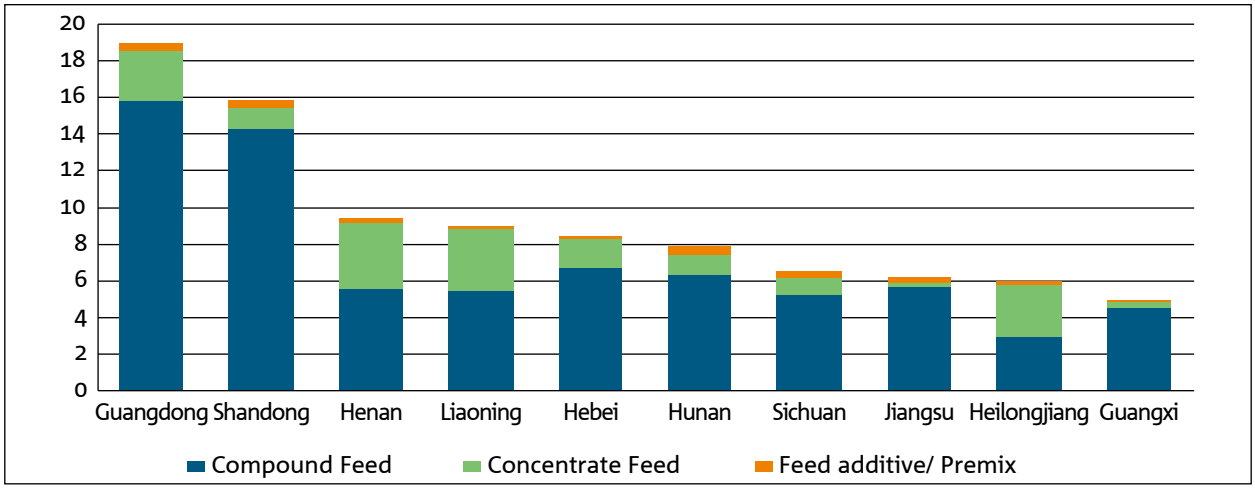


Table 2.1: China's million tons scale sized feed companies in 2008, including the location of their headquarters, annual production capacity, core products and company website.

New Hope (Liuhe) Group
Sichuan
13 million tons
Animal feed / Aqua feed
Website: www.newhopegroup.com

Hunan Tangrenshen Group
Hunan
4.3 million tons
Animal feed
Website: www.tangrenshen.com.cn

CP China
Beijing
7 million tons
Animal feed / Aqua feed
Website: www.cpgroup.cn

Guangdong Wen's Group
Guangdong
3.7 million tons
Animal feed
Website: www.wens.com.cn

East Hope Group
Shandong
6.1 million tons
Animal feed / Aqua feed
Website: hgc01171.chinaw3.com/corporation/ymgle_gyxw.asp?id=312

Dachan/East Asia Group
Beijing
2.9 million tons
Animal feed
Website: www.dachanfoodasia.com

Tongwei
Guangdong
3 million tons
Aqua feed
Website: www.tongwei.com

Tieqilisi Group
Sichuan
3 million tons
Website: www.tqlsgroup.com

Haid Group
Guangdong
2 million tons
Aqua feed
Website: www.haid.com.cn

Hunan Zhenghong
Hunan
2 million tons
Animal feed
Website: www.chinazhjt.com.cn

Wellhope De Heus
Liaoning
1.9 million tons
Animal feed
Website: www.wellhopeag.com

Guangdong Hengxing
Guangdong
1.5 million tons
Website: www.hx888.com/

Jiangxi Shuangbaotai
Jiangxi
1.5 million tons
Website: www.sbtjt.com

Jiangxi Zhengbang
Jiangxi
1.2 million tons
Animal feed
Website: www.zhengbang.com

Yuetai Group
Shandong
3 million tons
Animal feed
Website: www.ytfeed.com

Sanwang Group
Sichuan
1 million tons
Animal feed
Website: www.sanwang.com

2.2 Raw ingredients production

The main raw ingredients for feed production are corn, soy[1] and fish meal. China has a comparative disadvantage in land availability for the production of ingredients. The country has 22% of the world's population, but only 7% of the world's arable land. As most of the land is already intensively farmed, China depends mainly on imports of raw feed ingredients as input for the pig and poultry production chains. Alternatively, China could import meat products for human consumption, but the government policy is that China does not want to be dependant on food imports and rather imports feed instead of meat (Rabobank, 2008).

2.2.1 Corn

In regard to corn, China has a total acreage of 27 million hectares and is the second largest producer in the world. In 2008, the total production was 156 million tons, respectively, representing one-fifth of the world production (Table 2.2.). The main production areas in China are in the northern and eastern regions of China in the provinces of Heilongjiang, Jilin, Liaoning, Inner-Mongolia, Beijing, Hebei, Shandong and Henan.

The government's policy for corn production is changing from being a net exporter of corn to being self sufficient in corn. The policy is moving towards a future shift to being a net importer of corn, in line with the proposition that China is rather an importer of feed than of meat. The context of the policy is reflected in the import and export data of corn. Previous to 2008, the export of corn comprised a significant amount that measured nearly a million tons, but minimized afterwards to a number only in the thousands of tons. The main destinations for the export of China's corn was Taiwan and North Korea. The decrease of the export was due in large part to the world economic crisis that began in 2008. The international demand for corn decreased and the domestic prices for corn were higher than the international prices. Imports were relatively low, accounting for only 49.0 thousand tons in 2008, but were expected to grow in the future. The main countries of origin were the neighboring countries of Vietnam and Burma (see Table 2.2 for more data on import and export).

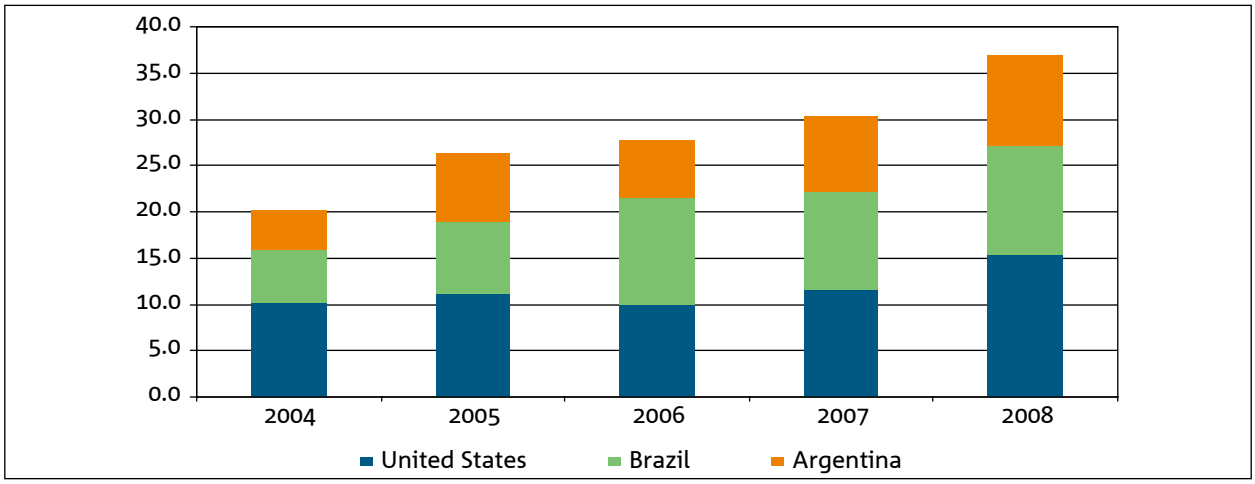
2.2.2 Soy beans

In terms of soy beans, China has a total acreage of 12 million hectares. They are the fourth largest producer of soy beans in the world. In 2008, their production was 16.5 million tons, which accounted for 7% of the world's production. The northern provinces of Heilongjiang, Jilin, Inner-Mongolia and Anhui are the main production areas. The domestic demand, however, is much larger than what these provinces are able to supply. Therefore, China imports an extremely large amount of soy beans, 37.4 million tons in 2008 and the demand is still increasing by up to 20% per year. Reports indicate that China buys half of the soybeans traded worldwide and as a result China is the number one importer in the world. The countries of origin are the United States, Brazil and Argentina. The imports from Argentina have remained stable, ranging from a total share of 22% to 28%, respectively. The United Sates and Brazil are constantly changing places in rank. In the event imports from the United States are decreasing, imports from Brazil are increasing and vice versa (see Table 2.2 for more data on import and export).

2.2.3 Fish meal

China is a net importer of fish meal with a domestic production in 2008 of 413 thousand tons, while imports reached 1.4 million tons, respectively. Two countries play a major role in the import of fish meal, Peru and Chile. Other origin countries are the United States, Russia, Argentina, New Zealand, South Africa and Burma. Export of fish meal is nearly zero when compared to imports and domestic production, with a number of two to four thousand tons.

Figure 2.4: Soy bean import into China per country of origin, in million tons (Source: Rabobank).



