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CHINA FOOD SAFETY AND SYSTEMIC DESIGN

Case Study of Dairy and Rice Industries in China and Chongqing City,

to Systemic Design a Possible Solution for China.

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BACKGROUND

The Situation Behind The Truth

Safety is always an issue when food industries modernized, and not just in China. Historically, western nations had similar experiences – and they still see problems today. Food borne illnesses have been documented on every continent over the last decade, according to the World Health Organization.

On food safety problems, the world shares common roots: **the profit motive**, **an imbalance of information between producers and consumers, inadequate laws, rules and weak regulation**.

But different nations approach these problems in different ways, through legislation, judicial practice, governance and social response. **China's most notable characteristic** here is that it **lacks a mature food system and a modern consumer movement**, and consumers as a group are relatively unsafe about making choices and getting their voices heard. Lu Fang of Jilin University's philosophy institute believes this is a key reason for China's worsening food safety problem.

Many people consume basic foodstuffs produced by small businesses in a barely regulated sector. Various authorities fire out orders, while conflicting standards paralyze enforcement efforts and businesses seem like they're competing to reach new ethical lows. It's an industry that operates more on tacit understandings than rigorous controls. Scientific research serves to **increase output and appearances**. Unregulated markets are chaotic, **waste is widespread and anything goes as long as it cuts costs.**

Over the years, China has seen in the same sequence repeating itself time and again: exposure, outrage, falling sales, fears and government intervention. **By 2008**, the turning point of Sanlu infant milk powder incident, startled the whole China**.** In the incident, at least six babies died and a further 860 were hospitalized after drinking milk laced with the chemical. The reputation of a whole food category was destroyed overnight.

Whenever doubts were raised about any particular product, the farmers growing foods suffered serious losses, due to food safety problems. And food production has been further concentrated in the hands of large scale industrial farmers.

As food safety problems have worsened over the decade, many experts have argued that elements of the public's attitude to food safety are misguided, such as zero-tolerance for risk, exaggerated fears about chemical pollution and a tendency to conflate fake brands and unsafe foods. Behind this expert view is the assumption that food production should be regarded not just as a part of the agricultural chain but as a modern food industry.

Nevertheless, the food supply chain in China is long and complex, stretching from primary crops in the field to processed products, from agriculture to industry.

The present research is focused on **OBEJECTIVE: Dairy and Rice Safety of China**, to discuss the reasons of recently serious food safety incidents in China. Dairy is a diet produced by animal, and liquid; rice is plant, and solid. Both of them are ordinary food in China, and are suitable for researching.

The **OBEJECTIVE** of this research is to present the **Three Main Steps** to analyze the food safety in China, and design a better industry system in Chongqing city:
- Background study of food safety issues in China, to summarize the why and how;
- Case study of dairy and rice industries in Chongqing city, to detail local questions;
- According to systemic design concept, to find a possible solution for food safety in China.

Systemic Design Methodology:

This article has adopted the systemic design methodology, due to its advantage in solving the problems in food industries, decreasing output, as well as making more profits and jobs.

As a designer, the concept of sustainability has been regarded as a core value of a project. According to the systemic design methodology, which treat the output from a system as a new raw material able to input in a new system. New products and more jobs can be achieved while designing the new system (Luigi Bistagnino, 2008).

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Part 2: CASE STUDY OF CHONGQING

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PART 4: CONCLUSION

INTRODUCTION:

This article followed the **4 parts** to proceed the research on food safety in China:

Key words: *Food Safety, Dairy, Rice, Chongqing City, Systemic design.*

PART ONE: Background Study. According to researches, it is summarized four types of food safety incidents in recently 10 years : the Adulterated Food, Food Additives, Pesticide Food, Fake Food; according to the analysis of Dairy and Rice Safety incidents, there are four main reasons caused food safety issues: Agriculture, Policy Control, Social Supervision, Industry System**.** Therefore, this research proposed two possible solutions: one is to track food safety from agriculture to consuming by coding, so that everyone can achieve every details of food they chose by scanning the different code; another is to design a better systemic industry, which is safer, more ecological, more profit, less pollution.

PART TWO: Case Study of dairy (Chongqing Tianyou Dairy Group) and rice (Chongqing Qiaoping Rice Group) industries in Chongqing City**.** Discover more details and local problems. To the aspect of dairy, It is found that the dairy cow diet is the key point, which means china Holstein cows eat worse than that of Europe, because of the lack of Alfalfa, so that a better cow diet is suggested; to the aspect of rice, without illegal food additive, but a good agriculture, rice should have an original good quality.

PART THREE: Systemic Design. According to part two, the cow diet may act as the breakthrough. Due to the researching on the cow diet proposed by Tianyou group and many other researchers, Algae, Mushroom Chaff, Rice Wine Grains, Rice husk have been tested to be good choice for cow diet. Therefore, according to systemic design concept, Industries: Dairy, Rice, Mushroom, Fish, Rice Wine, Algae, are taken into account to design a better industry system of Chongqing. From Output to Input, from quantity to quality, a better system of agriculture and industry is designed to gain more profits of about three times, more products, less pollution. To the aspect of dairy cow diet, due to more nutrient materials (5% more protein, 0.4% more fat, 4% less fiber), the production of Chongqing dairy milk may rise 10% amount, and more nutrient content which may reach the China Raw Milk Standard.

PART FOUR: Consequence and Discussion. According researching above, Systemic Design has developed the food industry system in Chongqing city, realized ZERO emission, more

profits, more products. The more important is this new system indeed has the potential to solve the food safety problems in China, turning from a linear industry to a systemic industry, from a chemical agriculture into a sustainable agriculture,from mass output into a ZERO emission, from harmful to sustainable to environment and humans.

DISCUSSION:

1, According to the new dairy cow diet designed by Tianyou Dairy Group:
The nutrient content in raw milk designed for Chongqing City can reach the China Dairy Standard. While The result is still need to be tested forward, and to be developed

2, In the systemic design, more details should be considered more deeply, such as the packaging, transportation, the waste shipping, the air emission, more suitable diet plan, and more possible systemic solution, all of which can give the solution to China's food safety and sustainable development

3, More concepts such as Food Traceability System, and Food Safety Packaging, Community Supported Agriculture (CSA) can also go on research by means of systemic design, to design a consummate food system in China

4, Finally, food safety should come back to our ourselves - producers, as well as consumers, should work together to rebuild the social trust of food

Map 1: Keywords of China

PART 1: BACKGROUND STUDY

China, as it is known to all, has changed totally due to the development in recent years. While along its developing, there still are many questions, specially on the food safety issues, which has scared the whole society. This article is focused on the food safety in China, to discuss and research a possible solution on this critical problem.

1: 10 YEARS - FOOD SAFETY ISSUES IN CHINA

1.1 History From 2007 To 2017

In recent 10 years, Food Safety in China has been the subject of widespread attention and heated debate. **This complex, systemic problem has so many dimensions.** With this series of articles, Chinadialogue has sought to open up the conversation around food safety with government officials, academics, civil society groups and industry experts. This has been tried to examine the root causes of China's current food crisis and, in so doing, to focus further attention on this important topic.

According to researching, there were a large number of food unsafe incidents that have happened in China, which has evoked a great concentration of the China public, even international medias. Poisonous food appeared in China generally performed in **several types as below.** (Yunxiang Yan, 2012)

Four Types of Food Safety Issues

* The first and more ordinary type is **the Adulterated Food**. For more profits, food manufacturers prefer to the cheaper or inferior raw materials to make their food products. In general, they are regarded as the dangerous. In most cases, these inferior foods were processed to be renewed with chemicals, so that they can be sold at a higher price due to the outlook of good quality and safety. For instance, the coloring unripe strawberries with carmine dye, which appeared fresh and light red, appropriate as the other good quality strawberries. Another example is in 2010 that Chinese people consumed three million tonnes of illegally

Four Major Types of Food Safety Incidents

10 YEARS - FOOD SAFETY ISSUES IN CHINA: A BRIEF HISTORY

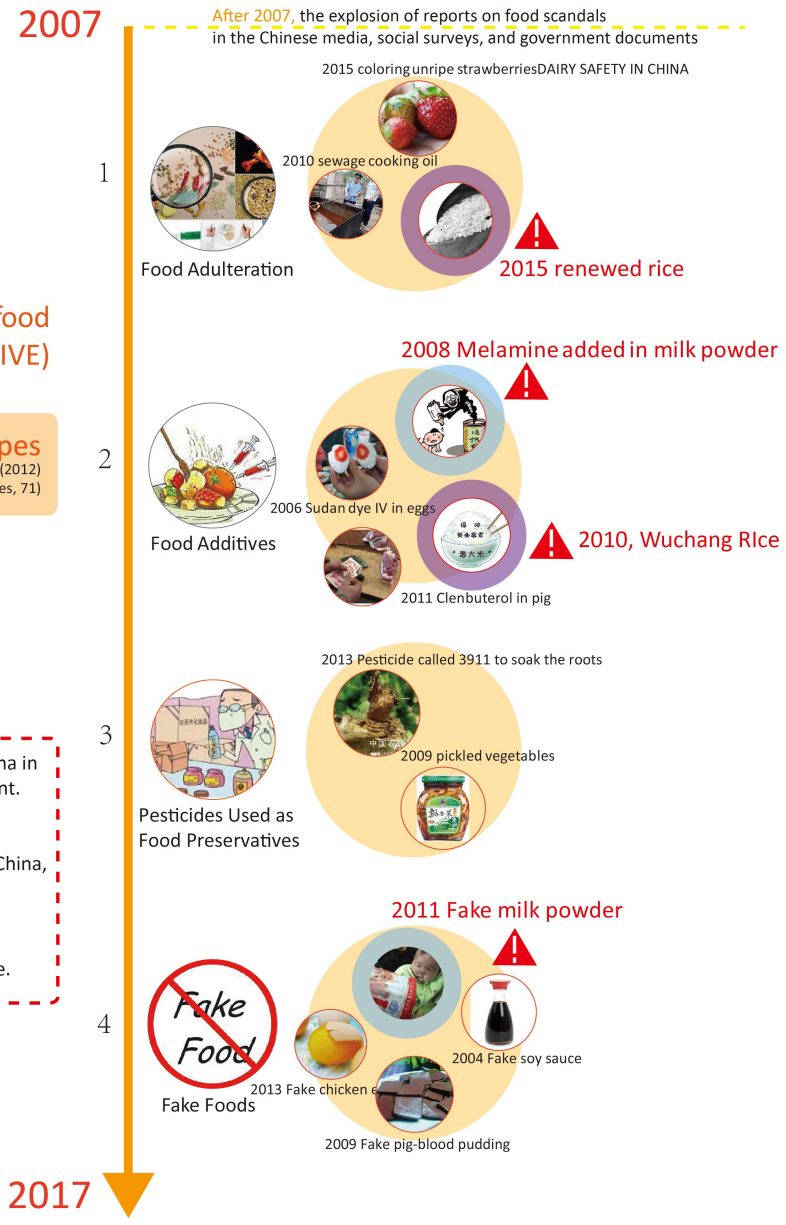
Poisonous food
(CHEMICAL FOODS OR FOOD ADDITIVE)

Four Major Types
(Yunxiang Yan (2012)
(Food Safety and Social Risk in Contemporary China. The Journal of Asian Studies, 71)

The poisonous food has been well known for the public in China in past 10 years, which caused lots of attention of the government.

This term of "unsafe food", "food safety" has spread through China, up to now, numbers of food issues have shocked the society, even be commented by aboard.

Besides, the Risk of Trust, caused the Challenge to Governance.



Map 2: Summary Map of Food Safety Incidents Between 2007-2017

recycled cooking oil.

He Dongping, a Chinese food-safety expert, who led a research group in a multiyear project of investigation of the large-scale production and circulation of sewage cooking oil, asserted that the cooking oil was widely found in little restaurants or bars, and food-processing factories, even in private homes. In a word, the cooking oil probably was utilized to prepare one of every ten meals around China (Barboza, 2010).

* **Food Additives**, as the second common type, are mixed with a variety of toxins or chemicals into the food processing chain. Such as antibiotics, colorants, and hormones are quite frequently inserted as food additives into animal feeds and processed food goods. The most startle incident shaking the whole China, was in 2008 **Sanlu Infant Milk Powder Incident**, which was mixed illegally the Melamine into milk powder while processing, and caused the horrible renal failure of infants. What more critical, was the mistrust of the public to China domestic dairy industry, which leaded the expansion of the foreign milk powder imported into China. Up to now, the foreign milk powder regarded as high quality and safety dairy product, has accounted a large number in the China milk market (Yunxiang Yan, 2012).

Nevertheless, several well-known incidents, such as in 2010 **Wuchang Rice Incident,** which was one of the most famous rice producer in China. The low quality rice was processed with flavouring essence to become good appearance, while this illegal processing would harm our health; another incident was the illegal using of Sudan dye IV to feed chicken or ducks so that these animals can produce eggs with red yolks, or using ciprofloxacin, enfofloxacin, flavomycin, or adding the melamine into a various of foods. More illegally, farmers may openly use some food additives, such as clenbuterol, which has long been forbad by the governmental standard. This food additive was sold in the market called in the Chinese name, ”shouroujing”, in the meaning of “lean meat powder.”

* The third type, is right the direct application of **Pesticides** into the food processing chain. For the majority of food producers, pesticides can be regarded as cheaper and efficient preservatives, such as the incident of pickled vegetables in Sichuan province. Besides, from 2000 up to now, the pesticides were used on thousands of acres of chive fields.

* The last type, too extraordinary to be ignored, is the **Fake Food**. In 2010, the case of **Fake Milk Powder** made of starch in Anhui province, has challenged the public imagination. Numerous of toxic chemicals were adopted to create the fake foods, as well as cheaper and inferior materials to instead of good quality raw materials.

Fake soy sauce made out of human hair and other chemicals were reported in 2004, in which the human hair can be collected as some kind of recyclable wastes at a low price; the fake chicken eggs made out of only water and chemicals appeared in domestic market from different regions in China in 2005 and 2007; and the fake pig-blood pudding also made out of water and chemicals caused another poisonous food incident in 2009.

Despite of government efforts to publish the new 2009 Food Safety Law, these fake foods, such as fake soy sauce, fake beef, and fake milk powder continued to emerge in China market in 2010, and more seriously, some of which have ranked the top-ten most influential criminal cases (Zou, 2011).

Therefore, the well known ‘‘Poisonous Food’’ has scared the public in China along years, which caused much attention of the government. This term of ‘‘Food Safety’’ has grown up through the whole China, even recently, there still are numbers of food safety issues damaged the social trust and public health, some of which even be commented by aboard.

Government Effort

Even though from 2007 to 2017, following a decade of scares, China has made a concerted attempt to tackle the problem posed to human health by unsafe food through improving its legislative framework, research capabilities and coordination efforts. It passed the Food

Safety Law and established three new bodies: the State Council Food Safety Commission, the Food Safety Risk Evaluation Expert Committee and the Food Safety Standard Examination Committee. The hope was these structures would help to stop products carrying toxins or other harmful substances from entering the food chain.

Thus, during 2015-2018, food safety incidents decreased. But the problems are still there, and the public is still complaining. New standards for Rice and Dairy products put together by the Food Safety Standard Examination Committee – a process that took more than a year and reportedly involved intense debate and fraught cross-departmental coordination before it produced a set of 60 rules – were a particular disappointment. Considered even weaker than regulations from the 1980s, they were described in some media as a "historic step backwards".

In a word, this reflects how deep-rooted and difficult to resolve China's food safety issues.

1.2 Focus - Dairy and Rice

Over the past 10 years, the problems posed to the food sector by China's industrialization have become clear, and the society has paid a high price. By 2005, China has suffered scares not only over vegetables, meat, dairy, rice, but also over hotpot broth, pickles, noodles. Thus, Illegal additives and the risks in the processing industry have become the focus of concerns.