[1] *Soy encloses soy beans and soy meal, but while soy meal is a by-product of the oil production from soy beans and while in volume it is less important than soy beans, the report will only examine soy beans.*

Figure 2.5: Fish meal import into China per country of origin, in million tons (Source: BOABC)

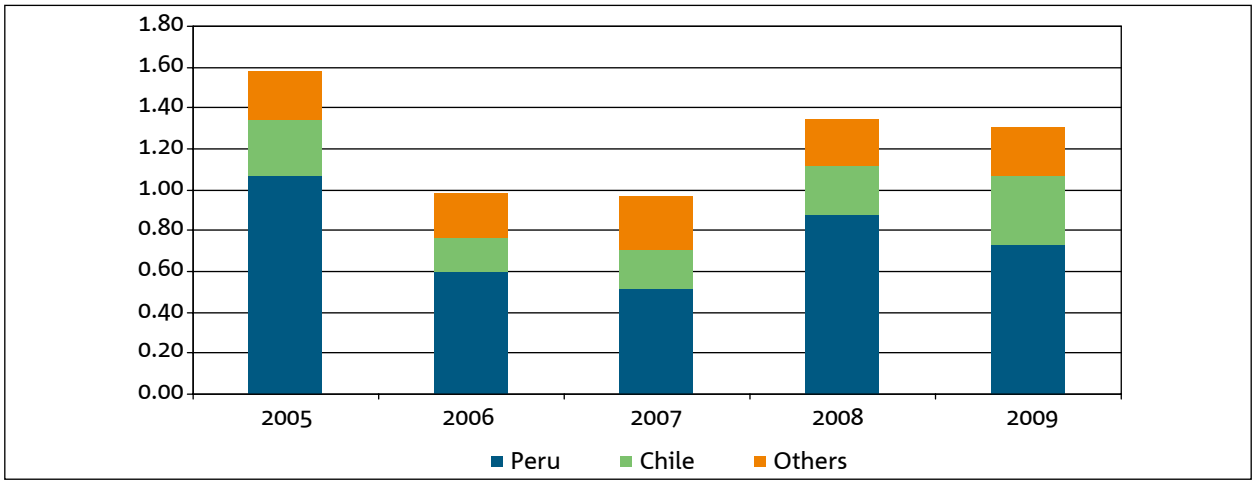


Table 2.2: Production, import and export of corn, soy bean and fish meal in 2008 and 2009 in 1,000 kg (t) (Source: BOABC, Rabobank, China Feed Industry Association)

	Corn	Soy Bean	Fish Meal
Government Policy	Net importer → self-sufficient → net exporter	Net importer	-
Production	2008: 156 million t 2009: 163 million t	2008: 16.5 million t 2009: 15.5 million t	2008: 413 thousand t 2009: 588 thousand t
2008 World Ranking	2nd (20% world share)	4th (7% world share)	
Import	2008: 49 thousand t 2008: 84 thousand t	2008: 37 million t 2009: 43 million t	2008: 1.4 million t 2009: 1.3 million t
Countries of Origin	Vietnam 2008: 19.6 thousand t 2009: 39.2 thousand t Burma 2008: 24.5 thousand t 2009: 27.0 thousand t	United States 2008: 15.4 million t 2009: 21.8 million t Brazil 2008: 11.7 million t 2009: 16.0 million t Argentina 2008: 9.8 million t 2009: 3.8 million t	Peru 2008: 0.86 million t 2009: 0.73 million t Chile 2008: 0.26 million t 2009: 0.34 million t
Export	2008: 252 thousand t 2009: 129 thousand t	2008: 465 thousand t 2009: 360 thousand t	2008: 2.1 thousand t 2009: 4.0 thousand t
Countries of Destination	North Korea 2008: 98 thousand t 2009: 102 thousand t Taiwan 2008: 138 thousand t 2009: 6 thousand t	Worldwide	Taiwan 2008: 0.97 thousand t 2009: 2.92 thousand t North Korea 2008: 0.29 thousand t 2009: 0.84 thousand t Vietnam 2008: 0.26 thousand t 2009: 0.24 thousand t

2.3 Additives production

2.3.1 V itamins

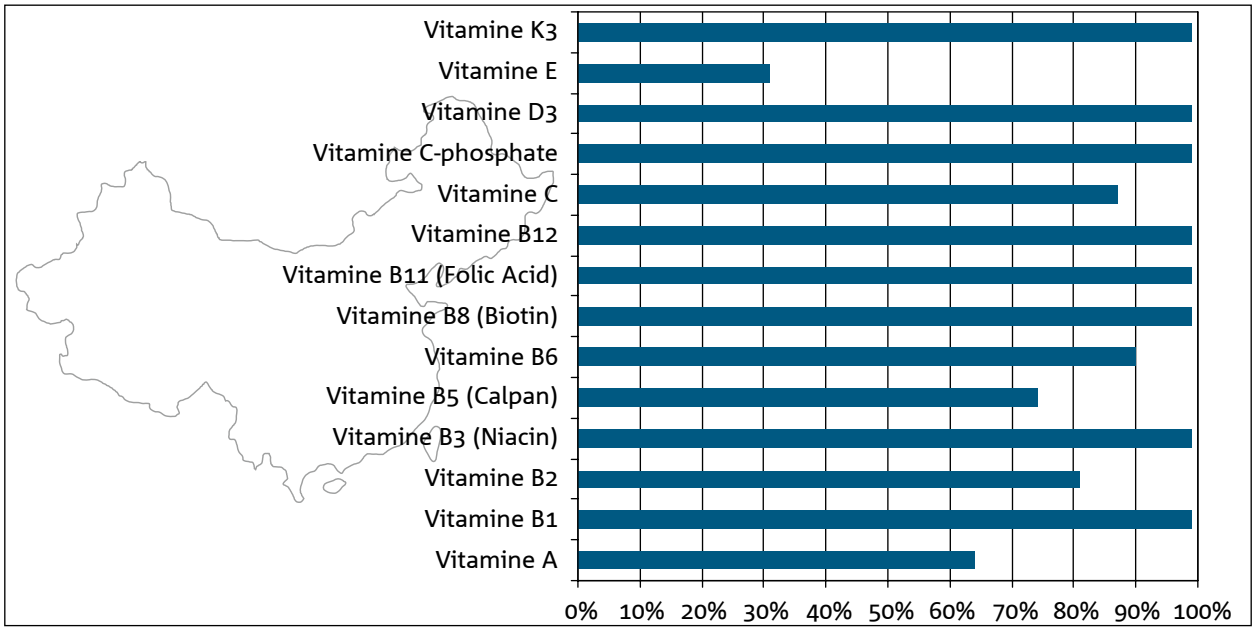
China is the center of the world with regards to feed and food grade vitamin production. With exception to the international companies Adisseo, BASF, DSM and Lonza there are almost zero non-Chinese players in the world vitamin production anymore.

For 12 of the total 13 vitamins known today, China is the world leader in production. For Vitamins B1, B3 niacin, B8 biotin, B11 folic acid, B12, C, D3 and K3 production takes place entirely within China (see Figure 2.6). For a number of the vitamins, one company holds the majority of the world production map. Production is centrally located within the Yangtze River delta, in the south-eastern region of the Jiangsu province and the north-eastern region of the Zhejiang province. Production costs are the main reason for the shift of vitamin manufacturing moving towards more China based locations.

The following details give an overview of the major vitamin producers and shows the importance of China in feed safety issues worldwide. A full list of vitamin producers can be found in Annex 1.

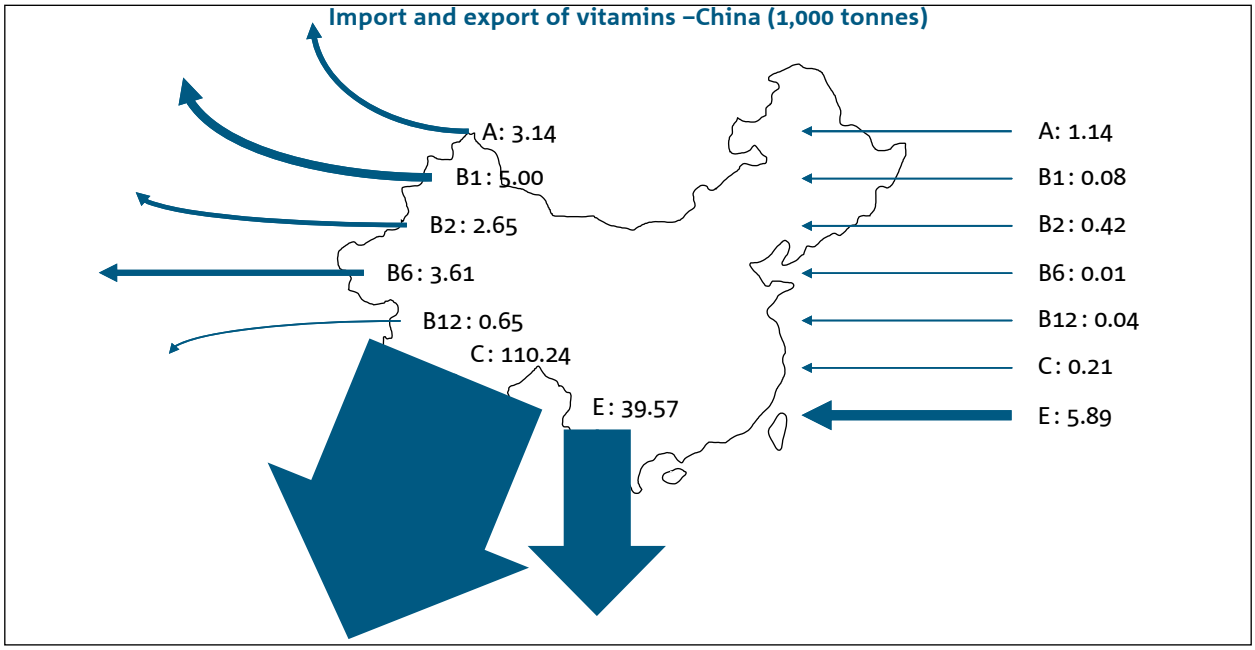
- **Vitamin B1, B6**: Zhejiang Tianxin Pharmaceutical Co produces feed grade Vitamin B1 and B6. Their estimated world market share, deduced from their production capacity, is 40% and 80%, respectively. They are GMP certified and the certificate was recently renewed by the State Food & Drug Administration of China and valid until 2015. On their website, they make special reference that their Vitamin B6 is Kosher and HALAL certified[2].
- **Vitamin B2**: The world's largest manufacturer is Hubei based and state-owned Guangji Pharmaceutical Co. with an estimated world market share for feed grade Vitamin B2 of 50%. They are GMP certified[3].
- **Vitamin B3**: Lonza, has a monopolistic position in the production of Vitamin B3. They are headquartered in Switzerland, but have production bases in Guangzhou. They operate local quality management systems, which comply with internal policies as well as with national and international standards (e.g. ISO) and regulations (e.g. GMP, PIC, HACCP)[4].
- **Vitamin B5 (Calpan)**: Zhejiang Hangzhou Xinfu Pharmaceutical Co.,and Shandong based Xinfa Pharmaceutical company are China's and the world's major producers for Calpan. Xinfu is accredited with ISO9001, ISO14001, HACCP and GB/T28001 certifications.
- **Vitamin B11 (folic acid)**: As far as available data, China is close to a monopolistic position in folic acid production. Shandong based, Xinfa, and, Jiangsu based, Niutang Chemical are the largest producers. Niutang makes special reference on their website that they are Kosher, Halal, ISO 9001:2000, GMP, OHSAS 18001, ISO 14001:2004 and HACCP certified[5].
- **Vitamin C**: Although there is not one dominant player in China, all manufacturing companies in China combined together create a dominant force in the world production. Almost 90% of the production of Vitamin C takes place in China.
- **Vitamin E**: DSM Nutritional Products is estimated to be the world leader in production of Vitamin E, with an estimated share of 50% of the world's production capacity. Recently, they announced that they have

Figure 2.6: Estimated share of China in the world production of vitamins (in %).



[2] *www.txpharm.com*
[3] *www.guangjipharm.com/en/pzbz.asp*
[4] *www.lonza.com*
[5] *http://www.niutang.com/products_food_folic.asp*

Figure 2.7: Import and export figures in 2008 of Vitamin A, B1, B2, B6, B12, C and E. (Detailed data on import and export can be found in Annex 2.)



signed a framework agreement for construction of their next and fifth plant in Sichuan with a capacity of 18,000 tons vitamin / vitamin mineral blends[6].

- **Vitamin K3**: Zhejiang Brother Chemical Co. is specialized in the production of Vitamin K3 and have an estimated world market share of 60%. They are certified by ISO9002, HACCP and Kosher.

From a production volume and export point of view, Vitamin C and E are the most important vitamins (Figure 2.7). The annual production of Vitamin C is estimated at 180,000 to 200,000 tons. In 2008, a total amount of 110,239 tons was exported. The top five main export hubs for Vitamin C are the United States, Germany, Japan, Netherlands and Belgium. It is very likely that Vitamin C is not fully consumed in these companies, due to the fact that the imports are transferred to other countries. In total, the list of export destinations for Vitamin C is well over 130 countries. Vitamin E powder production is estimated at 130,000 tons. In 2008, nearly 40,000 tons was exported. The main export hubs were the United States, Germany, Netherlands, Japan, South Korea, Thailand and Belgium (Table 2.3).

2.3.2 Amino acids

China is in not as strong in the production of amino acid as in the production of vitamins (Figure 2.7). For lysine it is estimated that China holds half of the world production, but for threonine and methionine China's position is much weaker (40% and 10% respectively).

Lysine is an extract from the corn fermentation process and production locations are in close proximity to the corn production areas. China's largest producer, Dacheng,

[6] *www.dsm.com/en_US/html/dnp/home_dnp.htm*

Table 2.3: China import and export of vitamin C and E in 2008 and 2009 in 1,000 kg (t) (Source: BOABC).

	Vitamin C	Vitamin E
Import	2008: 213 t 2009: 142 t	2008: 5,894 t 2009: 5,703 t
Export	2008: 110,239 t 2009: 99,692 t	2008: 39,569 t 2009: 38,480 t
Countries of Destination	USA • 2008: 24,653 t • 2009: 21,160 t Germany • 2008: 12,779 • 2009: 12,753 Japan • 2008: 10,209 t • 2009: 8,791 t Netherlands • 2008: 5,237 t • 2009: 3,918 t Belgium • 2008; 4,393 t • 2009: 3,595 t	USA • 2008: 9,596 t • 2009: 9,285 t Germany • 2008: 4,628 t • 2009: 4,703 t Netherlands • 2008: 4,180 t • 2009: 2,908 t Japan • 2008: 1,468 t • 2009: 2,303 t South Korea • 2008: 1,340 t • 2009: 1,293 t Thailand • 2008: 1,190 t • 2009: 1,022 t Belgium • 2008: 1,156 t • 2009: 1,112 t

has their headquarters in Jilin province. Their domestic market share is estimated at almost one third.

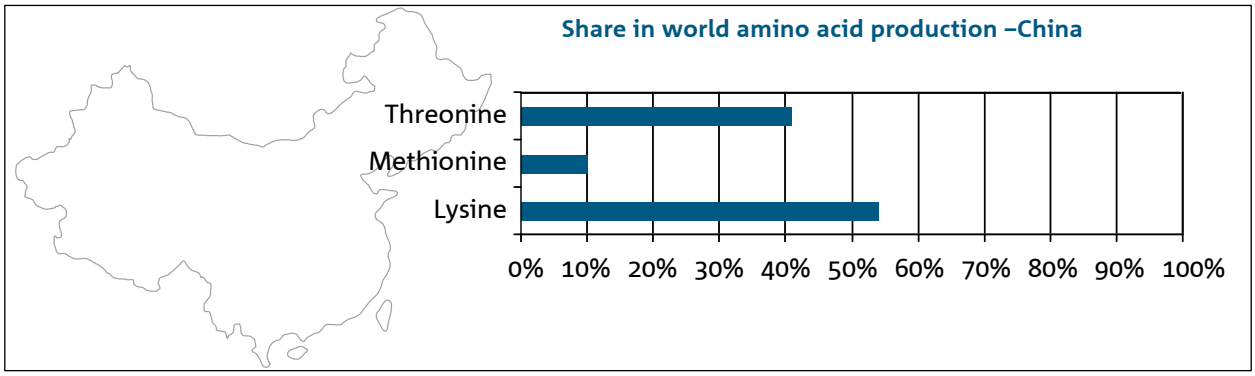
Methionine production requires a more advanced technology level. It is also a product of a fermentation process, but it takes one to two years for the bacteria culture to be acceptable, which China is not capable of yet. Only foreign companies have the technology to do so and they have intentions to start production within China and/or the Asia Pacific region. Based on the expressed plans, domestic production of methionine will increase to a one third share in the world production. The most important foreign amino acid producers are Evonik, Novus and Adisseo, together holding about 90% of the current world methionine production.

Threonine is of less importance compared to lysine and methionine. Major producers in China are Dacheng and Star Lake, both with a world market share of about 10%.

2.3.3 Other additives

China dominates the market for the production of choline chloride and inositol. It is believed that China supplies nearly 100% of the world capacity. Shandong based, NB Group is the major supplier of feed grade choline chloride with an estimated market share of nearly 70%. According to their own information, their production locations have passed the international ISO9001, ISO14001, HACCP and FAMI-QS certification and several domestic certifications (see Chapter 3 for domestic feed safety supervision and international certification schemes). They export to more than 70 countries and regions, with the European Union being one of their main markets.

Figure 2.8: Estimated share of China in the world production of amino acid (in%).