Among those food safety incidents discussed above, there was a more serious one that startled the whole China, "**The 2008 Melamine Milk Scandal".** In the incident, at least six babies died and a further 860 were hospitalized after drinking milk laced with the chemical. In the crisis that followed, risks were identified at all the major firms in the industry. The reputation of a whole food category was destroyed overnight. If we cannot keep our babies safe, what will happen to the future of China?

Except the turning point of dairy safety, rice as our Chinese most ordinary food, should be also taken into account. **In 2010, "The Wuchang Rice Incident"**, let Chinese know that our good quality rice was incredible processed by illegal food additive. Besides, **in 2007 and 2017, Cadmium Rice Incidents**, also exposed the problem of our soil.

Rice is the more basic food in China, if something bad happened to it, what will happen to us?

*The **STUDY OBJECTS** chosen are focused on the **Dairy and Rice Safety** in China.*

2: DAIRY SAFETY IN CHINA

2.1 Background

A history of Chinese milk

Yesterday

Traditionally, Chinese diets were primarily vegetable based; dairy products were not commonly consumed and were perceived as therapeutic food for the elderly, the infirm and the young. Economic growth and urbanization, along with the more sophisticated marketing channels that have accompanied these trends, have led to significant changes in dietary patterns, and milk and other dairy products are slowly being incorporated into the diet. (Fuller and Beghin, 2004). Fuller *et al*. (2004) reported that milk consumption doubled between 1996 and 2003 in households in the lowest 10 percent of the income distribution.

The dairy industry has gone through a process of transformation, away from a system characterized by smallholder suppliers towards a modern food production. Initially it was produced almost exclusively by scattered, local breeders, and delivered directly and fresh to the consumers.

Many middle-aged Chinese city-dwellers can still recall going out early in the morning as children and collecting milk from the farm truck as it went on its rounds. Each household would return two empty glass bottles, and receive full ones in return. The milk they took home needed to be consumed quickly.

A storage and transportation chain that can operate within the time so that the natural raw milk stays fresh, is like a sort of membership system, through which a local area is supplied via a series of designated stops – a **"Local Production, Local Consumption" model.** In China, this system was shaped by the storage and transport conditions of the time, and received the support of the state-run farms widespread under the China planned economy.

The emergence and popularization of processing techniques including pasteurization, extended the storage time and transportation distances of dairy products. Some regional dairy brands began to quicken their pace of development towards to a modern food industry. In most provinces, breeding farms became bases for provincial dairy brands to be established. These brands began to carry out basic production, handling sales over a relatively long distance.

Today

China's dairy industry developed quickly after 2000. There were several famous regional brands emerged in China: Sanyuan Dairy in Beijing, Guangming Dairy in Shanghai, Wandashan Dairy in north-east China and Sanlu Dairy in the north. In 2004, per capital milk consumption stood at 18.4 kilograms, marking an average annual increase of 20.64% since 1998 (Chen, 2006).

While things changed between 2002 and 2005, when brands like Mengniu Dairy and Yili Dairy – with substantial financial backing – entered each province and took control of their milk resources. With technical support from packaging firm Tetra Pak, a furious dairy product offensive was waged. As well as the introduction of modern processing technologies, including **Ultra-High Temperature Pasteurization** has enabled inter-regional transportation of dairy products from areas of surplus production, generally in the north and west of China, to areas of very high population, especially in eastern China (Fuller and Beghin, 2004).

Many dairy products has already been sold in China ordinary supermarkets, such as liquid

fresh milk, UHT milk, yogurt, milk powder, even cheese and ice cream. Nevertheless, many regional brands were knocked flat. Even relatively stable supply relationships and price negotiations were challenged. Yili Dairy and Mengniu Dairy came out on top. Dividing up the milk resources, they quickly established **a Brand System** covering the whole country (Lu and Zong, 2008).

Map 3: The Dairy Brand System in China

Mengniu Dairy

Guangming (Bright) Dairy

Yili Dairy

Sanlu Dairy

Wandashan Dairy

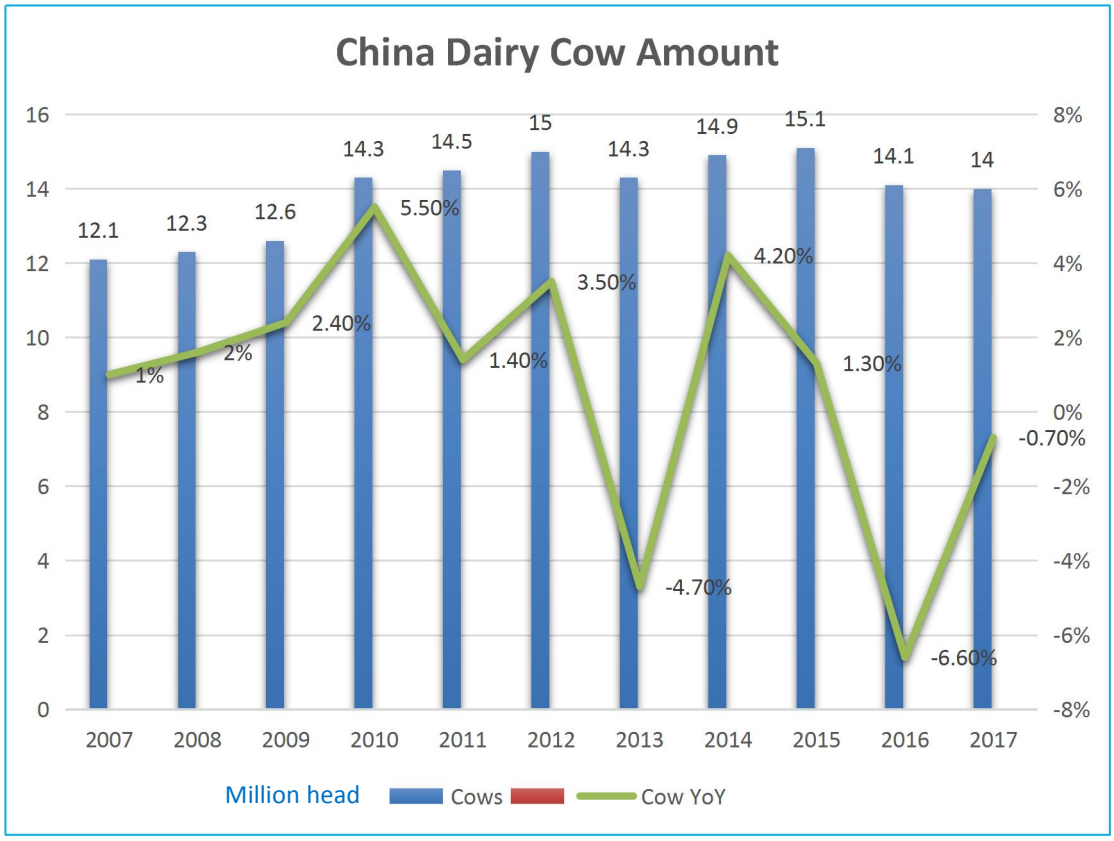
Sanyuan Dairy

Mengniu and Yili became the leading national brands, while others like Guangming, Sanlu and Wandashan continued their regional focus, at the same time as extending into other regions. Many other local dairy brands produced and sold within the confines of their local provinces. But they were now up against national players, who enjoyed an advantage not just in storage and transportation, but also in price.

Map 4: Ordinary Dairy Products Consumed in China

This dairy system transformed from a locally processed product to a modern commodity, which was possible to keep at a room temperature for 30 days, easy to store and to transport. By 2008, China's total milk output was over 37.8 million tonnes, five times more than that in 1998.

From that on, China has emerged as a country in the global dairy market. In 1949, there were only 1.2 million dairy cows in China (Greenfield, 2003). By 2004, there were 10.6 million, and there had been growth rates of 16.4% per year since 1998 (Fuller and John et al, 2007). By 2011, China had 14.4 million dairy cows. Chinese people came to accept milk and developed the habit of drinking it. While by 2017, the number of cows decreased, which may caused by the quality of cows, and the cost of breeding, so that the import of raw milk, and cooperation with foreign dairy companies are increasing, to satisfy the requirement of Chinese people.



Map 5: The Graph of China Dairy Cow Amount during 2007-2017

Why the number of China dairy cows decreased? There are several reasons.

The Scare, 2008 Dairy Incident

The China's dairy industry has been in a precarious state since 2008, the year of the **Sanlu Milk Powder Scandal (**Fred Gale, 2009), when babies across the country were poisoned by melamine-tainted infant formula milk powder. This incident revealed to the world in garish hues the flaws in China's milk industry, including deep structural problems. This was too big a failure to be passed off as the result of just one brand's poor quality control.

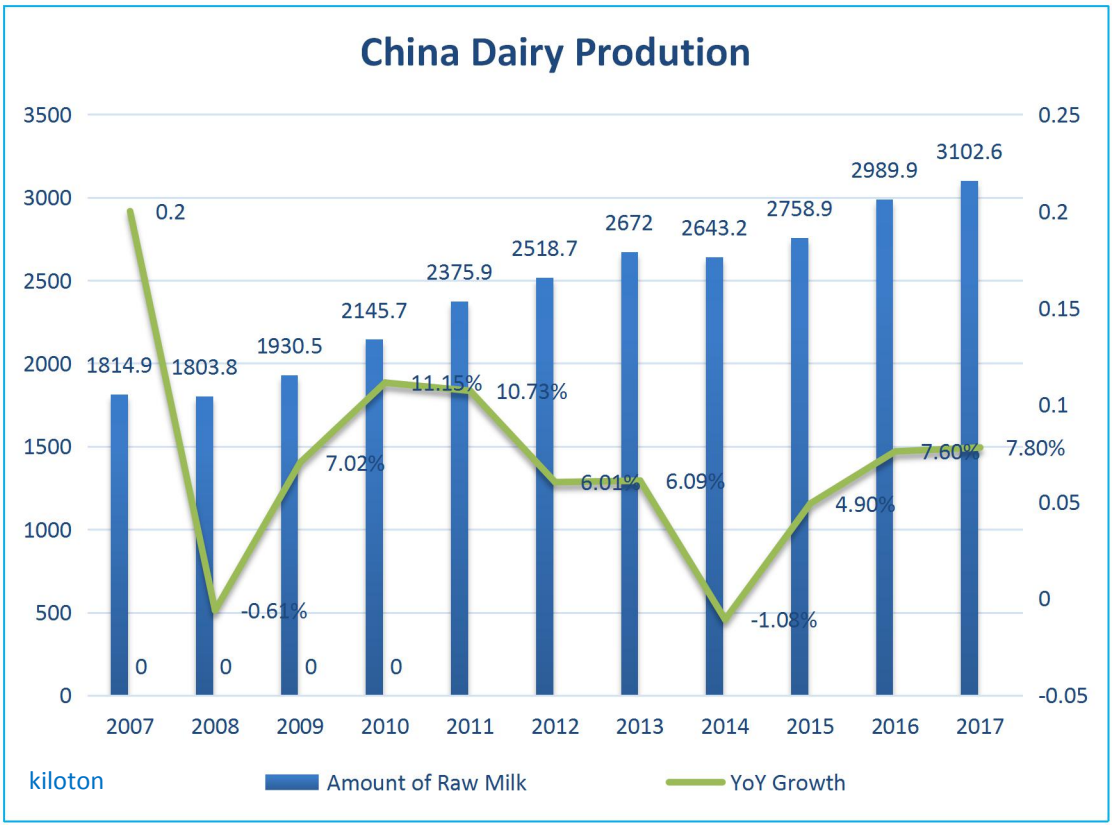
When it comes to the problematic relationship between agriculture and food industry in China, this is a case study worthy of analysis.

At this turning point, the introduction of improved-performance dairy animals and genetics from the United States, Canada, Europe, Australia and New Zealand, as well as adoption of improved feeding and management practices has greatly increased the productivity of China's dairy industry (Beghin, 2006). As a result, China's dairy production has surged from just over 10 million metric tons in 2001 to a level of nearly 39 million metric tons in 2009,

making China the third largest milk producer in the world, trailing only the United States and India (USDA, 2008). This is an astonishing average annual rate of growth of 26% since 2001 (Qian and Guo, 2007).

The Influence to Economy

According to the official report on China Dairy Production and investment, during 2007-2014, China dairy production developed year by year. While in 2008, due to the Sanlu infant milk powder incident, it decreased.



Map 6: The Graph of China Raw Milk Production during 2007-2017

Since in 2008 the melamine incident, the scale of China's dairy farming increased year by year, while china's dairy was not changed the drawback of the **Mass Input and little Output** fundamentally. One cup of milk in China from the "born", has a price three times of that in world average.

According to statistics, China's raw milk prices have rapidly raised double from 2.25/kg in 2007 to 4.5/kg this year, and about one-third higher than the world average price, and the number 4 in rank of the world dairy (Li, 2009). Persistently high prices of raw milk is the main reason that prices of dairy industry as a whole are high, and corporate has a low profit.

Why the price of raw milk remains high?

One of important reasons is farming costing too much. The majority of cow diet is based on forage. while because of the low quality of the local grass, it leads to a mass of imports of **high-quality forage (Alfalfa)**, which increased suddenly the cost. The reason is that, alfalfa is one of the main factors to improve raw milk production, of which the quality in China is lower than that of imports, so that big enterprises as Yili Dairy and flying crane used 90% of alfalfa from imports (Yoo, 2010).

According to China statistics, in 2011 China Alfalfa Production was about 30 million tons, while total imports reached 276,000 tons. From January to August in 2013, China has imported 435,800 tons of alfalfa, an increase of nearly 60% .

In addition, the level of intensive dairy farming is inefficient, which raised the cost of raw milk. The vice president of Guangdong Provincial Dairy Association, Mr. Wang introduced, at present in a pasture of dairy heads 1000, mostly there were employees of 30-50 people, personal cattle breeding of 20-30 heads, while the per capital of breeding abroad are more than 100.

Another reason is the temperature. Summer is always the high season for milk production but the low season for milk consumption, while winter is on the opposite. This has given way to the natural market behaviour of prices dropping in the summer and rising in the winter.

This cycle impacts directly on milk farmers. One farmer said: ‘‘At the start of term and during holidays, we can sell all our milk. People from the factories come down and grab it. But when they don’t want it, you could even take it to their factories and they’d still refuse to buy it from you. In a single year, there will be three or four dips like this. The milk from one cow can vary somewhat in quality,’’ he continued,‘‘depending on the time of year. But it is factories which have the final say on the testing standards. If they say it’s too high then it’s too high and if they say it’s too low, it’s too low.’’ (Yoo, 2010)

According to some expert estimates, if it can be solved problems of the forage, land, labor, at least China raw milk prices will fall by 10%. Besides, the waste has the problem of no recycle. It means too cost of input, to much of output!

As a result, due to the attention of the China public, the development of dairy cow, species and breeding condition, are focused. This may caused the decrease of the number of cows, to eliminate the low quality cows from the farms, but keep the good ones. On the other side, this may also increase the breeding cost, to achieve a healthier dairy cows and raw milk of a higher quality.