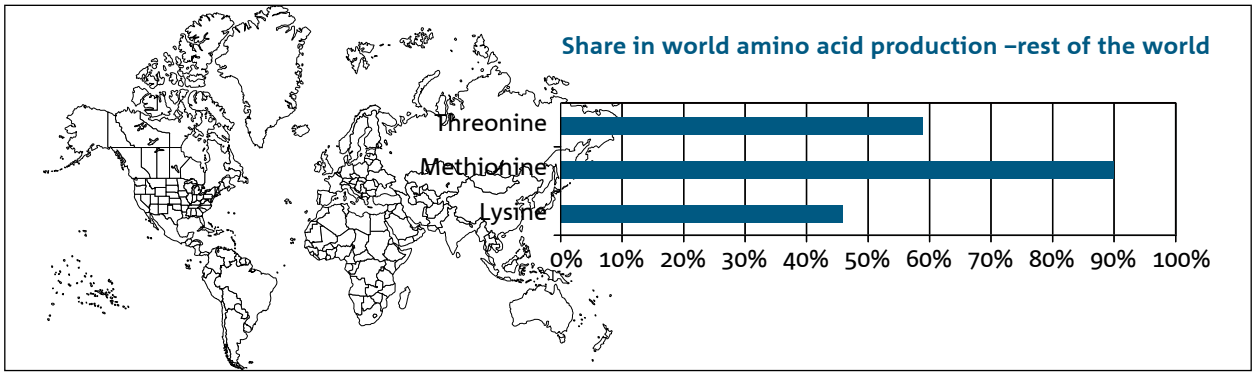
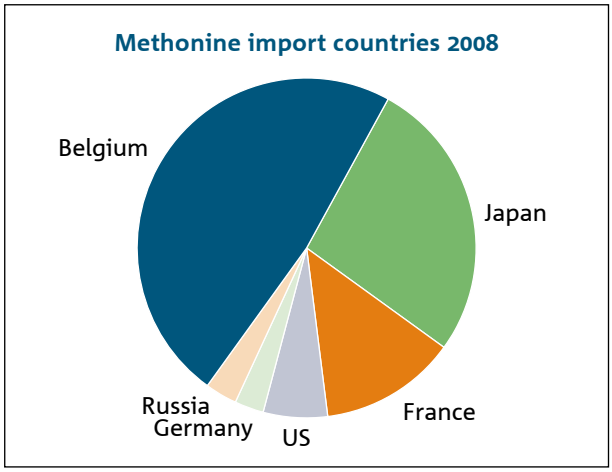


Figure 2.9: Methionine imports into China to origin country and Lysine exports out of China to country of destination.



3 Feed safety arrangements in China

3.1 Governance structure in China

A number of institutions are involved within the animal feed industries and deal with issues ranging from regulatory decree, quality assurance, safe production and circulations within the marketplace. The governance structure of the animal feed industry in China is explained via a flow chart related to the functioning of the most important institutions (Figure 3.1).

The Ministry of Agriculture (MoA) is the highest administrative department in charge of agriculture under the State Council and has the responsibility for the entire national administration and the supervision of feed and feed additives. Within MoA, their animal husbandry department is designed to handle this task. A special National Feed Working Office has been established within this department to overlook the tasks of feed industry. The tasks include developing feed sector development strategies, drafting sector bylaws and making decisions, promoting technology progress and product quality standards.

Vertically, the administrative lines fun from the top MoA directly to the provincial feed working offices, city and county feed working offices to township animal husbandry stations. These lower levels of feed working offices are typically established within the corresponding bureau of animal husbandry, under the local government.

Within the agricultural system, two other organizations called the National Animal Husbandry Station and the China Feed Industry Association are affiliated with the MoA. Despite the different names, they both are in cooperation in a functional organization engaged in animal feed, grass management and dairy industry. Their tasks extend to technology extension, sector data collection, quality assurance and certification.

In addition to the agricultural administrative lines, two other ministerial administrative organs need to be mentioned as well. Those are the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) and the State Administrative for Industry and Commerce (SAIC).

AQSIQ is in charge of national product quality, metrology, entry-exit commodity inspection, entry-exit health quarantine, entry-exit animal and plant quarantine, import-export food safety, certification and accreditation, standardization, as well as administrative law-enforcement. Furthermore, they also serve as entry-exit product control as well as certification and standardization, which are both highly relevant to the animal feed industry. The certification and accreditation is performed by the Certification and Accreditation Administration of the P.R. China (CNCA), while standardization is performed by the Standardization Administration of the P.R. China (SAC). Both CNCA and SAC are under the administration of AQSIQ.

The SAIC is in charge of market supervision and regulation and related law enforcement through administrative means. The objective is to maintain market order and protect the legitimate rights and interests of both the businesses and consumers within the market. Typically, SAIC handles the product circulations within the market lace through local bureaus at different administrative levels. The institutions involved in the feed industry and its relationships are illustrated in Figure 3.2.

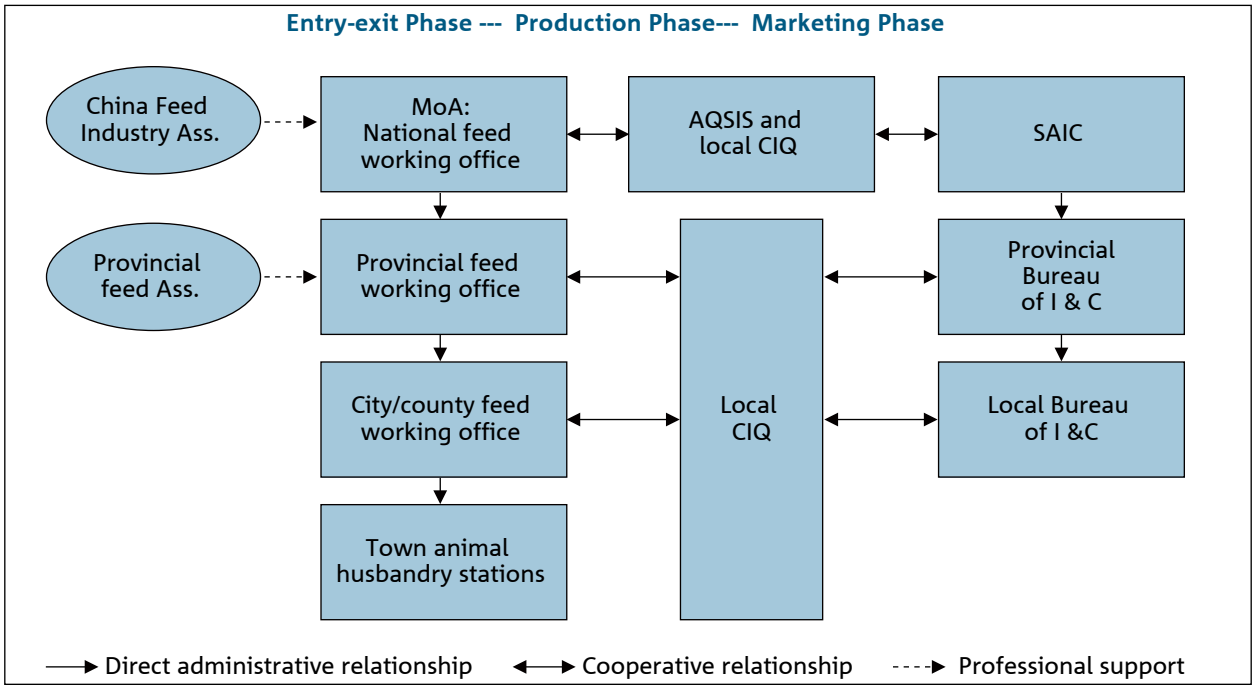
3.2 Feed safety laws and regulations in China

The National People's Congress (NPC) is the highest legislative authority in China. It is empowered to enact formal laws and rules. The State Council, head of the nation's executive, is empowered to adopt administrative measures, enact administrative rules and regulations, issue decisions and orders in accordance with those issued by the NPC. Within the State Council, there is an administrative office, the Legislative Affairs Office (LAO), which assists the Premier with legal advice and works together with different ministries in enacting administrative laws.

Before going into feed safety laws in China, it is absolutely necessary to introduce the Food Safety Law first due to the impact it has on feed laws. Following a spate of food scandals and five years of deliberation and review, the NPC gave the green light to the intensively-debated Food Safety Law on February 28, 2009. The law went into effect on June 1, 2009. On April 24, 2009, the State Council published the first implementation regulation related to the new law. The main impacts on Chinese food industry are as follows:

- Centralized government administration of food safety. Under the Food Safety Law, a Food Safety Commission is established under the State Council

Figure 2.7: Estimated share of China in the world production of amino acid (in%).



to act as the highest authority to oversee food safety throughout China. The commission will coordinate and supervise the main authorities responsible for food safety, including MoA, AQSIQ, SAIC, Ministry of Health and State Food and Drug Administration.

- Unification of food standards. Under the Food Safety Law, thousands of rules and standards that currently govern the Chinese food industry will be consolidated into one unified, published, national food safety standard.
- Three certificates to replace the old Food Hygiene Certificate
- Strengthened control over food additives
- Inspection exemption policy abolished
- Imported foods under stricter control
- Mandatory internal inspection and record system
- Stricter control over food-related advertisements
- Food recall system improved
- Increased penalties for non-compliance

It is under the principle of this new legislation, old regulations and bylaws related to the food industry that are constantly undergoing substantial changes.

As far as the feed industry is concerned, the current Feed and Feed Additive Regulation was enacted by the LAO of the State Council in May 1999. Two other ministries, Ministry of Agriculture (MoA) and General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) are involved in adopting the implementation methods under the leadership of the State Council. This regulation is compromised of the most important law system within the Chinese feed industry. The six management methods are supplementary documents to the execution by either MoA or AQSIQ of the aforementioned regulations.