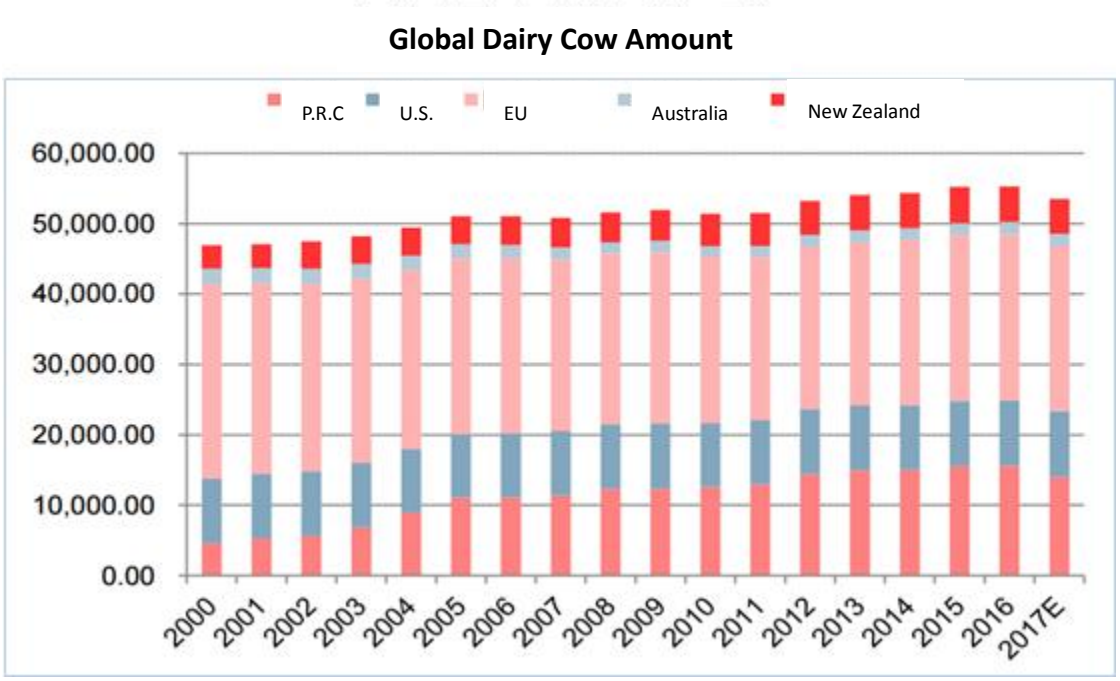
Future

Trends in Production and Consumption of Dairy Products

According to OECD and FAO, the milk and dairy sector will remain one of the fastest-growing agricultural subsectors over the coming decade in terms of production, only exceeded by poultry meat and vegetable oils. They project global milk production will expand at an annual rate of two percent over the period of 2012–21 (Fuller, Huang, Ma et al, 2006), similar to that of the last decade. Again, most of the expansion in output is projected to occur in the developing countries.

All developing countries and regions are projected to see sustained growth in production, with the highest rates of growth in sub-Saharan Africa and India. Growth in China is projected to slow as the industry has matured. India is projected to consolidate its position as the world's largest producer, increasing its share of global production from 16.4 % to 18.8 %.

Emerging issues and challenges



Map 7: Global Dairy Cow Amount

According to China Industry Development Institute, Since 2017, the dairy industry has continued growing as in 2016. In the period from January to April, 2017, the total dairy output of enterprises was 9.031 million tons, an increase of 1.5% year-on-year, and the sales volume in the first quarter was 6.791 million tons, an increase of 3.70% year-on-year. In the past two years, the yields and sales of dairy products in China have steadily increased, but the growth rate was still low.

In the world, those leading dairy producers and exporters are cutting back, and their total number of cows also is failing, such as United States, European Union, New Zealand as well as China, all of which will continue to fall in the short term. According to USDA data, the 27 European Union countries had 23.545 million cows in their inventory at the beginning of 2017, which was 50000 heads less than that in last year. New Zealand has been affected by major natural disasters in the past two years, and the impact of the earthquake on cows continued last year. In April 2017, it suffered the worst hurricane in 50 years. Hurricane "Cyclone Cook" registered from the North Island of New Zealand. Many cows in New Zealand were transferred. Pasture was also soaked, and this wet environment have an impact on dairy production from 2017. New Zealand's dairy powder prices have also rebounded in the past two months.

In the United State, the number of cows s was 9.349 million at the beginning of 2017, an increase of 39,000 heads from last year, an increase of 4.2% year-on-year. The number of cows in China was about 14 million at the beginning of 2017, which was 1.6 million heads less than that in 2016, an increase of 10.26% year-on-year.

While, on the contrary, the rapid rise in aggregate consumption of milk is propelled by increasing numbers of people with rising incomes, changing from primarily starch-based diets to diets containing growing amounts of dairy products. The underlying forces driving this trend – primarily population and income growth and urbanization – are set to continue, and the potential for increased demand remains vast in large parts of the developing world.

Besides, the consumption of moderate amounts of dairy and other livestock products has important nutritional benefits, but the rapid growth in production and consumption of these products also has a number of possible harmful effects:

* The expansion of livestock production increases the demand for feeding, the pressures on the **land and water resources**, and in particular, the livestock sector's impact on climate, which pushed the output of **greenhouse gas (GHG)** emissions.

* The increasing number and concentration of animals in more intensive production system increases the contact between people and animals, rising the risk of spreading diseases and the passage of disease agents between animal species and from livestock to humans. The intensification of livestock production may also marginalize smallholders further, with serious social implications.

2.2 Analysis

To summary up the dairy safety issues happened in China recently, it is obviously that even those famous dairy groups in China has also been involved in the eddy of food addictive and microbiological exceeded.

And almost there is none of the dairy brands in China escaped from the eddy of dairy safety issues, of which products have a various of problems, no matter of their fresh milk or milk powder, yogurts.

The most critical dairy safety issue undoubtedly was the Melamine adulteration in infant milk powder, which shocked the whole China in 2008, and been reported in large numbers of foreign newspapers. This incident not only waked the public consciousness of dairy safety, but promoted the reconsideration of the government and company to reinforce their strategy and planning of milk processing and investment. While facing the incoming of foreign dairy company, the domestic dairy companies are also forced to challenge themselves to improve their present equipment and cow feeding system as well as milk processing procedures.

Domestic Dairy Brands and Dairy Safety Issues

Sanlu Dairy Group

2008.06 Infant Milk Powder "Melamine Incident" startled the whole China

Mengniu Dairy Group

2008.09 Fresh milk products involved in "Melamine Incident"

2011.04 Students poisoned after drinking Mengniu milk

2011.12 Fresh milk exceeded of Aflatoxin

Shengyuan Dairy Group

2010.08 Infant milk powder "precocious incident"

Wandashan Dairy Group

2010.05 Multiple batches of substandard food in yogurt sampling test

Bright Dairy Group

2011.08 Fresh milk with maggots

2012.06 Superior milk products were inspected caustic ingredients

2012.07 Two batched products were inspected exceeding of total number of colonies

Yili Dairy Group

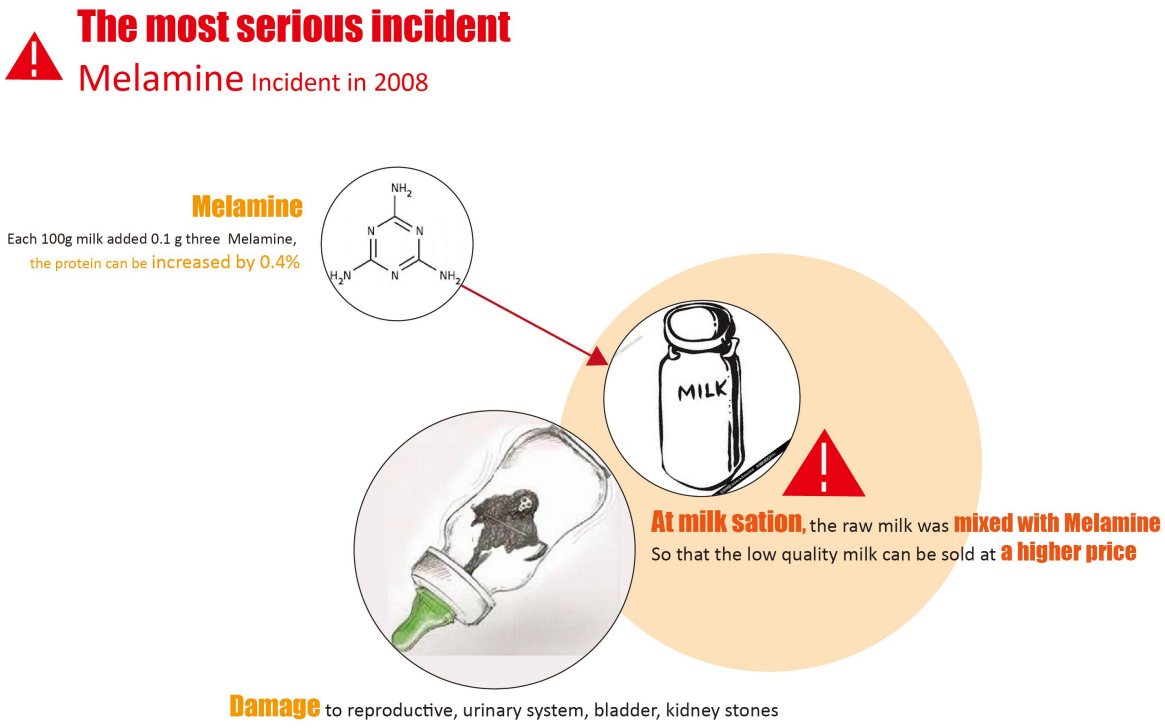
2012.06 Dairy Powder Products of level 2-4 were tested with animal mercury

Nanshan Dairy Group

2012.07 Beihui Infant formula milk powder inspected Aflatoxin M1 exceeded

Map 8: Domestic Dairy Brands and Their Dairy Safety Issues

The following is the investment of Melamine adulteration incident in 2008, and the research gave a brief study of its reason and affection.



Map 9: The Fact of Melamine Incident in 2008

Melamine Adulteration Issues

Melamine and other "protein powders" (Fred, 2009) were added to watered-down milk to increase its apparent protein content. One journalist described what a rural milk merchant routinely added to a 10-ton truckload of milk: 5-7.5 kg of "protein powder" which included melamine or other protein-enhancing substances, 6-7 bottles of hydrogen peroxide, 20-30 packages of gentamicin (an antibiotic), 4-5 ml. of vitamin C, 10-15 kg of whey powder, 2-2.5 kg of fat, and sometimes sulfuric acid which he stirred in with a rake (Xu and Chen et al, 2008). The truck driver kept a bottle of hydrogen peroxide under the driver's seat to add surreptitiously before the milk was tested.

> **The Sanlu Dairy Company** has devised the "small-farm procurement strategy" in Hebei Province since the 1980s, providing cows and technical advice to farmers who paid off loans in milk. In some villages a piece of land was set aside as a "dairy production zone" (*yangzhi xiaoqu*) where cows were centrally housed and milked. Local governments provided land and other support for establishing supply chains, including the building of

> milk supply stations and logistics centers to collect milk from small farmers. Other companies adopted this small-farm supplier model. Some companies signed contracts with farmers that specified the sale price for raw milk.(Fred Gale, 2009).

Up to 2006, dairy industry statistics estimated that about 60% of milk was produced by farms with 20 or fewer cows, including 35% produced by farms with 1-5 cows. Large farms with over 500 cows accounted for a significant 9% share of production but small farmers were clearly the dominant suppliers of raw milk. Data from China's second agricultural census showed that 87 % of dairy cattle were held by nearly 2.8 million household-operated farms in 2006. A significant share of cattle is held by non household farms--enterprises, state farms, collectives, and institutional farms—which accounted for 13% of dairy cattle. The average number of dairy cattle held by household dairy farms was 5 head (compared with 336 for non household farms).

In 2007, *The New York Times'* investigation of wheat gluten adulteration had revealed the long-established practice of adding Melamine and Cyanuric Acid to animal feed to increase the apparent nitrogen level but it was not widely known in China until after the milk adulteration incident (Barboza, 2007).

The low protein content of milk produced by poorly-fed cattle raised on small farms may be one factor that encouraged adulteration.

Zhu Juan (2008) noted that animals with poor diets and weak disease resistance produce milk with low protein and fat content. Zhang et al. (April 2008) reported that protein levels were low in milk produced by small-scale farmers. Microbial contamination may also be higher; Zhang et al. also reported that only 20% of small-scale "backyard" farmers use disinfectant prior to milking, compared with over 90% of large-scale farms.

The scramble for raw milk supplies during 2007-2008 and soaring prices of milk and feeding have created strong incentive to water down milk or accept substandard milk at a time when adulteration was apparently increasing. According to research, the severe cost-price compass in 2008 pushed the industry into disorder. Dairy companies competing to buy scarce milk paid less attention to quality. One farmer in Hebei Province declared that

representatives from dairy companies regularly called or went door to door offering to buy milk directly at a premium price during this period (Hebei Youth Daily, 2008).

Farmers in Shandong Province complained that companies' quality standards adjusted with market demand—they were willing to accept any milk he delivered when demand was strong, but rejected similar milk (in mid-2008) when the companies had abundant inventories of milk. Feeding price increasingly becoming higher and higher after 2007/08 has squeezed profit margins for farmers (despite rising milk prices) and may have induced farmers to choose the poor-quality (less expensive) forage that reduced the cow milk productivity, and further possibly reduced protein and fat content in raw milk. Due to prices soaring, and limited supplies, milk producers had incentives to water down raw milk. While, farmers were put in embarrassment by rising feeding costs, and less growth in raw milk collection prices also had incentives to water down raw milk, even though reports in the news media suggested that farmers were not responsible for the adulteration (Barboza, 2007).

According to tracking the incidence of Melamine adulteration over time, the increased frequency of infant illnesses during 2008 that brought the scandal to light probably reflects an intensification of the practice. For more details, it was found that the problem came from the origin - the farming, as well as the processing. It means the **agriculture and food industry** always play the key role while taking about food safety.

Dairy Farming

The recent development of the dairy industry has been characterized by hundreds of dairy companies branching out geographically from their home province or city to gain greater retail market share and to expand their milk supply base.

In China, dairy farms now concentrate in the northeast and southeast China, due to its advantages of geography and climate. Especially, the farms located in Inner Mongolia have more benefits, due to their fresh grassland, and forage of good quality, such as Alfalfa. And those big ones are almost state-owned, while the small ones are founded by individuals.

In 2017, four big dairy companies — **Yili Dairy** (private-owned, www.yili.com)**, Mengniu Dairy** (private-owned, www.mengniu.com)**, Sanlu Dairy** (state-owned, bankruptcy)**, and**

Bright Dairy (state-owned, www.brightdairy.com) — accounted for nearly half of dairy sales. Besides, more than 700 dairy companies split the other half of dairy sales, most of which ar smaller, and private.

Map 10: The Location of Dairy Farms in China

Big Dairy Enterprises in China

Bright Dairy Group (Guangming Group), the early leader in the industry, began as a state-owned milk supplier for Shanghai. Two other companies have emerged from Inner Mongolia. Yili Dairy, now China's largest dairy company, began in the 1980s as a local food processing company in Inner Mongolia, and Mengniu Dairy was established in 1999 when a group from Yili Dairy formed its own company. Other major players are identified with a specific home base. Wandashan Dairy is based in Heilongjiang and Sanlu is based in Hebei Province, both northern agricultural provinces with abundant feed resources. Several provincial and city governments in northern China made the dairy sector a focus of local economic development.

The rapid growth of China's dairy industry has stimulated a great deal of new investment in the industry, both domestic and foreign. Major dairy processing firms have been established

in grassland areas of Inner Mongolia and around major cities. They have developed complex purchasing and distribution networks to enable quick and efficient movement of milk and dairy products to consumers across the country (even though milk still is regarded as a luxury item by most low income families).

In 1998, **Yili Dairy** started to invest capital in the establishment of independent milk stations with mechanized milking equipment. Each milk station had construction costs of around 500,000 yuan (US$79,000). The following year, **Mengniu Dairy** took the lead in another unprecedented initiative – a milk station established through a social cooperative. Niu Gensheng, founder of the Mengniu Dairy Group, explained the logic: ‘‘Someone in the industry wants to set up a milk station and needs 400,000 yuan and I have 40,000 yuan to spare.’’(Xiu and Klein, 2010). Mengniu Dairy took control of milk resources from which the milk station collected a management fee. In only a short time, this model boomed. Many private individual milk stations popped up, as well as milk stations operating under the banners of various organizations, and ‘‘opening up channels for dairy farmers to get rich’’ all over the country. The price at milk stations upstream and downstream in the industrial chain varied by as much as 0.5 yuan per kilogram.