1. Supervision and quarantine methods of the import and export of feed and feed additives (AQSIQ, relatively new, implementation date September 1, 2009)
2. Manage methods of safety production and hygiene of animal raw material feed (MoA)
3. Manage methods of feed production licenses of feed additives and additive premix (MoA)
4. Manage methods of approval numbers of feed additives and additive premix feed products (MoA)
5. Manage methods of the new feed and feed additives (MoA)
6. Manage methods of registration of imported feed and feed additives (MoA)

On February 20, 2010, the LAO published a revised version of the Feed and Feed Additive Regulations for public comments. This draft reflected the Chinese government's efforts in tightening the reins on animal feed to boost food quality and safety and can be seen as a consolidation of older measures with new requirements resulting from the latest announced Food Safety Law. It includes four chapters and 48 articles. The contents in the draft are double the amount of pages compared to the previous version. The main modification includes the following three main areas:

1. New feed and new feed additives. It clarifies the evaluation procedures and the responsible agencies for the new approval of new feed and feed additives. A monitoring period is also set forth for new feeds and feed additives. The scientist composition in the National Feed Evaluation Council is also spelt out.
2. Import and export of feed and feed additives. The registration procedures for first time imported feeds and feed additives are further tightened up. The marketing, packaging and labeling of the imported products are more refined.
3. Production, marketing and usage of feed and feed additives. A tracking and tracing system along the

feed supply chain is spelled out. Tough punishment for abusing the use of animal feed and feed additives is imposed. Producers should immediately cease production and sales of detective products, recall the products and report the situation to the relevant administrative authorities.

3.3 Feed safety supervision and Inspection

The inspection and monitoring of feed quality and safety in China is guided by a regulation titled "General Practices for the Monitoring of Feed Quality and Safety," issued by MoA on March 16, 2010 (amended version). This regulation standardizes the monitoring procedures, including sampling principles, testing requirement and monitoring the application of the results. Every year, the MoA makes national planning for each province concerning the size of samples and the subjects investigated. Based on the general national planning, each province works out its detailed monitoring strategy, often adding specific locally required sampling on the top of the MoA plan. Every half year, each province will report to MoA their sampling and testing results. MoA will pool the monitoring results and publish the results via their website, including the main results and the major problems identified. In addition to the general summarized conclusions, several blacklists for disqualified enterprises are attached as well.

These huge samplings are analyzed by 49 CNCA accredited institutions. These institutions are scattered throughout China. According to their main task, they are technically grouped into national level, ministerial level and local level. The task of the National Feed Quality Supervision and Inspection Center in Beijing is mainly focused on the research in developing new inspection methodologies. The ten supervision and testing centers at the ministerial level of MoA are guiding the implementation of the local centers in their regions, in addition to their daily testing and analysing of tasks. The remainder of the local institutes mainly carry out the route testing and inspection tasks.

3.4 Assurance schemes in practice in China

3.4.1 Domestic standard in China: China Feed Certification Scheme

In December 2003, the Management Method of Feed Product Certifications was announced by the Certification and Accreditation Administration of the P.R. China (CNCA) within AQSIQ. This is China's only domestic initiative available on voluntary feed and feed additives product certification. Its logo is presented in Figure 3.3. This management method was further elaborated by its Implementation Rules of Feed Production Certification announced by CNCA in April 2004 and later amended in August 2006. Although its scope is mainly focused on individual product certificates, the principles of the HACCP quality assurance system are clearly stated and required in the articles.

Several certification centers were accredited by the CNCA to begin certifying feed and feed additive products. The four frontrunners are HSL certification service (HSL), China quality certification center (CQC), Southeast standard certification center (SEC), China certification and inspection group (CCIC). In 2005, CNCA and MoA jointly announced that more than 100 feed and feed additive products were accredited by the China Feed Certification. A summary of the products and their locations are presented in Table 3.1.

Figure 3.3 The Logo of China Feed Certification

Table 3.1 A selection of certified feed products in different provinces

Provinces	Number of Companies	Certified Products	Certification Agents
Tianjin	1	Compound feed for meat ducklings	HSL
Hebei	3	Choline chloride	HSL
Shanxi	1	Concentrate supplement dairy cattle feed, compound feed for piglets	HSL
Shanghai	1	Compound feed for piglets	HSL
Jiangsu	3	DCP, compound feed for piglets, compound feed for shrimp	CQC
Zhejiang	1	Compound feed for suckling pig feed and laying ducks	HSL
Fujian	14	Compound feed for eel, soft-shelled turtle, laying ducks	SEC, CCIC
Jiangxi	1	Compound feed for piglets	CQC
Shandong	7	Compound feed for meet ducklings, growing period pigs, piglets, broiler and laying chickens	HSL,CCIC
Hubei	3	Compound feed for grass carps, broiler chickens and piglets.	CQC
Hunan	6	Compound feed for broiler chickens, growing period pigs, piglets and laying ducks	HSL,CQC
Guangdong	6	Compound feed for Nile tilapia, broiler chickens, growing period pigs and prawns	HSL
Sichuan	1	Compound feed for piglet and broiler chickens	CQC
Yunnan	1	Compound feed for piglets and broiler chickens	HSL

Source: http://www.chinafeed.org.cn/pages/fagui/browser.php?id=1276

3.4.2 International standards in China: HACCP, ISO9001, ISO22000, GMP+ FSA, Fami-QS

In addition to the Chinese government initiated China Feed Certification scheme, the following other assurance schemes, to a certain extent, have been adopted within the Chinese feed production industry: HACCP food safety management system certification, ISO9001 and IS 22000 quality management system certification, GMP Feed Safety Assurance Scheme (GMP+ FSA) and FAMI-QS (European feed additive manufacturers practices certification).

3.4.2.1 HACCP

The Hazard Analysis and Critical Control Point, also known as the HACCP, is a systematic preventive approach to food safety and pharmaceutical safety. It addresses physical, chemical, and biological hazards as a means of prevention rather than finished product inspection. Since 2004, the National Feed Working Office of MoA has started to promote HACCP assurance schemes within the China feed industry. The China Feed Industry Association has also published several books regarding the technical guidelines on HACCP principles and certification procedures.

3.4.2.2 ISO Series

The International Organization for Standardization, also known as the ISO, is responsible for the ISO 9000, ISO 14000, ISO 22000 and other international management standards. ISO 9000 is a family of organizational quality standards. The ISO 14000 family addresses various aspects of environmental management. ISO 22000 is an international standard that defines the requirements of a food safety management system covering all organizations within the food chain from “farm to fork.” ISO 9000 is the most widely applied ISO certification in the Chinese feed industry. The agency HSL publishes a list of all certified feed companies on their website, with a total of 178 HACCP and/or ISO certified companies by HSL.

3.4.2.3 GMP+ FSA

The GMP+ Feed Safety Assurance scheme (GMP+ FSA) is managed by GMP+ International and focuses on the control of safety of feed products within the entire supply

chain. Safety is focused on the safety of the animal products produced with the supplied feed from the perspective of the final consumers of dairy, meat and eggs. In the current GMP+ FSA scheme requirements for quality management like ISO 9001 and the principles of Hazard Analysis Critical Control Points (HACCP) are incorporated. Additionally, a feed industry focused prerequisites program has been determined.

The scheme covers all stages of the feed supply chain, such as collection, trade, storage, transport (sea vessels, inland waterway transport, road transport and rail transport), transhipment, processing, transport of feed ingredients and the production of additives, premixes and compound feed. One of the main characteristics of the GMP+ FSA scheme is the obligation that the entire supply chain must participate and be controlled. Otherwise, the final links in the feed chain would face the contaminations of feed, which is not manageable anymore and would result in a large financial damage and loss of reliability within the market in the view of the government and the food industries, the following links in the animal production chain.

Currently, more than 11,000 companies, located in 67 countries worldwide, participate in the GMP+ FSA scheme. In total, 35 of those companies (July 2010) are located throughout China. These Chinese GMP+ FSA certified companies are mainly producers or suppliers of feed materials and micro-components (such as trace elements). GMP+ International is searching for increased participation by Chinese companies. This will enable them to be linked to the most elaborate international standard regarding feed safety assurance and will enable them to create a level playing field regarding feed safety management internationally. For GMP+ FSA certified companies, it is easier to export to other parts of the world, especially to Europe.

In addition to the certification scheme, GMP+ International offers participating companies a large amount of relevant information and knowledge that was acquired during the longstanding experiences in varying situations, which are stored in the Feed Safety Database

Table 3.2 Comparison of selected quality assurance schemes in China

	China Feed Certificate	HACCP	ISO 9000	Fami-QS	GMP+ FSA
Scope Industry	China Feed	Global Food and Pharmaceutical	Global All	EU Feed	Global Feed
Target	Individual product	Preventive measures	System measures	Tracking and tracing	Whole feed chain approach

(FSD). The FSD contains generic risk assessments of feed ingredients, facts regarding characteristics of undesirable substances, laboratory testing results, which companies can use for their own feed safety management.

3.4.2.4 Fami-QS

In addition to HACCP and ISO, the assurance scheme of the European Feed Additives and PreMixtures Quality System (FAMI-QS) can also be found throughout China. FAMI-QS was designed by the European Association of Feed Additive Manufacturers, which includes all feed additives and premixtures. This scheme covers quality and feed safety management systems, traceability, product regulatory compliance, among all other areas. Most Chinese companies who have been accredited with these certificates are vitamin producers who are exporting partners to the EU markets. The leading agencies who are actively in the FAMI-QS certification scheme in China are SGS-CSTC standards technical services Co., Ltd (SGS), Bureau Veritas Quality International (BVQI) and HSL certification service (HSL).