Niu Gensheng was well versed in the operational logic of grassroots communities. He explained that, ‘‘Inside every village in cow-farming regions, there are always those with money and those with power. **When you combine the money with the power, milk stations become a reality.**’’ The ‘‘rich and powerful’’ have placed themselves at the centre of production chain.

Regardless of the size of a business, it must rely on the milk station to obtain its raw milk.

This brings it’s own issues. As long as these milk stations have the right connections, if they have any problem with raw milk quality, all they need to do is give the inspectors a call and quote the batch number, thus ensuring its smooth clearance.

Some businesses have devised measures to prevent these ‘‘connections’’ from disrupting milk quality. Some have specially accredited employees enforce strict regulations; companies who transport milk change their route once a month, and rotate their milk-station inspectors on a fortnightly basis.

Small Dairy Farms in China

Up to now, in China there are more than 20 dairy farms in operation, which are all modern and equipped (Zhiyan.org, 2017). Most of them are located in the north of China, because the climate and temperature are suitable for dairy farming. While even though these farms are with a total capacity, it is still not enough for Chinese people, and there still exist many small and private dairy farms all around China.

Small dairy farms in Inner Mongolia

Those small dairy farms have many potential problems: first, the cows raised in small farms, eat worse, and in a poor situation, so that their raw milk has a content of lower dairy protein and less fat. Some dairy companies with small national market shares are still dominant in their home city or province.

Example of Traditional Herders in Inner Mongolia

Local dairy herders are losing their livelihoods as industrial farming booms in Inner Mongolia. Good news for big companies; bad news for local small business and the environment.

Shu Ni reports:

''Despite years of visits to Inner Mongolia, I have never heard of dairy

giants purchasing milk from naturally grazed cattle.''(Qian and Guo, 2007)

A herder Gereltuya's home in Inner Mongolia's East Ujimqin banner is about a kilometer from the main road. It's another 200 kilometers to the milk-processing plant in the city of Xilinhot. Her two nearest neighbours are at least a kilometre away.

Lantu, a dairy herder in Xulun Hoh, also known as Plain Blue banner, is 8 to 10 kilometre from the main road, and then another 10 kilometre from the town. Alateng Sukhbataar, in Hexigten banner, grazes his cattle 8 kilometres from the main road. From there it is 150 kilometre to the government seat. Given these typically long distances, the herders would need to take their cows on a journey of over 100 kilometre, twice a day, to reach an automated dairy collection station. This means their cows'milk will never make it into the factories that produce and package cartons of milk.

China's dairy giants only purchase raw milk that has come from a sterile environment. Hand-milking is not permitted: the cows must be taken to a robotic milking machine twice a day.

What does that mean for the farmers?

In the city of Baotou, there was a man surnamed Zhang, the owner of an automatic milking system (Qian and Guo, 2007). Zhang made 2 million yuan in the trucking business, which he invested in dairy farming during a so-called ''milk boom'' in the region. Nearby farmers come to his plant to have their cows milked.

As the plant is near the milk packaging factory in the city, the transportation costs are lower and the profits are higher. The dairy farmers who use his plant come from small towns, far from the grasslands, so they use straw and cornmeal as fodder, rather than grass.

Zhang's records shows that costs of breeding increased, while milk prices only rise slowly, so that farmers' profits are decreasing. Since there are only two large companies, Mengniu and

Yili Dairy Group, by dominate milk purchasing, farmers have little choice about who they sell to. Milk doesn't keep long; it must reach a factory at the day it is produced, so there's little scope for bargaining. The companies can delay payment, but the farmers have to keep delivering the milk or they will have to dump it. Consequently, Zhang has lost much of his initial investment of 2 million yuan, and many other farmers nearby even have switched away from dairy business.

Those small companies only supplied local markets. They couldn't build up brand recognition elsewhere. But they closed links with the local herders, and others nearer to the main roads could deliver their milk twice a day. The companies' standards were appropriate for the area. The milk produced locally was thick and creamy; it was milked by hand, and the local firms permitted this. In most of the cities, there had once been a local dairy processing firm. But these have now either closed down or been bought up by big Chinese or international companies.

So, where have all the cows that used to graze naturally gone?

For instance, Gereltuya's family own 20 cows – all local breeding and hand milking. The milk is fermented and made into butter or a traditional food known as "milk tofu", mostly to be eaten at home or given to friends. Only a small amount is sold. (Qian and Guo, 2007)

Thus, dairy production is split: on one side, the milk of pasture-grazed cattle does not reach industrialized supply chains, in a good natural quality, but is processed into traditional foods by herders. On the other side, large-scale dairy farms on the edges of cities and on main roads, sell their raw milk to big companies. While their cattle fed on fodder based on straw and milked robotically, producing raw milk in a lower industrial quality.

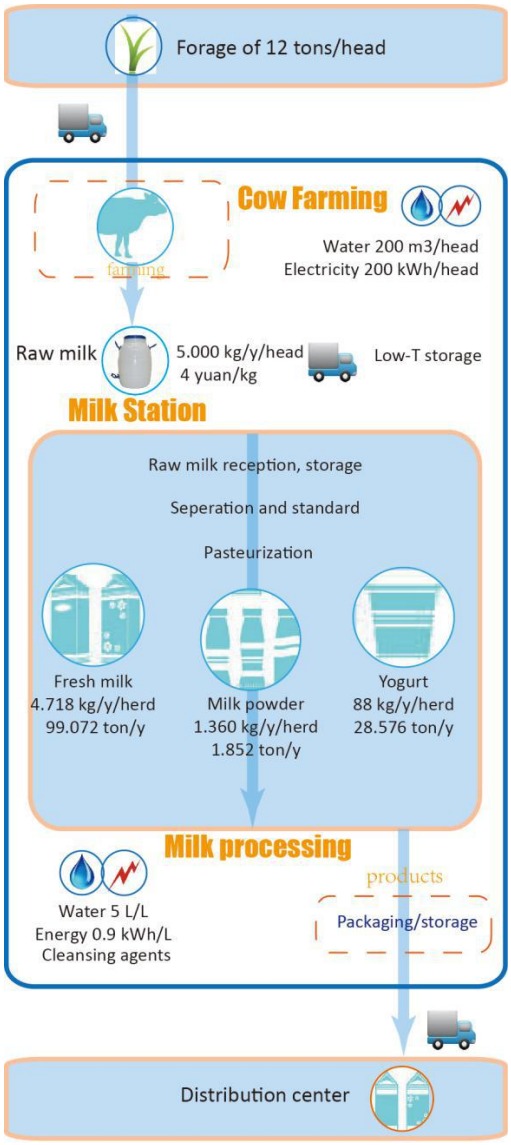
The Key Points

Dairy Farming & Milk Station

Different dairy companies provide different situation in dairy farming and milk processing. While, the milk station always play a key role in the dairy supply chain.

Milk stations can provide a solution by acting as an intermediate channel in dairy business. To quote one dairy farmer: "The milk produced doesn't come into contact with our hands. It doesn't even come into contact with the air." For businesses, having to negotiate and

transact with such a large number of dispersed milk farmers also pushes up costs. In the face of all of this, the dispersed milk farms had no space whatsoever in which to negotiate. They began to depend on the milk stations for their livelihood.



Map 11: the Processing Map of Dairy Industry

Milking Stations

According to the discussion above, It came into existence, turning the milk production model into one of **"Decentralized Farming, Centralized Milking**" (Zhang, 2008). On the surface, this was clearly rational: centralization of goods and equipment would surely guarantee the quality of milk in the primary chain. While in the behind, gray zone of illegal processing may also exist.

Discussion

Like many other Asian countries, China has a short history of consuming dairy products. The high rate of lactose intolerance in Chinese people (Greenfield, 2003), and the lack of refrigeration, all have extended periods of food shortages through several periods in the 20th century, while the animal production was discouraged (Fuller et al., 2007), and other factors also led to a very small and disaggregated dairy industry, and one of the lowest levels of per capital milk consumption in the world.

For nearly a decade, China's milk industry developed at an amazing rate. Price and quality became bargaining chips for businesses engaged in fierce competition. The reality is that, many farmers started to raise cows under state initiatives which promoted and encouraged this business model. In some places, the state provided favorable loans to these farmers; in others, households which raised dairy cattle received preferential policies for farming land. When the market is good, one cow can fetch over 10,000 yuan (US$1,600), an enormous financial stretch for a typical household (Zhang, 2008). But once locked into such an investment, it is extremely hard to break free.

This case highlights the reality for China's food production industry: local small-scale agriculture makes little or no profit, while competition between big brands hits those at the bottom. Between the "small, scattered, chaotic" (Zhang, 2008) back-end suppliers and the increasingly industrialized and capitalized front-end businesses, there is a gray area, characterized by the dual operation of a fully modernized market system and a pre-modern, local logic. This is the industry's battleground.

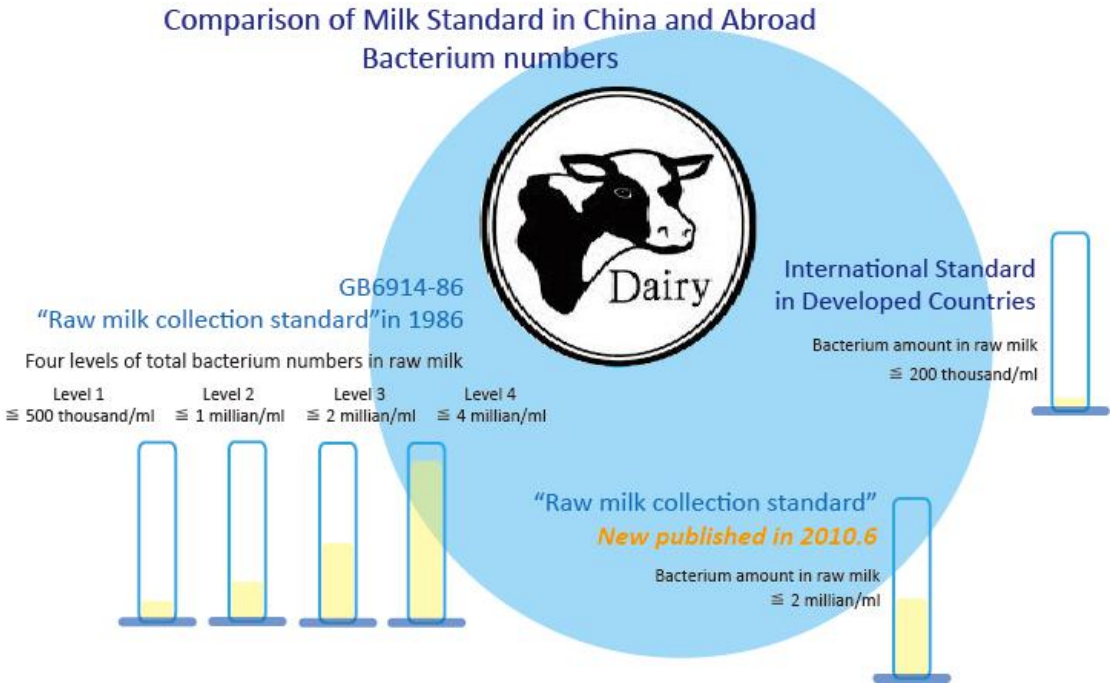
A guaranteed quality depends on every link in the whole process of milk production – including environment, sanitation, disease control – and if you detect that one batch is not up to standard, all you can do is get rid of the batch. The guiding thought should be geared towards control.

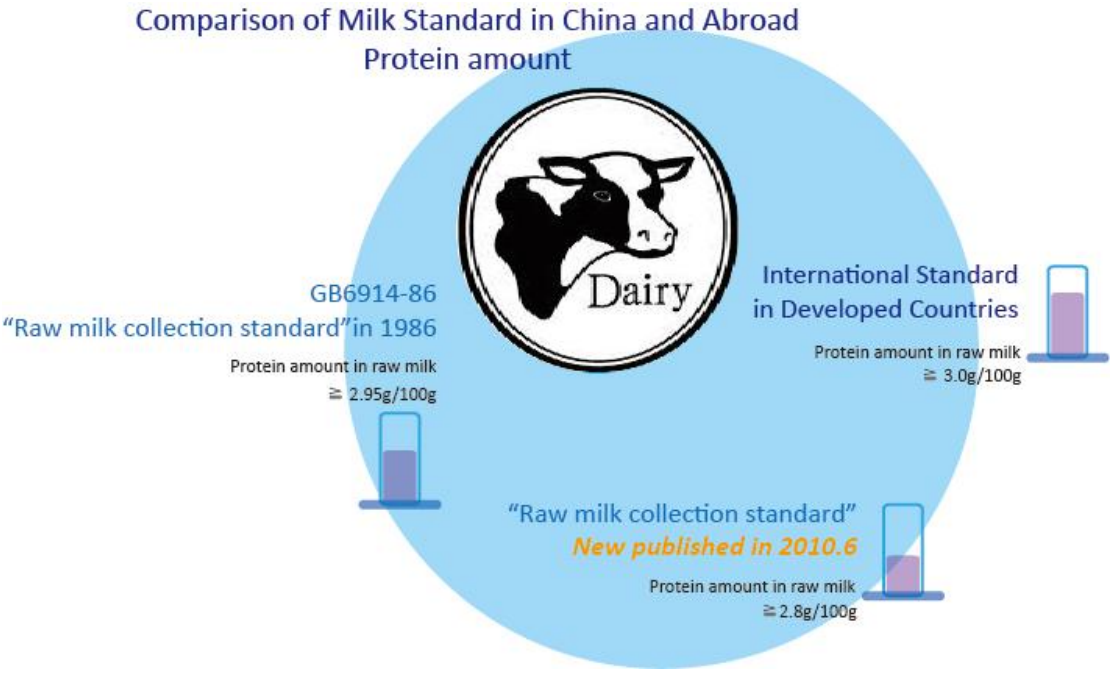
China's dairy industry is one where the supply chain is key. It is an industrial problem rooted in China local milk resources.

2.3 Quality and Safety Standards

Nevertheless, our China government should play a key role in food safety. To aspect of dairy, the China Dairy Standard showed a not optimistic situation. And our people still did not recognize this problem, and without social supervision. In January, 2010, the Chinese authorities imposed new milk product and production standards, ordering dairy product manufacturers to obtain new production certificates this year, and said those unable to guarantee product quality would be shut down.

The new national safety standard for dairy products **lowered the minimum protein level required for raw milk from 2.95 % to 2.8 %**. The new standard also set the maximum limit for bacteria in raw milk at two million cells per millilitre.





Map 12: The Comparison of Milk Standard in China and Abroad

In comparison, western nations' dairy standards call for a bacterial count of roughly 100,000 per ton of raw milk, and a protein content of roughly 3 %.

The Ministry of Health said in a statement that the threshold protein count was lowered because most milk producers could not meet the standard. Therefore, according to the general secretary of the Dairy Association of Inner Mongolia, the People's Daily newspaper reported that 70% of China's dairy farmers would be forced to throw out their milk or even sell some of their cows if stricter standards were imposed.

Discussion:

China produces the worst milk in the world

it is known to all that Chinese milk has a low protein level but a high level of bacteria. ‘‘What is produced from garbage is garbage,’’ one critic said. Ordinary people were concerned in the wake of the Melamine-tainted milk scandal. The government lowers safety levels because producers cannot meet stricter standards. Some 70% of milk producers would go out of business if forced to meet standards (Xin and Li, 2011).

Beijing (AsiaNews/Agencie, 2011) – Chinese authorities have some of the lowest quality standards in the world when it comes to raw milk production. In mainland China, this leads to the production of milk with the lowest protein content but also with some of the highest levels of bacteria, Bright Dairy president Guo Benheng said. "Our raw milk standards are almost the world's lowest," Guo told a forum on Sunday. The mainland's standard for the protein content of raw milk was much lower than in the United States and European Union.