3.4.3 Comparison of different quality assurance schemes in China

Table 3.2 compares a selection of quality assurance schemes relevant to the Chinese feed industry in terms of their scopes, industries covered and the main target of those schemes. China Feed Certificate is only targeting the safety of individual feed product in China, while Fami-QS aims to improve the transparency of the feed chain within the EU. The other three schemes are internationally orientated. HACCP is mainly focused on the food and pharmaceutical industry while ISO 9000 can be applied in many industries. GMP+ FSA is targeted on the entire feed chain approach.

3.5 Tracking & tracing

Tracking & tracing is another specific element that compromises quality assurance. This involves a system and a method whereby the most accurate and rapid traceability of irregularities in batches of feeds and feed materials is possible. Proper registration of details on batches of raw materials and feeds in the logistical process make it possible - in the event of contamination by an undesirable substance – to quickly organize a recall and to identify the source.

The Dutch animal feed industry has one of the most advanced quality assurance programs in the world that was developed in close collaboration with the dairy, egg and meat processing sectors. Dutch animal producers also aim to guarantee the highest quality standards. Livestock farmers that operate under the Dutch PVE/IKB and KKM quality assurance systems are required to use GMP+ FSA feed.

4 Feed Safety In Chinese Practice

Interviews have been conducted with Dutch compound feed, premixes and additive producers active throughout China. In these interviews the following items have been addressed and are described in the following chapter: production volume and market position, current feed safety arrangements in place, QC/QA management, bottlenecks encountered in relation to feed safety and opportunities to improve feed safety in the Chinese feed chain. Furthermore, a small analysis has been performed at two non-Dutch feed producers in China to gather insight on the same issues as mentioned for the Dutch producers.

4.1 Position of Dutch companies in the Chinese feed chain

Most of the large scale Dutch feed companies began participating within the Chinese market over the past decade. The first step in entering the Chinese market is establishing a representative office in China. Afterwards, a joint venture company with large Chinese enterprises or wholly capital companies is a established. Interviews were conducted with these large scale Dutch compound feed, premixes and additives producers, which list leading position in the market and help maintain the rapid growth seen in China. The main business and activities in China are as follows:

DSM

DSM began trading with China in 1963. Currently, DSM has been investing in China for over a decade. DSM China engages in actives that are divided into five clusters: Nutrition, Pharma, Performance Materials, Polymer Intermediates and Base Chemicals & Materials, which the total target revenues in China in 2010 has been set at 1.5 billion USD.

Animal nutrition is a stream business of the Nutrition Group. Ultimately, DSM plans to have five premix and blend vitamins plants in China by the end of 2010, located in Shanghai (established in 1997), Shandong (in 2006), Hunan (in 2008), Jilin (in 2009) and Sichuan (in 2010) province. This has allowed them to be one of the leaders in all foreign companies within the China premix industry.

In 2010, the company has continued to be very active and has increased their animal nutrition business investment. Their fourth premix factory, located in Changchun, Jilin province, is beginning practice in July of 2010 with an operating budget of 15000 tons per year. The fifth plant, located in Sichuan, is under construction with a budget of 18000 tons vitamins/blend vitamins and minerals production capacity. The latest factory will begin production in the beginning of 2012.

All DSM factories are ISO9001, HACCP and FAMI-QS certified factories with complete internal quality and safety management, including: barcode system, monitoring system, training system, tracing and tracking. The safety of employees, healthy production and a friendly environment throughout the entire production are DSM's primary concerns.

Vitamex

Vitamex (Vitamex N.V. Belgium) began investment in China together with DKSH (DKSH Switzerland) in 1994, which established a joint venture feed plant in Guangxi province. With business increasing, the two companies invested in a second feed plant in Jiangsu province in 2000 and the third feed production base in Tianjin in 2001.

By June of 2009, Vitamex had acquired all shares of the three feed production bases in China from DKSH and had become the wholly Vitamex investment company with more than 200 employees in China, with factories primarily focused on the production of premix.

In November of 2009, Vitamex established an export and import trading company in Shanghai for feed products to be imported into China from Europe and raw materials

Company Name	Production Bases	Trading Company or Operation Office	Main Products	Certification
DSM	5	1	• Vitamins • Blend Vitamins or Minerals • Premix	ISO9001 HACCP FAMI-QS
Nutreco	2	1	• Blend Vitamins or Minerals • Premix	ISO9001 HACCP
Provimi	3	1	• Premix • Concentrate feed	ISO9001
Sonac	7	1	• Blood processing products	ISO9001
Wellhope-De Heus	46	1	• Concentrate feed • Compound feed	ISO9001 HACCP
Vitamex	3	1	• Premix • Speciality feed	ISO9001 HACCP

sourcing in China to supply global factories of Vitamex.

At present, Vitamex China is using SCALA ERP software system. The company is applying their internal quality and safety management system, which is based on the Chinese state quality standards: GB/T19001-2000 and HACCP. Currently, the company has ISO9001 and HACCP certifications.

Wellhope-De Heus

Wellhope-De Heus International is a combination of a joint venture company together with a big Chinese feed group – Wellhope and De Heus International. The joint venture company is currently in the top 15 of the largest feed producers in the world. In China, the main area is the north-eastern part of China and Wellhope de Heus has a total of 46 production locations. By the end of 2010, they will launch five more new plants throughout China.

In 2009, a total output of approximately 1.9 million tons of premix, concentrate and compound feed for pigs, poultry, ruminants, fish and fur animals, with an equivalent of over 4.3 million tons of complete feed was produced.

Compound feed production is Wellhope-De Heus primary business focus and they specifically cater to the Chinese domestic market. The company is also involved in production of farm equipment, feed mill equipment and machinery, animal drugs, pigments and other feed additives, as well as taking part in broiler integration and planning to go into pig integration.

Wellhope-De Heus is one of the first ISO 9001 and HACCP certified companies within China. A Dutch Chief Technology Officer in Wellhope de Heus based in Beijing has been placed in charge of the entire group technology, feed formulations and quality control support.

Nutreco

Nutreco began sourcing vitamin products in the mid 90's, and now is one of the largest vitamin end users in the world for feed applications. More than 80% of raw materials that Nutreco global factories are sourcing in China are amino acids, Vitamins and micro minerals. Nutreco established an Asian procurement center in 2008. The key focus of the procurement center is the sourcing of raw materials from China for all Nutreco factories worldwide for consumption and international trading.

Trouw Nutrition China is wholly owned capital Nutreco company, which is the premix production business group of Nutreco. The business group has two factories located in Beijing and Hunan that focus on the blending of vitamins and premix production. The total production capacity of the two factories are 20,000 tons vitamins blend /year and 120,000 tons premix /year, respectively. Trouw Nutrition China is one of top three listed premix and blend vitamin companies in China mainly due to the fact that their products are directed towards the domestic Chinese market. Currently, the two factories are both ISO 9001 and HACCP certified. The safety and quality control is conducted by Nutreco Global internal management system – Nutrace. It is Nutreco's internal system that is applied to Nutreco companies worldwide and are open to all Nutreco internal companies, e.g. supplier information system, evaluation system, monitoring, sampling system, tracing and tracking, testing and analysis systems and risk analysis systems. Nutrace provides an efficient platform to all internal companies concerned with raw materials supply, production information and knowledge exchange.

Provimi

Provimi is one of the first large scaled international feed companies to participate in Chinese market. The company first arrived in China in 1997 in the form of a representative office in Beijing and began to increase in size until they established a factory in 2000. Currently, Provimi has three production plants that are all ISO 9001 certified factories. They are located in Lianyungang, Jiangsu province, Guangxi province, and Chongqing with a total capacity 60,000 tons/year for pig premix and concentrate feed production. Provimi is one the top ten premix production companies in all of China. Provimi has applied internal global safety and quality systems that are based on the instructions of Chinese state standard and HACCP.

"One Provimi" is the Provimi slogan for quality and safety issues. Uniform the quality standard of raw materials,

finished products and feed formulations is the principle of “One Provimi” slogan.

In addition to their production plants, Provimi has a representative office located in Beijing as their procurement organization for international raw materials trading, e.g. amino acid, vitamins and minerals. The main business is raw material sourcing from China (amino acid, vitamins and mineral products) and engaging in export business to Provimi clients worldwide and supplying the factories of Promivi.

Sonac

Sonac China is a joint venture company and the largest agricultural group in Europe, established by Sobel division of VION (65% shares) and Wuhan Enbi Biology Co., Ltd (35% shares). The headquarters is located in Wuhan and there are seven production bases located in Henan, Sichuan, Suzhou, Anhui, Shanghai, Jilin and Wuhan in Hubei province. The seven production bases are ISO 9001 certified factories and are currently applying for GMP+ certification within the next year in order to reach the same quality standards seen in Sonac Europe.

The joint venture company focuses on the production of animal blood during the slaughtering process and applying that to the animal feed fields. The total capacity of blood processing is up to 170,000 pigs per day. Their products are animal-origin protein, blood plasma and blood cell, all which supply the Chinese domestic market.

Sonac is one of the top three largest companies on animal origin protein production within China. The output in 2009 for blood plasma was 2,800 tons, the output of blood cell was 10,000 tons. Currently, products are mainly sold to the domestic market and the company has a planned strategy to expand export business to reach Europe and other Asian countries within the near future.