‘‘International standards for the dairy industry also require checks for antibiotics and nitrites in raw milk, but China does not even make such requirements," Guo added. "Can we make a very high-end product with a relatively lower standard? In fact, we cannot. What is produced from garbage is garbage."

Guo’s comments could raise more concerns and lead to a loss of confidence among Chinese consumers, already tried by the Melamine adulterated milk incident that killed six newborn children and caused kidney-related damage to an additional 300,000, which has been discussed deeply above.

The new dairy standard has been changed into even lower.

How Milk Standards Triggered Uproar in China?

In 2010, new regulations for China's dairy industry sparked a storm over safety risks and the role of business in setting policy. Zhu Hongjun, one of China officials, who covered the story, looks back on the controversy.

The Melamine Milk Scandal of 2008, when babies across China were poisoned by tainted milk powder, triggered huge changes in China's food-safety systems. The most obvious was the establishment of the high-level State Council Food Safety Commission, which is chaired by vice-premier Li Keqiang and includes representatives from 15 different ministries and commissions. This was China's highest-level response to food safety problems yet. Another change, which drew less attention, was the formation of the Food Safety Risk Assessment Commission and the Food Safety Standards Examination Commission in the second half of 2009 (Xin and Li, 2011).

The latter, in particular, was intended to clean up and rebuild China's food safety standards – a movement regarded as fundamental to creating a new era of food safety.

The new standard for raw milk was part of the first batch of regulations produced by this process, but amid the controversy engendered. The effort being made to bring order to chaos was overlooked.

Before the Food Safety Law was passed, China was the only nation in the world to have more than one set of food-safety standards. Under the Food Hygiene Law, the Ministry of Health was in charge of food hygiene standards. Under the Product Quality Law, the State Quality Administration was in charge of product quality standards. And under the Agricultural Products Quality and Safety Law, the Ministry of Agriculture was in charge of the safety and quality of agricultural products. These were all mandatory state standards, but there were clear conflicts between them, which caused understandable distress among businesses.

Over the last 30 years, China's food standards have become outdated, and the revision process has been slow. There have only been three major new promulgation or updates. Prior to the current cleanup, one quarter of existing regulations had been in force for a decade or more – some hadn't been revised for 20 years. This is despite the fact that,

according to regulations on implementing China's standards, they should be re-examined every five years.

The controversy that erupted over new raw milk standards in 2010 almost obscured these positive developments. The standards clean-up was thrown into disarray just as it got started. The controversy was sparked by standards for protein content and bacterial counts in raw milk.

Acceptable levels for both these measures decreased in comparison with the former standard: from **2.95% to 2.8%** for protein content, and from **500,000 per milliliter to 2 million** per millilitre for bacterial counts – the laxest standards ever. In Denmark, New Zealand and almost all big milk-consuming nations, protein content must be over 3%, while bacterial counts per millilitre must be under 100,000 in the European Union and United States; and under 30,000 in Denmark. The Chinese media called the new standard **as "A 25-year step backwards".** (Xin and Li, 2011)

In June 2010, China Southern Weekend and Commercial Magazine brought the controversy to public attention, and it rumbled on until late 2011. Official explanations failed to calm down public concerns.

Public Anger Was Directed at Two Targets:

First, the laxer standards for protein content and bacterial counts, and the clear gap between these and standards overseas, were seen as an attempt to protect China's backward and small-scale dairy farmers.

Second, large companies, most of which had been involved in the melamine scandal, participated in drafting the new standard. The public believed the new standard had been set in accordance with business interests.

But, people asked, why should a laggard industry be allowed to dictate standards?

These concerns got to the heart of the debate over food safety standards – should China's food standards be brought in line with international standards or should the country's own circumstances be considered? Is compromise acceptable? And how should the public and

business interests be balanced? The standards will influence the growth of companies and their industries – conflicts of interests are inevitable.

‘‘As one of the reporters who wrote about the affair, I heard a range of views.’’ Said Chen Junshi, a member of the Chinese Academy of Sciences, has said, any standard was the product of compromise.

‘‘No fewer than 50 meetings were held to discuss the new raw-milk standard, and industry opinions were solicited. I obtained a list of industry opinions, covering industry associations, authorities and businesses themselves. Views were diverse, reflecting different interests.’’

Those differences are not just due to competition between large and small firms, or between producers of pasteurized and that of UHT milk. The government’s real obstacle is China’s backward in dairy sector, disparate livestock-rearing standards and issues of milk quality. Safety standards are in the public interest, but will also affect the interests of China’s numerous small farmers – and the stability of their livelihoods.

During formulation of the standard, the view that the cause of the melamine scandal was that ‘‘the existing standard for milk quality was too high and small farms couldn’t reach it – leading them to risk adulterating their milk’’ was put forward. Figures from the agricultural authorities showed that in northern areas such as Inner Mongolia and Heilongjiang Province, many small farmers still can’t ensure protein content of 2.8%, never mind 2.95%. The dairy industry associations in northern provinces are firm in their stance and have even privately worked together. The Secretary of Liaoning Province’s industry association, Lu Gechuan, said that their research found 40% of dairy farmers could not keep protein content at 2.95% or above.

Opponents have two arguments.

First, the weak position of small farmers is not due to overly stringent standards, but overly powerful big business. Even if standards are low, things will not improve as long as big businesses continue to act as they do (Zuurbier, 2008). Second, given normal rational and scaled livestock raising, the standards should be easy to reach. Any failure to do so is caused by **poor farming methods**, and high standards are needed to force the industry to improve.

The Shanghai Dairy Association is representative of this view – Shanghai's dairy farmers are mostly large and well-run operations on Chongming Island. Shanghai's sources of milk are as good as those of nations like New Zealand.

As for bringing Chinese standards in line with those of other nations, almost none of over 10 food standards experts interviewed agreed the country should rapidly adopt the standards of the European Union. Reasons included trade barriers, the need for time in which to make improvements and underlying national interests. But there was a consensus that standards need to be forward-looking.

Another debate centred in the participation of businesses in the setting of standards. This is not the first time this has happened. Supporters pointed out that businesses know the latest movements and trends, and have a right to be heard on the development of their industry. Opponents called the integrity and public-mindedness of big Chinese firms into question and with the lessons of the melamine scandal still fresh in people's minds, how can they be trusted?

All the different views have merits. Whether standards are raised or lowered, whether companies participate or not, the most important thing is for the authorities and the evaluating bodies to have the capability and data needed to make decisions and balance different interests.

But this seems to be the weakest link in the process of sorting out and rebuilding China's food standards. One veteran expert who has participated in the setting of many standards recalls that when raw milk standards were being determined in the past, the authorities would first collect seasonal data from locations around China for analysis before setting indices.

But on this occasion, as the focus is on tidying up and combining standards with the leading body – the Ministry of Health, does not have jurisdiction over farms. And there was not enough collection of baseline data. This means the different interest groups all stuck to their own positions.

With a lack of a scientific data, thoroughgoing research or a real understanding of the

situation, it was hard to avoid the final decision being determined by a balancing of superficial pros and cons, unable to choose between the people's lives, safety, consumers, dairy farmers and businesses.

There was **no platform for calm debate** and the different sides stuck to their extreme positions and attacked each other. Scientific opinions weren't given a hearing, and the truth was obscured.

Sorting out China's food safety standards is an onerous and complex work.

Differing interests and business participation are not actually the core issues – or at least, they are just a normal. More important is that, when a standard is being revised, the work is supported by real research and reliable data on the industry and its problems. This is an even more enormous task. And it is essential.

2.4 Problems

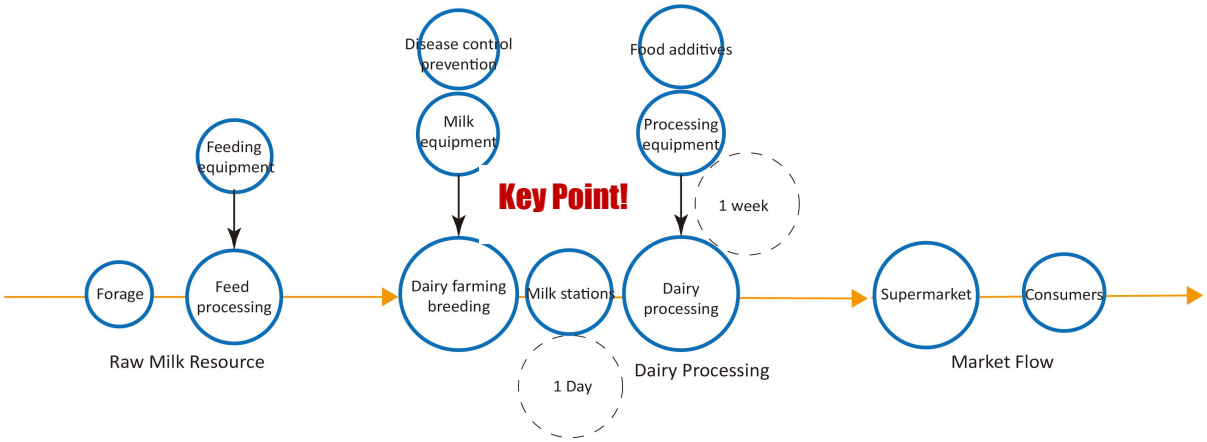
Guaranteed quality depends on every link in the whole milk production process – including **environment, sanitation, disease control** – and if you detect that one batch is not up to standard, all you can do is get rid of the batch. The guiding thought should be geared towards control."

According to the discussion above, in the years around 2005, national brands completed a market "sweep", which shaped the structure for **milk distribution and quality control** that has existed ever since.

Besides, it is obvious to find that animals with poor diets and weak disease resistance produce raw milk with low protein and fat content. Zhang et al. (April 2008) report that protein levels are low in raw milk produced by small-scale farmers.

It is a problem rooted in local milk resources. The competition over milk resources has been ferocious.

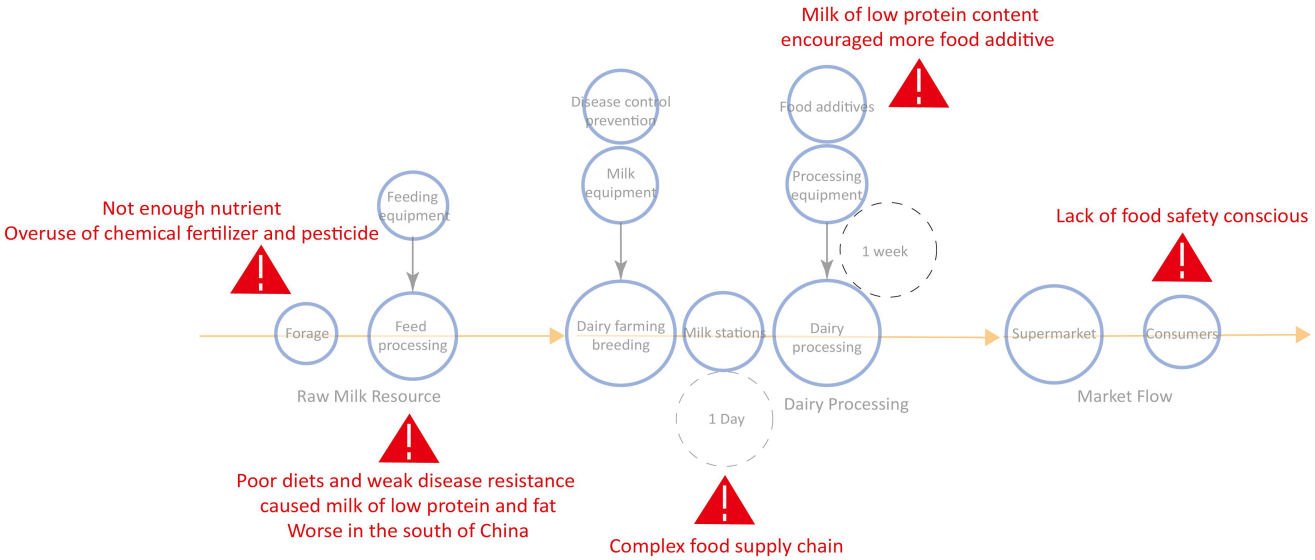
Supply Chain



Map 13: The Dairy Supply China in China

Milk Station Acts as The Key Point!
If We Control Those Milk Stations by coding?

Questions



Map 14: the Location of Questions

Where The Problems Are Located?

* **First, the forage cultivation.** It is common in China to use chemical fertilizer and pesticide in a large number, and is often extremely beyond the necessary of the plant. Therefore, there is another well known word, ‘‘Nong Yao Can Liu’’, which means the Pesticide Residues. After several incidents caused by the pesticide residues on vegetables, this has become another severe poisonous food, vegetables and fruits, as well those animals fed with these poisonous forages. To the aspect of dairy cow feeding, where located as the key point, can be the breakthrough to develop the dairy industry in China, which has been discussed above;

* **Second, the supply chain.** The milk station as the key role, has the responsibility of collection the raw milk, which is more necessary to set a regulation, to track and control, for example, where the raw milk comes from and comes to. Because all the raw milk from nearby are all collected to the milk station, if one of them has some problem, without coding or tracking, it is really a tough work to find out where goes wrong ; while at the milk station is also more potential to involved in the incidents of food additive, for the aim to change the low quality milk into a good one;

Except dairy farming, China’s dairy industry is one where the supply chain is also a key.

* **Third, to the customers**, the China society has a litter conscious of food safety years ago. While nowadays, even though they knows, they don’t know how to keep their family safe. Thus,they need a way to realize their duty of supervisor. If there is a code to number the dairy products, all of us can find the number on the products, and knows every details of productions, from farming to supply. this method has been used on many ways, for example, in Italy, they mark code on every fresh eggs, to record the information of the egg, so that if some egg has problem, it is much easier to check and recall the bad eggs.

In conclusion, the dairy safety issue came from the origin - agriculture, during the middle - industry, to the end - consumers, which is not easy to change them, because of the China real situation. Thus, it is necessary continue the research on rice safety, for more details to conclude question, and find a possible solution.

3: RICE SAFETY IN CHINA

3.1 Background

A Brief History of Rice Industry in China

Yesterday

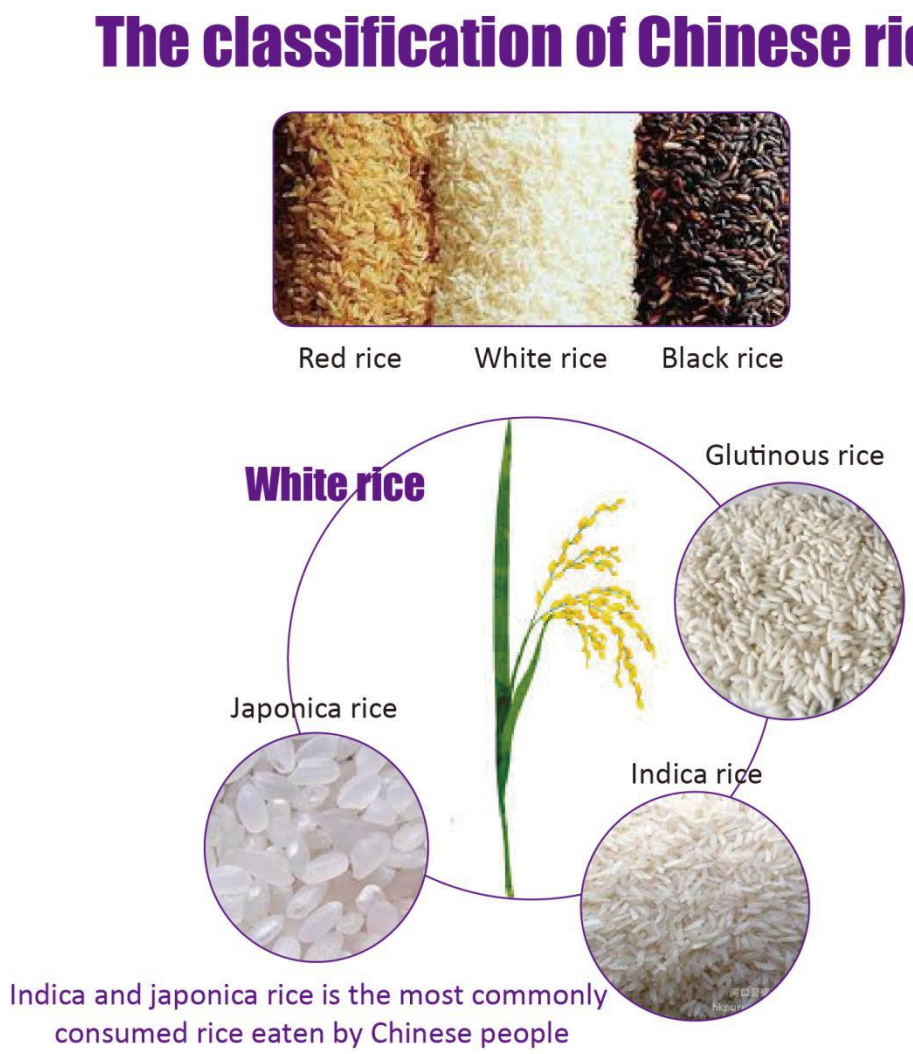
In the end of nineteenth century, the rolling rice machine was invented, improving the milling efficiency greatly. To the mid-twentieth century, the appearance of jet air rice milling machine promoted the processing efficiency advanced.