4.2 Current QA/QC management of Dutch companies in China

All of the companies that were interviewed in China strictly implement their own internal QA/QC management systems, which is the same management system that is applied worldwide to factories based on the ISO 9001 and HACCP certifications. The internal QA/QC systems and QA/QC departments in China are conducted by Dutch experts who combine Chinese quality and safety laws and regulations.

4.2.1 Supplier management

Sourcing raw materials from China for trading and supplying to global factories, is one of the key activities in China for most of the large scale international companies. The supplier management and raw materials quality and safety control is the most important sector for the entire QA and QC management. Not only is it essential within the entire feed production, but also because of stricter EU policies and regulations concerning the quality and safety of raw materials imported from China to EU countries due to the serious food / feed quality and safety scandals seen in China over the past few years.

Concerning supplier management issue, the companies all have complete internal supplier management systems, which include supplier assessment management systems, new suppliers management systems, sample analysis systems, auditing systems and approval systems. The qualified suppliers have ISO, HACCP or FAMI-QS certifications according to the different raw materials they export.

Moreover, the Dutch experts travel together with the Chinese employees, visiting the suppliers, completing the factory audits and reassessing operations each year in China to ensure the quality and safety of the raw materials.

Most often a number of Dutch companies have organized with Dutch and Chinese authorities. For example, the Dutch embassy in China or Chinese associations have worked together to conduct supplier training concerning quality and safety issues, specific company requirement instruction, new EU and international policies and regulations, International certification applications and to help Chinese suppliers improve the overall quality and safety arrangements. These types of seminars also provide a good platform for Dutch and Chinese to exchange tips on regulations and information.

4.2.2 Tracking and tracing

A complete and proficient tracking and tracing system and management is the basis for the entire production quality and safety control. It is also key in the daily routine for employees who are working on the first production lines to implement. In general, the basic product information can be traced according to the barcode or the batch number located on the product packing bags. Details such as plant information, production date, analysis report for each batch and samples information can be traced. The majority of the companies are targeting and working on the development of a complete tracing and tracking system to reach the same standards of the factories in Europe. For example, complete raw materials information and supplier information, distribution agencies and farms information.

4.2.1 Employees training

The companies that were interviewed placed a high emphasis on the training of their employees. Generally, in the companies that were interviewed they conducted employee training within internal companies 2-3 times a year. The Dutch QA and QC managers also visit China regularly for information exchange and exchange technological knowhow. The QA and QC managers who are working in the China factories visit the headquarters in the Netherlands 2-3 times a year to discuss training issues.

4.2.2 Logistics arrangement

An important sector, the transportation and logistics arrangement, is the link that connects the entire feed chain and affects the overall quality and safety arrangement. For the majority of the companies in the export business, they are buying from the producers directly. The logistics practices are as follows:

- The inland transportation to the port and shipments are all arranged by the suppliers directly;
- The suppliers deliver the goods to the port, the shipments are arranged by the buyers (the companies). The advantages of this practice are: the companies can choose the logistics companies that have long-term agreements or cooperation, the safety is more of a focus; the cost of the shipment transportation can be better controlled by the companies.

In terms of raw materials, inland transportation from door to door or door to port, the transport tools are typically trains or trunks. The conditions level of the trunks in China is diverse. For example, most of the vitamin products are delivered by 25 kg packing bags with trunks with close containers. However, it is normal in China for certain bulk materials such as corn to be transported by open trunks without packaging.

For the transportation of feed products, are mainly arranged by the feed companies. A number of the feed companies have their own trunks and logistic departments for feed transportation. Others cooperate with local logistics companies for door to door services to their distributors and farms.

4.3 Future QA/QC management of Dutch companies in China

4.3.1 Motivation to improve feed safety arrangement

In recent years, feed quality and safety are very hot topics especially after the melamine scandals in China in 2008. For feed companies, quality and safety improvement is closely related with all industries within the entire food chain, such us the safety and quality of crops industry, logistics companies, feed raw material suppliers and trading companies.

As the leading companies in the feed industry, and leaders in their specific areas, there main focus is on safety and quality. In the addition, new governmental laws and regulations, new requirements, client and market demands and trends are other key factors that motivate companies to keep improving on the feed safety and quality arrangement.

4.3.2 Bottlenecks in improvement applicable for the whole feed industry in China

- ***Lack of financial resources***

  In recent years, the feed supply in China is over the demand that the feed market can supply. As a result, especially in the small size feed companies, the real output is 2/3 or less of their production capacity. Many feed companies are running on very low profit or in some cases even losing money. The companies are struggling and do not have sufficient resources to invest in quality and safety improvements.

- ***Government policies***

  In general, governmental regulations are behind the current demand in the feed industry. A review in recent years has showed scandals related to safety and quality issues. The government has released new regulations and policies after these serious incidents occurred. After the melamine scandals, there has been increased transparency on safety issue in the public and the awareness and knowledge on food safety have increased throughout society. The Chinese government has announced stricter regulations concerning food safety in the beginning of 2009 and urged the safety and quality improvement within the feed industry. More complete feed regulations on safety and quality assurance urgently needs to be drafted and released.

- ***Lack of laboratory facilities and complete inspection system cross the whole food production chain***

  Small sized farms and slaughterhouses are still common throughout China. In 2009, 37% of pig farms in China were backyard farms and 35% of slaughtering houses were still manual slaughterhouses. The inspections by the government

in those places were difficult to manage and properly execute. There was a lack of laboratory facilities for analysis and testing. For example, for testing of residues. These small-scale farms and slaughterhouses can not arrange the quality and safety testing by themselves. Safety problems related to feed products could be difficult to be found in the first stage in the farms or second stage in the slaughterhouses. This increases the chance for bad quality and unsafe feed and food products to remain widespread within the market. This is also an obstacle for the motivation for the feed companies to improve the quality. With the increasing number of small sized farms/feed companies/ slaughterhouses in China that are integrated into larger sized within the industrial production in feed chain in the near future, the inspections systems through the entire sector in the food production chain can be much easier managed and executed.

4.3.3 Bottlenecks specific for the Dutch feed companies in China

- ***Lack of dedicated suppliers on raw materials***

  In general, the suppliers in China are price driven. The suppliers often easily break agreements and stop supplying because they are able to sell to other clients at a higher price, especially under the tight supply in the market. This brings serious risks to the supply of the total production.

- ***Farmers' lack of knowledge and awareness***

  The majority of farmers in China lack knowledge of animal nutrition, laws and regulations and awareness of the safety. This is due to the fact that most Chinese farmers have lower levels of education. To train the farmers on the knowledge and awareness of safety and quality issues and raise the awareness of laws and regulations will help farmers in using better quality and safer feed products, improve the efficiency of animal production with better safety arrangement. The higher safety and quality feed requirements by farmers can enhance the feed companies to produce higher quality feed products to meet the market demand. This will also contribute to a higher quality of food production.

- ***Different quality standard and requirement between EU and Chinese law***

  A number of Dutch companies are facing the problems on the implementation of the internal company system in China. Due to the different requirements between the company's standard and China's legal standard, Dutch companies need to be compliant with both systems. For example, the specifications are different between EU and Chinese law and a number of the testing items according to Chinese regulations but do not need to be tested in Europe or different analysis items compared with EU and Chinese regulations.

4.4 QA/QC management of Chinese companies in the feed chain

4.4.1 Case 1 (Foreign China-based company)

An interview was conducted with one of the largest foreign feed companies based in China, which has 22 plants throughout China, producing premix, concentrate feed and compound feed. The company is HACCP certified and is planning to apply for ISO22000 certification in the future. Their products are sold to the domestic market and comply with Chinese national standard according to Chinese state standards.

It is evident that there is a unique internal recall procedure in their quality and safety system, which is specially designed for the Chinese market, for adoption to the Chinese client demands and market requirements. Although no recall incidents have occurred, the company cooperates with its clients by organizing a simulated recalling practice annually, to ensure that the tracing and tracking system and recalling procedures run smoothly.

In addition to the common obstacles in the feed industry that were mentioned, there is another difficulty for companies concerned with the training of staff who are working on the first production lines. A phenomenon in Chinese factories and on the first production line is that workers prefer physical work than paper work. Companies must promote during the training program the importance of completing the recording and daily paper work to the workers.

4.4.2 Case 2 (Chinese company)

Two large scale Chinese feed companies were interviewed, both having a production capacity above a million tons per year. Both companies are ISO9001 and HACCP certified and their internal management is compliant with international standards. The motivation of safety and quality certification application for the Chinese feed companies is mainly for the company to market and promote the company's image branding. Another important reason is to develop the export business opportunities.

The QA manager from the one of the companies pointed out that most of the large-scale feed companies in China have ISO and HACCP certifications. The Chinese companies commonly use the certifications as marketing and promoting tools, and do not place a high priority on the improvement of routine work implementation, which should strictly comply with the assurance system. Also, compared with the Dutch companies, the Chinese feed companies put less investment on employee training issues.

References

ANFQ, 2010. An Overview of Aquaculture and Sustainability in China. The Ministry of Agriculture, Nature and Food Quality of the Netherlands. 46 pp.

Rabobank, 2008. China Feed Industry. Presentation by Jean-Yves Chow at VIV 2008, Beijing, PR China.