The rice technology developed rapidly at the late of twentieth century. The optical color sorting technology continued to improving in the automatic cleanup standards. Along with the expansion of the rice cultivation in the North Cold area, in 1988 the washing-free rice started to product in Daqing City, Heilongjiang Provincial Food Bureau, having a production line of 50 t / d (Gao and Zhou, 2014).

In 1998, the ultra-low temperature dust technology has been applied to kill bacteria, which developed the wash-free rice production in 1999, and the new generation of washing-free rice was produced in the Great Northern Wilderness Group Zhaoyuan rice company.

In 2010, the appearance of new product "Pearl Rice" as the patented invention marked the rice processing technology turned into a new era. In the same year, ‘‘oil mixed pearl rice" and "skimmed pearl rice" were also invented. (Gao and Zhou, 2014)

Along with the accelerated process of urbanization in China, in the future there will be at least two hundred million of rural people moving to cities and towns, and the urban demand for rice will increase significantly, leading to the increasing of urban foods consumption.



Map 15: The Classification of Chinese Rice

In general, Indica and Japonica rice are the most commonly consumed type for Chinese people. **Panjin rice**, is one type of Japonica rice, which has been cultivated from 1907, in Liaoning Province. Due to its good quality and flavor taste, it has become one of the Chinese national rice products.

In this area of 12,000 square meters, located the China's first rice museum, in addition to showing a variety of rice, there demonstrated the stone milling machine, and plow trucks, and other traditional farming tools, as well as other modern equipment, such as harvesters, transplanters.

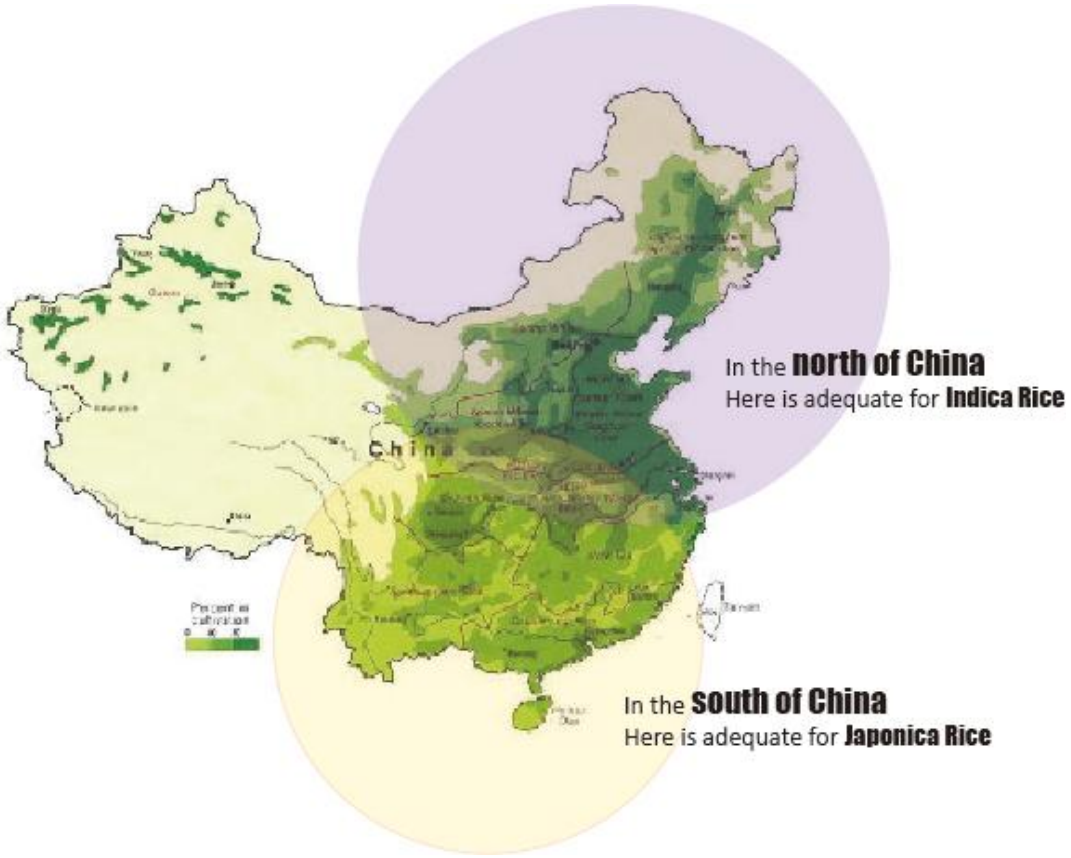
Map 16: Introduction of Panjin Rice Museum

In the museum (Xinhua newspaper, 2014), the most striking part is the cold fresh rice technology. It is understood that R & D personnel found the method of combination of the unique soil and water quality in northeast China, stocking crabs, fish and ducks in the rice fields. They can either graze, catching insects, nor dig, excretion natural fertilizer, making nutrients more easily absorbed by the rice soil. To avoid injuring the crabs and fish, farmers do not use chemical fertilizers to rice fields, or any pesticides. While in southwest China, due to the high temperature in summer, this rice-fish farming system was not so common used as that in northeast China. This breaking point was used of special low-temperature storage of raw grain, instead of the traditional raw grain storage methods, to make the birth of cold fresh rice products.

Now

The rice as the main food eaten by every Chinese, has its special protein, which contains the lysine-containing alkali-soluble gluten accounted for 80%, and the lysine content is much more than other cereals, and the amino acids has a reasonable ratio, which is relatively close to the best ratio of protein amino acid pattern from World Health Organization identified.

The biological value (BV value) of rice protein was 77, and the ratio of the effectiveness of the protein (PER value) was 2.2 (1.5 in wheat, 1.1 in corn), with the protein digestibility of more than 90%, higher than other grains (Li and Liu, 2007). Therefore the nutritional value of the rice is quite high.



Map 17: The Distribution of Chinese Rice

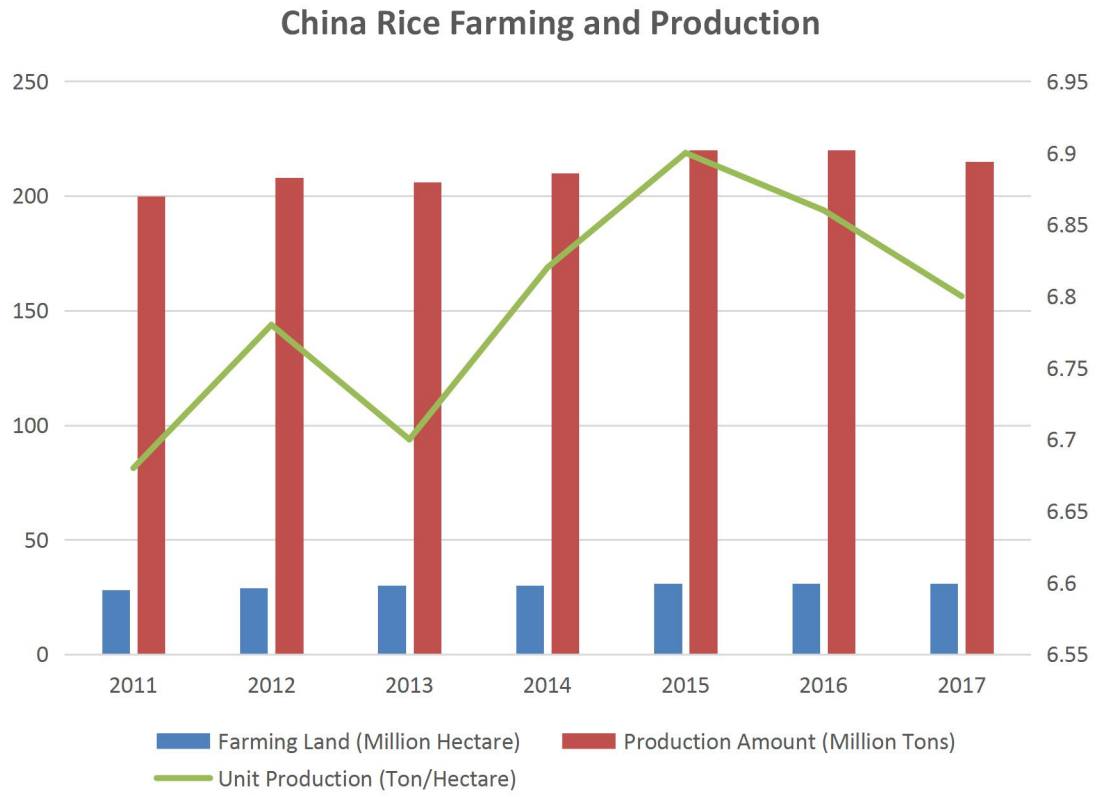
Yangtze River is suitable for single and double cropping, including cities in the north area of Nanling, the south area of Qinling - Huaihe River, such as Jiangsu Province, Zhejiang Province, Anhui Province, Jiangxi Province, Hubei Province, Hunan Province, Chongqing City, Sichuan Province, Shanghai City and others (Zhang and Wang, 2005). This region locates in the subtropical zone, rich in calories, the fertile soil, abundant rainfall, rivers and lakes as a facilitate irrigation. Over years, the rice acreage and production in this zone accounts for about 2/3 all over China, and respectively is China's largest rice-producing area.

Food crops in the northern region of China are mainly wheat and corn, whilst in the southern region is grain-based (Yu and Zhu, 2009).

The paddy cultivation is mainly in the southern region of China, and concentrated in the Yangtze River, Northeast Plain, the Sichuan Basin and other regions. Its main features are: the

terrain is almost plains, basins and valleys; a humid climate, rain and heat together, an abundant rainfall; near the river, easy to irrigation; a fertile soil; densely populated.

To the aspect of national rice production and the relative increasing rite, the situation may not be optimistic. According to China National Bureau of Statistics, during Jan to Dec 2013, the national total rice production was 117.688 million tons, and increased 9.28% compared to 2012 (Yu, and Xiao, et al., 2014). And according to Industry Information Network, released "2013-2017 Analysis Report of Chinese rice market supply and demand forecasts and investment prospects", the national total rice production in 2017 was 146.66 million tons, which was not enough for Chinese people. Thus the import of rice from India and other countries has increased yearly.



Map 18: The Graph of China Rice Farming and Production during 2011-2017

It is obvious that the China rice production rate has not increased yearly, while this may not be a negative situation. Due to the population control strategy of China government, the social and family structure has changed after years, such as the new birth was less, and the adult afterward became the large of the population aging representation. Thus, rice as the main food in China is also on its way to be reduced.

Besides, the food consumption and **diet habit have changed** at the same time of modernization in China. This means the less rice is eaten, while more vegetable and meat are preferred being eaten as ordinary food, as well as those fast food and junk foods.

Economy

The area of rice industry is concentrated highly, according to 2017 statistics showed that China's rice production was mainly concentrated in the central, eastern and northeastern three regions, accounted for 33.9% of national output, respectively, accounted over the same period of 33.9%, 27.7%, and 27.6% (Yang, 2017).

In China, The Characteristics of The Rice Industry (Yang, 2017)

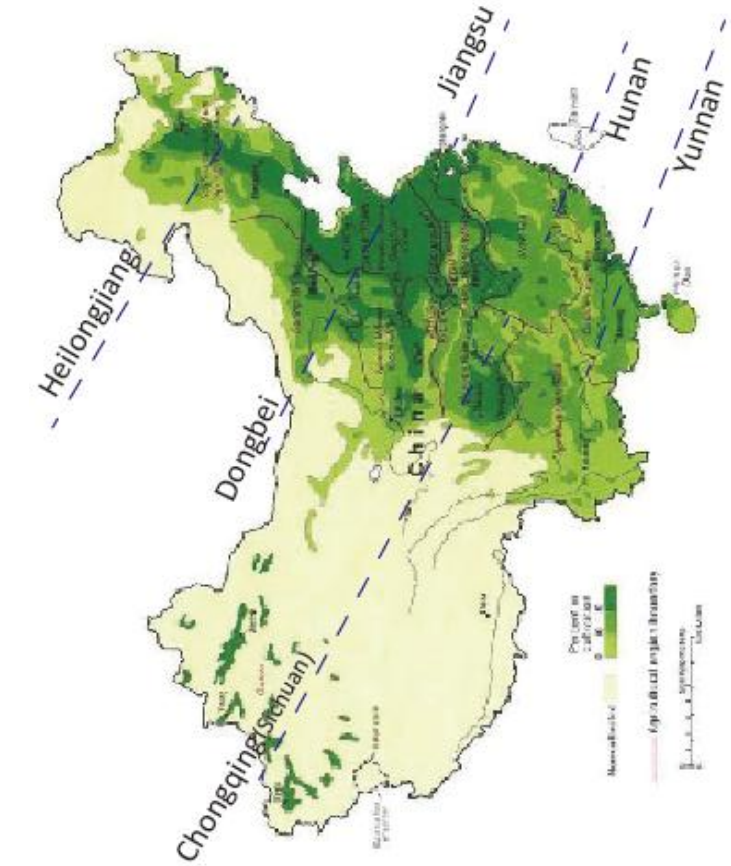
* 1) Small and Scattered: According to statistics of China Food Industry Association, in 2017 the numbered rice processing enterprises are 7698, among which there are only 18 enterprises with the production more than 1000 tons. Many of them are not full open but closed.

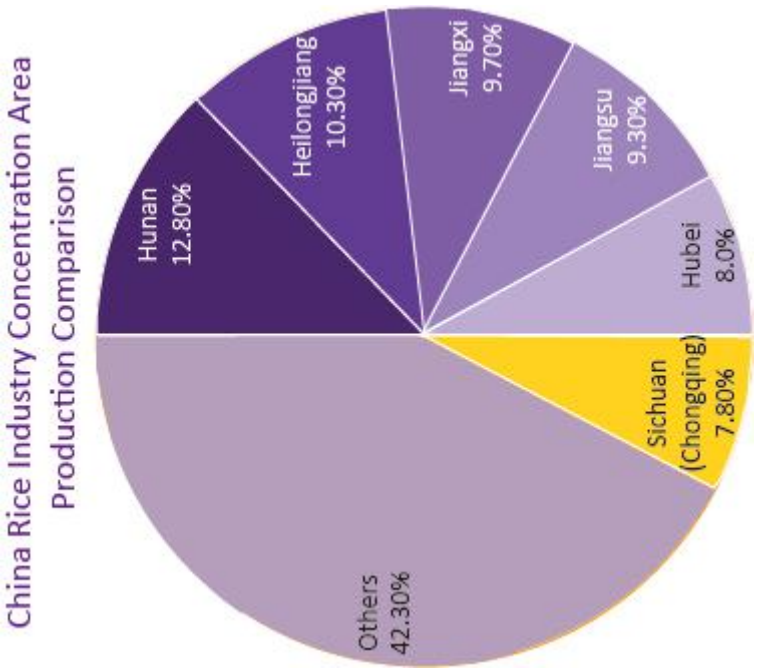
* 2) Low Threshold: rice as a traditional product, its profit margins quite low, with the average profit of only about 10%, so that the competition is quite fierce. The rice processing technology and capital threshold is not high, leading to a large number of manufacturers.

* 3) Excess Capacity: in 2017, the annual rice production capacity of the numbered rice processing enterprises reached 146.66 million tons. In 2017, the processed rice was 43.81 million tons, while the production rate was less than 30%.

* 4) Lack of National Brands: Currently, the domestic rice market is still dominated in bulk meters, and rice brands can be named very few. People unconsciously regard the price as the evaluation ruler of good quality rice.

While up to now, the rice industry has changed than ever. As many rice safety incidents was revealed, the society asked it is significant to develop our rice products, we need a good quality rice. While there is big challenge, which is our huge population, our quickly development that caused too much pollution to the environment. What we need is a better future!

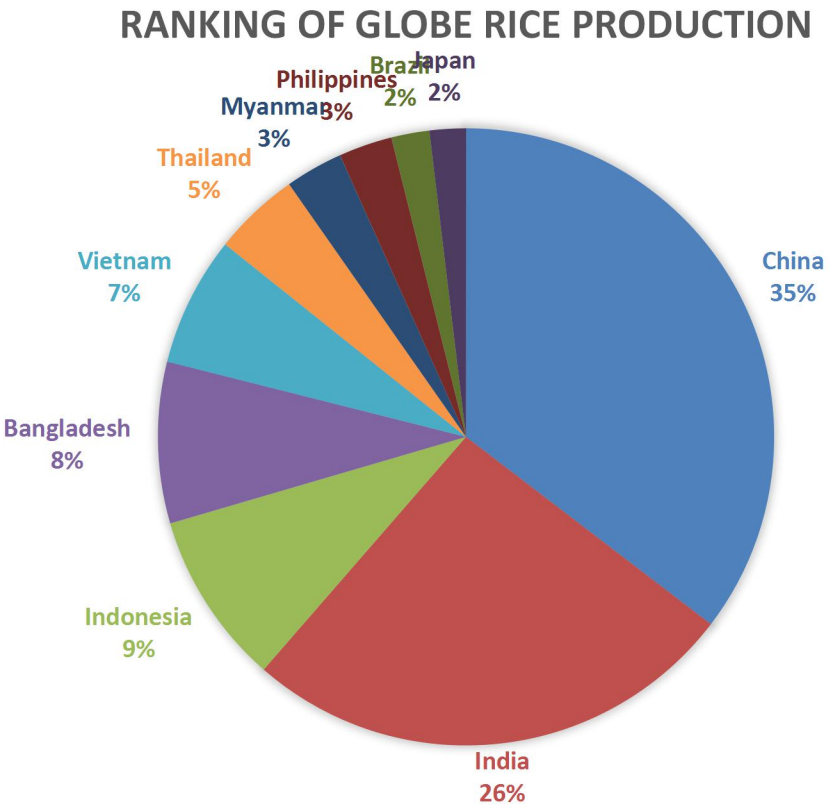




Map 19: The Map of China Rice Production Location

Future

Up to 2017, China has become the biggest rice producer in the world, while not the best. The change is on the way. Along with the continuously developing in China, the arrival of the brand consumption stand on the commercial stage, which stimulated the development of high-end rice industry. In China, consumers are entering the era of brand consumption instead of ordinary goods consumption. Brand rice products means a better quality, and better life! Besides, combined with the media, "poisonous rice, stale rice" incidents are frequently on exposure, more and more people recognized the significance of food safety and quality, improving a more potential and significant market space to be developed.



Map 20: The Graph of Ranking of Global Rice Production

While the rice market has already changed gradually. A higher quality rice began to stand out.

New products

The appearance of tiny packaged rice was mainly due to the following three reasons (Zhou and Lun, et al., 2013):

* 1, The improvement of the domestic economy and living standards. Rice, as the national food of the Chinese people, in the planned economy period, people had no way to ask for the rice quality. While today, people's income has increased, to require for a better packaged and a higher quality of rice. Therefore, the tiny packaged rice has been emerged.

Map 21: Example of Tiny Packaged Rice

* 2, The National Population Policy. The planned population has decreased the family persons, while has increased the demand for tiny packaged rice.

* 3, The increasing market competition. With the liberalization of grain marketing system, rice commodities were higher and higher. And the market competition has forced manufacturers to pursue a differentiation of rice products, in a variety of rice type and packaging, seeking to a breakthrough.

The appearance of tiny packaged rice, it should be said that the rice industry has obtained a new role of high-end level in food business.

First, it reflected the industry processing technology developed to a new level. In the beginning, the original use of sacks or loaded bags to package rice, made it easy to leak and

to absorb moisture, so that its shelf life was very short. To the late seventies, the Hong Kong Golden Rice has tried to solve this problem of shelf life, and conducted a series of studies. The plastic packaging materials in the first time was adopted by the vacuum processing technology, to develop the rice products, afterward people gradually accepted this packaging products, which evoked a great development for the rice company. At the same time, domestic manufacturers have also absorbed this packaging technology. Meanwhile, in order to solve problems of the rice and impurities inside vermin, they also used the water milling and the corresponding impurity and other processing procedures.

Particularly, its emerge, has touched people's awareness of brands. Rice manufacturers began to focus on the needs of consumers, and concerned about changes in national policy, and paid attention to changes in the market. Supermarkets have begun to engage in promotional activities, and in the domestic there also begun to emerge a list of companies, and rice advertising on CCTV. Consequently, China rice brands began to stand up.

3.2 Analysis

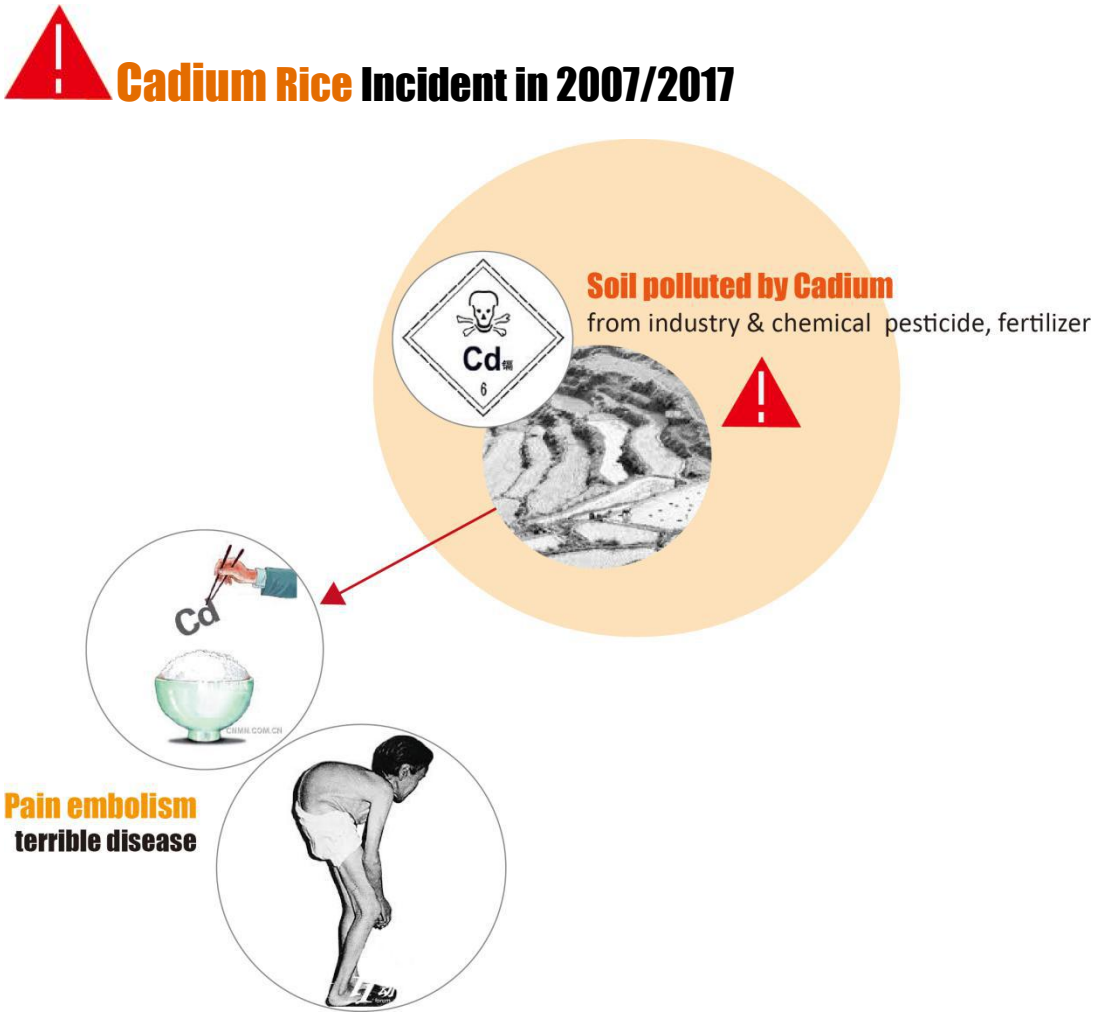
1.Rice Safety Incident (Agricultural Problem)

Several key points of the **Cadmium incidents** in raw rice grain.

Rice is the staple food for much of the world, second only to wheat in its importance as a food cereal in the human diet. About 560 Tg of rice are grown annually, almost 40% of which is grown and consumed in China (Tan and Wu, 2014). In many regions, paddy rice is **heavily exposed to Cd**, causing a health hazard. Clear evidence has linked human renal tubular dysfunction with soil Cd contamination in subsistence rice farm families in Asia. In Japan, rice is a leading source of Cd burden for the human population. Reported Cd concentrations in rice range from 0.02 mg kg−1 to 1.06 mg kg−1 in the Jinzu river basin and from 0.11mg kg−1 to 0.67 mg kg−1 in the Kakehashi river basin (Nogawa et al., 2004).

Cd contaminated rice products have also been reported in Shenyang, Chongqing and Guangzhou in China (Hu et al.,2014). While in 2017, this incident still was be revealed in Jiangxi Province.

In Zhangshi sewage irrigated region of Shenyang City, Liaoning Province, China, 13% of paddy rice contained Cd as high as 1.0 mg kg−1, which exceeds the maximum allowable limit (0.2 mg kg−1) of the National Food Hygiene Standard of China (NFHSC, GB 15201-94; Hu et al., 2014). In the sewage irrigated area in Guixi, Jiangxi Province, China, grain Cd concentrations ranged from 0.296 to 1.749 mg kg−1, also exceeding the NFHSC limit. In Qujiang, Guangdong Province, China, Cd concentrations in rice grain as high as 1.86 mg kg−1 have been reported. In short, paddy rice polluted by Cd in the soil currently impairs food safety, making it a perfect model system to study the proposed concept of PSCs.(Zhang et al., 2013)



Map 22: The Fact of the Cadmium Rice Incident in 2007/2017

In 2007, there was a investment for more than 170 rice samples from six regions of China (east, northeast, central, southwest, south and north), which were randomized purchases and scientific investigation, and found that among the 170 rice samples, 10% of the commercial rice in the market had the problem of excessive cadmium.

While up to 2017, the Cadmium Rice emerged again in China rice market, which was also caused by soil pollution of cadmium. In the rice market, although the phenomenon of excessive cadmium always exists, the rice cadmium pollution is relatively more serious than that in the north, such as some cities, Jiangxi, Hunan, with the problem of excessive cadmium more serious. This problem was almost caused by industrial pollution, overuse of chemical pesticide (Wang and Wang, et al, 2014). Even though China developed quickly, the ignorance of environment protection, human health care, always there need to be solved.

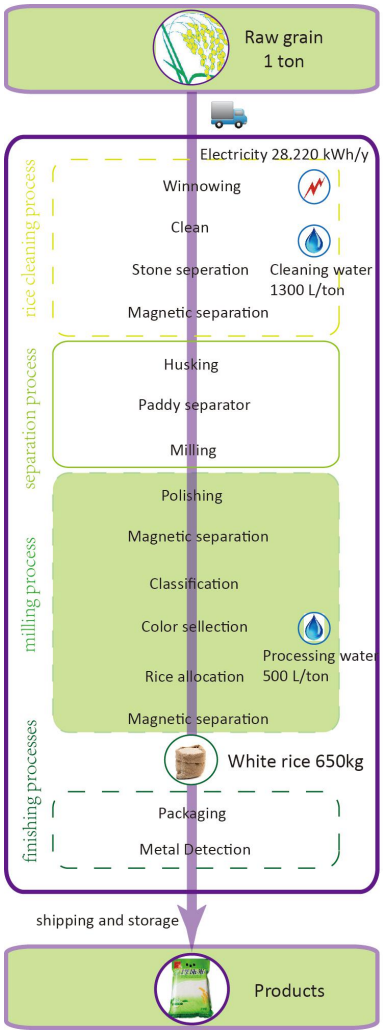
Map 23: The Rice Safety Incidents in China during 2007-2017

2.Illegal Processed Rice Products (Artificial Problem)

Not only exists the rice safety issues caused by China agriculture, but the artificial reasons during the industrial processing, leading the rice market into a serous situation (Liang, 2010).

*** Inferior rice became shoddy after the over-polishing**

"Over-polished rice may also be the moldy rice, by excessive grinding the moldy part, then shoddy." Director of Grain Branch of Guangdong Province, Yajun Wang told reporters. Over-polishing also concealed some illegal means of the illegal small manufacturers. Some small factories polished the old rice, moldy rice into shoddy. "After polishing, old rice can sell a higher price as the new rice. More criminals, the polished moldy rice, with the surface removal of the rice to become lighter, mixed and sold with the normal rice."



Map 24: The Processing Map of Rice Industry

*** Oil sludge exists while rubbing the rice, attention of polishing with the mineral oil**

In addition, consumers should beware of the rice mixed with illegal mineral oil while polishing by criminals. According to reports, consumers can identify the rice by looking, smelling, touching: If the hand gets into the rice, based on observation of the hand out, the new rice can be proved with the little white powder that can blow off. Whilst the powder cannot blow off lightly, and exists oil sludge while twisting, the rice is old one or be bad quality. This inferior rice although is very bright, it is dark beige and smells greasy.

*** Distinguish colored rice:**

The inner part of Black rice is also black, must be colored. Natural red rice, black rice will also fade after washing. While in the market, according to reports, there is the inferior quality black rice in a long time storage, which is sold shoddy after staining; another type is the use of ordinary write rice stained as the black rice. Experts explain the way to identify the dyed

rice: after breaking a red or black rice, the real rice is white inside, while the fade one is totally black. The stained black rice is smelly.