Annex 1: Overview of the main additive producers in China, their location and their production capacity (expressed as estimated share in world capacity).

Additive	Company Name	Location	Production Capacity
Vitamin A	XP	Zhejiang	30%
Vitamin B1	Tianxin	Zhejiang	40%
Vitamin B2	Guangji	Hubei and Henan	50%
Vitamin B3 (Niacin)	Lonza	Guangdong	Close to 100%
Vitamin B5 (Calpan)	Xinfu	Zhejiang	30%
	Xinfa	Shandong	
Vitamin B6	Tainxin	Zhejiang	80%
Vitamin B8 (Biotin)	Shengda	Zhejiang	40%
Vitamin B11 (Folic Acid)	Xinfa	Shandong	30%
	Niutang	Jiangsu	30%
Vitamin B12	Duowei	Ningxia	40%
	Yuxing	Hebei	
Vitamin C	Weishang	Hebei	20%
	Luwei	Shandong	
	Welcome	Hebei	10%
	NEGPC	Liaoning	
	Tiger	Anhui	
	Jiangshan	Jiangsu	
	DSM	Europe	10%
Vitamin C-phosphate	Tiger	Anhui	30%
	Tianyin	Hebei	30%
Vitamin D3	NHU	Zhejiang	40%
	Garden	Zhejiang	30%
Vitamin E	DSM	Europe	50%
	XP	Zhejiang	
	NHU	Zhejiang	
Vitamin K3	Brother	Jiangsu	60%
	Peace	Jiangsu	40%
Choline chloride	NB Group	Shandong	70%
Inositol	Zhucheng Haotian	Shandong	60%

Annex 2: China import and export of vitamin A, B1, B2, B6, B12, C and E, including countries of origin and destination (source: BOABC)

IMPORT					
29362100	Vitamin A				
			2008	2009	Jan. to Apr,2010
		Total	1,121,074	542,689	252,908
	331	Switzerland	547,350	256,912	111,076
	304	Germany	252,679	63,647	58,093
	305	France	248,537	193,046	68,392
	302	Denmark	44,776	16,750	6,050
	502	USA	27,712	12,009	9,292
	309	Netherlands	20	325	5
29362200	Vitamin B1				
			2008	2009	Jan. to Apr,2010
		Total	78,142	84,762	1,425
	304	Germany	66,400	78,860	640
	502	USA	8,159	2,410	322
	116	Japan	2,370	740	200
	142	China	1,000	2,700	
	111	India	213	52	243
	309	Netherlands			20
29362300	Vitamin B2				
			2008	2009	Jan. to Apr,2010
		Total	414,400	423,104	168,421
	304	Germany	246,114	346,311	46,720
	133	South Korea	149,300	73,600	121,310
	143	Taiwan	11,000		
	502	USA	7,805	3,145	320
	116	Japan	181	48	71
29362500	Vitamin B6				
			2008	2009	Jan. to Apr,2010
		Total	7,915	16,840	11,163
	502	USA	6,260	22	180
	304	Germany	925	16,480	10,660
	142	China	600	320	300
	111	India	78	15	21
	116	Japan	52	3	2
29362600	Vitamin B12				
			2008	2009	Jan. to Apr,2010
		Total	39,466	12,642	1,676
	305	France	36,002	8,000	
	331	Switzerland	2,300	2,841	900
	302	Denmark	975	1,651	726
	116	Japan	185	150	50
	129	Philippines	4		
29362700	Vitamin C				
			2008	2009	Jan. to Apr,2010
		Total	193,221	124,591	21,522
	303	UK	108,645	91,890	18,026
	305	France	27,952	2,974	1,005
	116	Japan	24,847	12,514	2,423
	402	Argentina	20,000		
	502	USA	11,677	17,213	68
	309	Netherlands	100		
29362800	Vitamin E				
			2008	2009	Jan. to Apr,2010
		Total	5,877,838	5,678,790	1,905,573
	331	Switzerland	3,851,854	4,310,408	1,360,168
	304	Germany	1,116,343	1,005,358	393,370
	305	France	516,213	15,034	17,511
	502	USA	368,106	330,885	125,919
	302	Denmark	25,282	17,075	8,605
	309	Netherlands	40	30	

IMPORT					
29224190	Lysine		2008	2009	2,010
		Total	21,787,217	21,006,378	21,006,378
		USA	10,180,142	12,639,503	12,639,503
		Brazil	9,825,075	6,592,500	6,592,500
		South Korea	1,584,000	1,164,700	1,164,700
		Thailand	99,000	297,000	297,000
		China	99,000	312,675	312,675
29224110	Lysine				
			2008	2009	Jan. to Apr,2010
		Total	1,465,805	1,823,330	6,009
	410	Brazil	1,365,000	1,822,500	6,000
	502	USA	100,048	25	9
	116	Japan	702	800	
	136	Thailand	50		
	304	Germany	5	5	0

EXPORT					
29362100	Vitamin A				
			2008	2009	Jan. to Apr,2010
		Total	2,954,726	1,975,540	713,680
	304	Germany	1,464,379	847,392	345,393
	502	USA	1,159,510	778,292	280,062
	309	Netherlands	116,890	65,536	18,728
	410	Brazil	45,396	22,637	6,680
	141	Vietnam	36,640	76,190	16,206
	501	Canada	32,380	12,650	14,300
	116	Japan	28,480	34,815	9,126
	301	Belgium	25,300	44,600	3,500
	236	Nigeria	24,200	52,300	12,900
	111	India	21,551	41,128	6,785
29362100	Vitamin B1				
			2008	2009	Jan. to Apr,2010
		Total	2,772,185	3,344,619	1,320,430
	502	USA	1,259,740	1,376,833	684,520
	304	Germany	319,750	390,050	153,850
	309	Netherlands	224,975	392,750	70,050
	111	India	186,135	221,250	93,200
	301	Belgium	155,875	129,260	57,210
	305	France	151,535	169,490	50,900
	116	Japan	150,936	152,271	30,225
	112	Indonesia	114,615	200,125	73,000
	136	Thailand	104,900	150,025	43,425
	141	Vietnam	103,724	162,565	64,050
29362300	Vitamin B2				
			2008	2009	Jan. to Apr,2010
		Total	1,676,190	1,368,425	604,770
	502	USA	423,258	434,840	218,020
	304	Germany	355,990	259,115	150,650
	111	India	219,985	134,500	79,300
	309	Netherlands	217,535	167,445	15,510
	132	Singapore	134,640	107,005	61,540
	301	Belgium	76,125	59,500	19,500
	410	Brazil	70,482	87,510	17,780
	303	UK	66,895	35,060	20,775
	133	South Korea	55,710	48,950	12,945
	143	Taiwan	55,570	34,500	8,750

EXPORT

29362500	Vitamin B6				
			2008	2009	Jan. to Apr,2010
		Total	2,259,438	2,745,093	1,061,217
	502	USA	726,453	866,091	368,025
	304	Germany	336,160	405,325	184,625
	309	Netherlands	271,720	327,975	59,600
	305	France	169,850	192,575	51,500
	116	Japan	159,100	206,002	118,025
	111	India	133,755	160,800	72,257
	132	Singapore	132,800	175,625	38,300
	112	Indonesia	126,725	199,450	95,100
	301	Belgium	107,225	80,000	37,500
	410	Brazil	95,650	131,250	36,285
29362600	Vitamin B12				
			2008	2009	Jan. to Apr,2010
		Total	461,201	85,809	18,725
	309	Netherlands	127,129	120	101
	502	USA	94,156	24,498	13,438
	304	Germany	91,639	204	19
	410	Brazil	55,783	20,199	86
	132	Singapore	40,635	25,430	170
	133	South Korea	15,059	7,263	2,927
	111	India	11,157	4,860	1,873
	301	Belgium	10,004	9	1
	141	Vietnam	9,011	1,889	45
	429	Mexico	6,628	1,337	65
29362700	Vitamin C				
			2008	2009	Jan. to Apr,2010
		Total	66,418,960	58,522,618	27,459,059
	502	USA	24,653,429	21,159,768	10,532,409
	304	Germany	12,778,880	12,752,560	6,440,175
	116	Japan	10,209,305	8,790,565	3,304,165
	309	Netherlands	5,236,860	3,918,335	1,475,875
	301	Belgium	4,393,125	3,594,500	1,665,300
	303	UK	2,577,660	2,483,800	696,530
	410	Brazil	2,142,790	2,122,576	1,240,165
	307	Italy	1,682,760	1,427,820	1,137,060
	412	Chile	1,373,800	832,825	402,500
	133	South Korea	1,370,351	1,439,869	564,880
29362800	Vitamin E				
			2008	2009	Jan. to Apr,2010
		Total	25,932,208	24,482,560	9,806,707
	502	USA	9,596,078	9,285,485	3,185,416
	304	Germany	4,628,320	4,703,260	2,597,435
	309	Netherlands	4,180,140	2,907,510	1,291,790
	116	Japan	1,468,280	2,303,180	663,096
	133	South Korea	1,340,330	1,292,995	434,865
	136	Thailand	1,189,740	1,022,280	412,450
	301	Belgium	1,156,200	1,111,580	477,665
	410	Brazil	918,290	385,405	106,180
	132	Singapore	755,870	843,150	343,590
	601	Australia	698,960	627,715	294,220