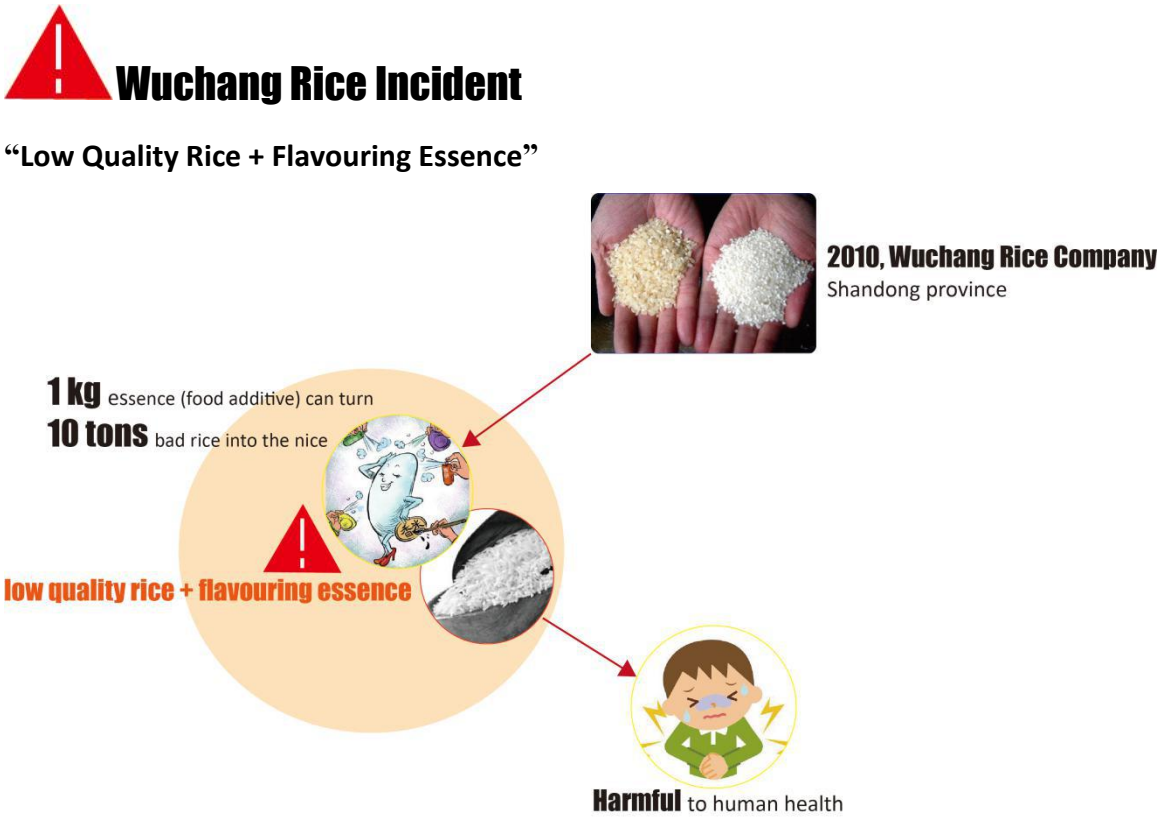
*** Added flavor rice:**

Add industrial flavors to the rice for a better taste. Experts also said that there are some industrial flavors added to enhance the flavor of rice, so that the ordinary rice can acts as flavor rice, or the old rice as the new one. Since the natural rice flavor can only save up to two or three months after the rice packaging is open, in order to changing the stored rice into the new one, it is necessary to add some amount of industrial flavor.

The new rice has a natural adore, whilst the old rice without aroma. Unscrupulous traders join the old rice with flavors, while the aroma is different from the natural aroma, which can be easily distinguished.

3. The Most Serious One - Rice Safety Incident

In 2010 Wuchang Rice Company "low quality rice + flavouring essence". Recent food safety incidents, 18-05-2011,《Guangzhou Report》



Map 25: The Fact of Wuchang Rice Incident in 2010

According to official report in 2010, the famous rice ‘‘Wuchang’’ sold in Heilongjiang Province, was partly processed with flavouring essence. After researching, it is revealed that the flavoured rice was mixed with the good one, when the rice company developed their products, so that the company could earn more money.

During 2009 - 2010, due to the support of government and local enterprises, the Wuchang Rice was required to provide more and better products. While the reality was on the contrary, it was not easy to reach this aim quickly. By a too fast production speed, the rice of good quality was obviously not enough (Liu and Li, 2011).

Finally, the leader of Wuchang rice, named Qiao, based on more than 10 years of rice production, has become one the best rice of China. he purchased those rice from farmers around the city, who planted rice in a small amount. Those rice cannot reach the China Rice Standard, with a lower quality. Thus, to solve this problem, Wuchang Rice reprocessed the rice of lower quality, rewashing, mixed with the flavouring essence to get a good appearance, a good smell. When this reprocessed rice was sold with the good one, the costumers cannot distinguish them from their appearance, only if they taste those rice. In that way, the cost of rice became lower, at the same time, the rice company can reach the production aim. There was only one problem: the flavouring essence illegally mixed was superior the Food Standard, which will harm our health.

Not only the Wuchang rice incident, there are many kinds of edible flavouring essences, which have penetrated into every corners of people's daily life. Around the world, there are more than 5,000 kinds of food flavors that can extract raw materials, and about 1,500 kinds of food flavors are approved for trial use in China (Liu and Li, 2011).

It is no exaggeration to say that " in all our deep-processed food, we can almost see the shadow of essence".

Consequently, with the frequent occurrence of food safety incidents, such as dyed bread, Sudan red egg and other related food safety issues, consumers are concerned: will excessive addition of edible essence bring potential food safety problems? The answer is affirmative.

3.3 Quality and safety standards

Following are the national the rice processing standards:

Indica rice processing national standard GB1354-2009

Fine Indica rice processing national standard GB1354-2009

Japonica rice processing national standard GB1354-2009

Fine Japonica rice processing national standard GB1354-2009

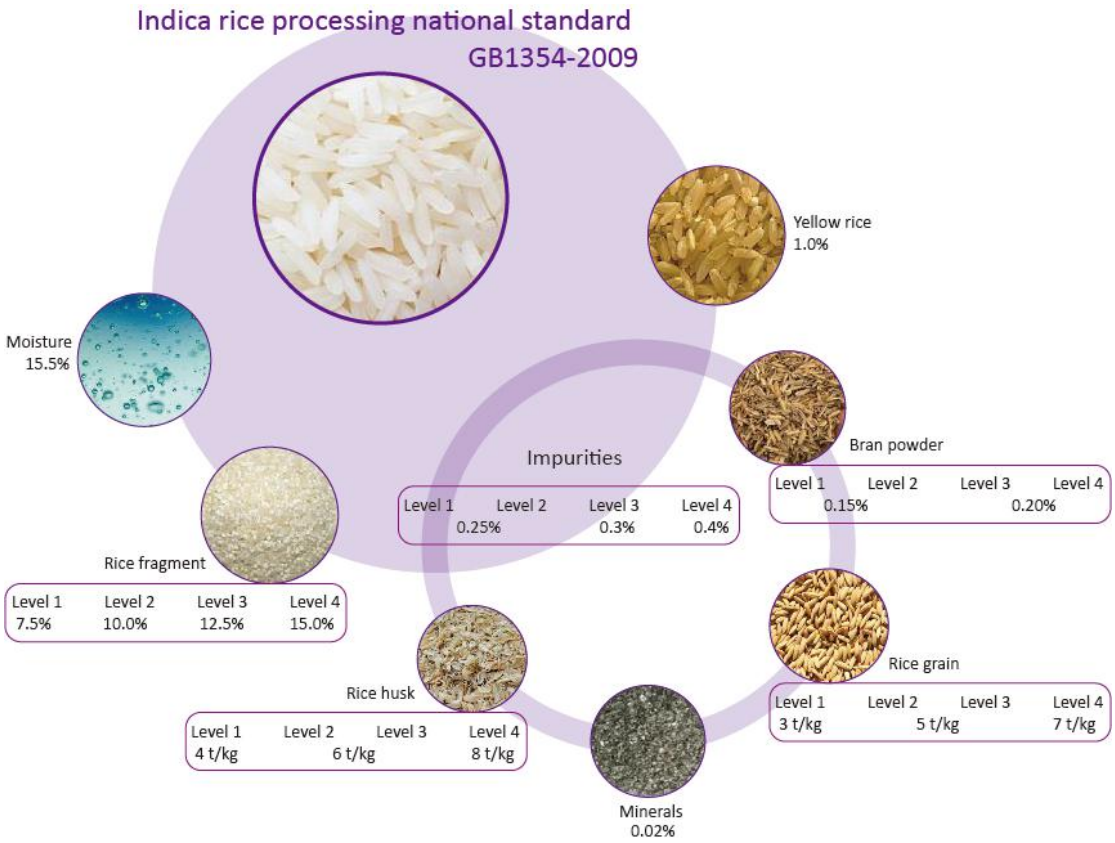
To the aspect of rice quality standards, the UN Food Standard Board made the regulation of cadmium content per kilogram rice non up to 0.4 mg. EU regulated the cadmium content per kilogram rice no more than 0.2 mg, and the relevant Chinese standard was 0.2 mg.

While, in China, expect the rice quality control, from the rice-producing areas to the acquisition, storage, processing and marketing, the important step of grain heavy metal testing is missing.

According to the China Rice Standard, it is easy to find that our China rice has an original good quality, because rice has a long agricultural history in China, our Chinese have a good command of rice planting. If we keep a good soil to maintain a good agriculture, and a standard industrial processing to get a good products, rice will be safe and nutrient.

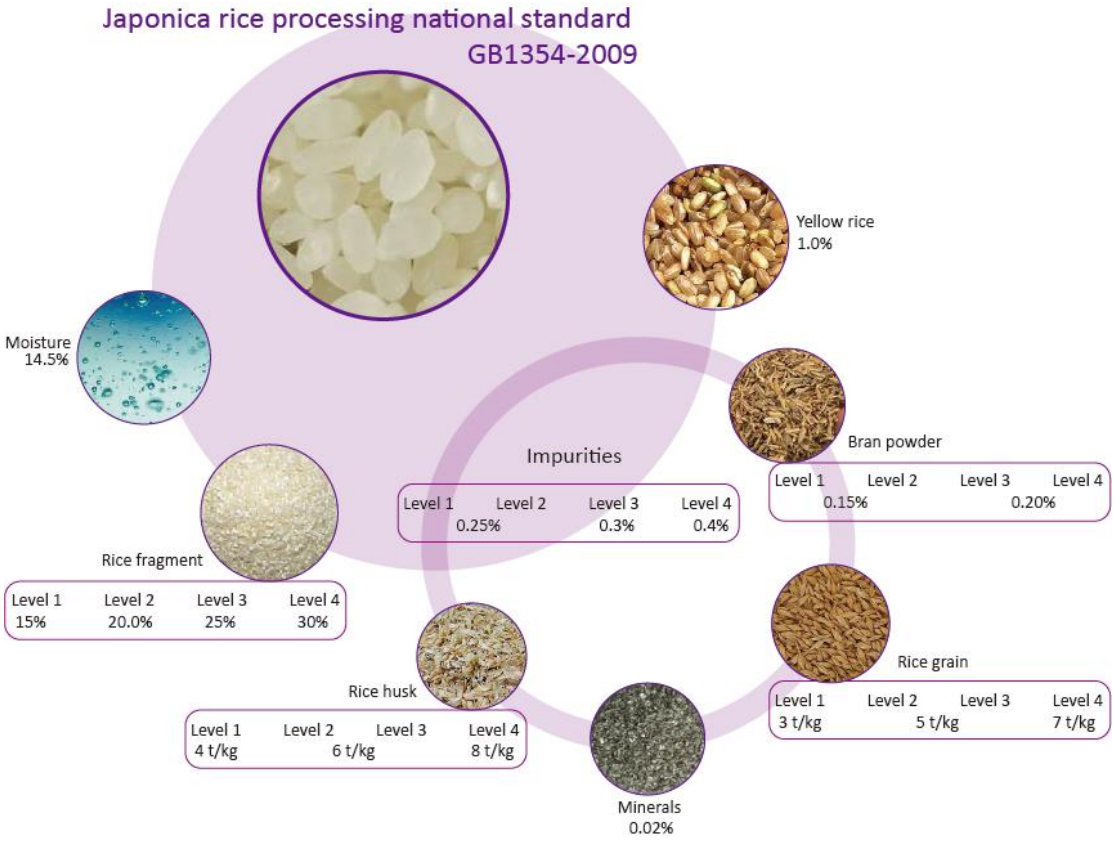
While the reality is not as what we think. In China, there are still too much pollution caused bu industries, illegal waste treatment, which finally turned back to our soil and water; most of output during processing, all became waste; the illegal food processing still exist, because of our huge population, more profits, as well as higher and higher market demands.

As a result, our base of agriculture was destroyed, next we need to pay much more in the food production.

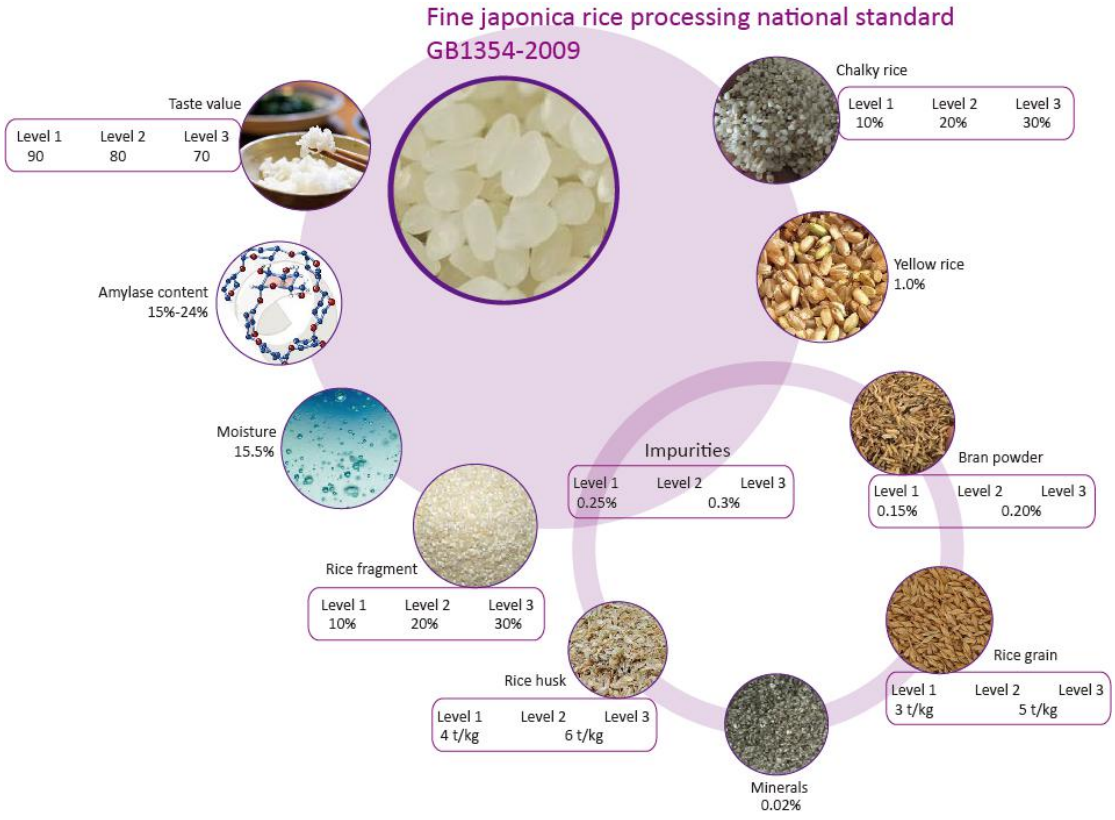


Map 26: the Indica Rice Standard in China

Map 27: the Fine Indica Rice Standard in China



Map 28: the Japonica Rice Standard in China



Map 29: the Fine Japonica Rice Standard in China

3.4 Questions

According to researches above, it can be summarized in the Supply Chain Map, to discuss detailed problems. As it exhibited in the map of Rice Supply Chain, we can find out that the supply chain from agriculture - production - market, China should have the ability to produce a good quality rice (Jin, 2014).

While the reality is on the contrary:

The first, the critical problem is located in our agriculture, such as the rice grain polluted Cd in the soil, and heavy metal components in rice grain. It means the soil has been polluted, because of too much waste and unreasonable treatment, both of liquid and solid waste; to the aspect of farming, the overuse of chemical fertilizer and pesticide is also cannot be ignored, and is well known to the society (Zhang, Jiang, Qu, 2011).

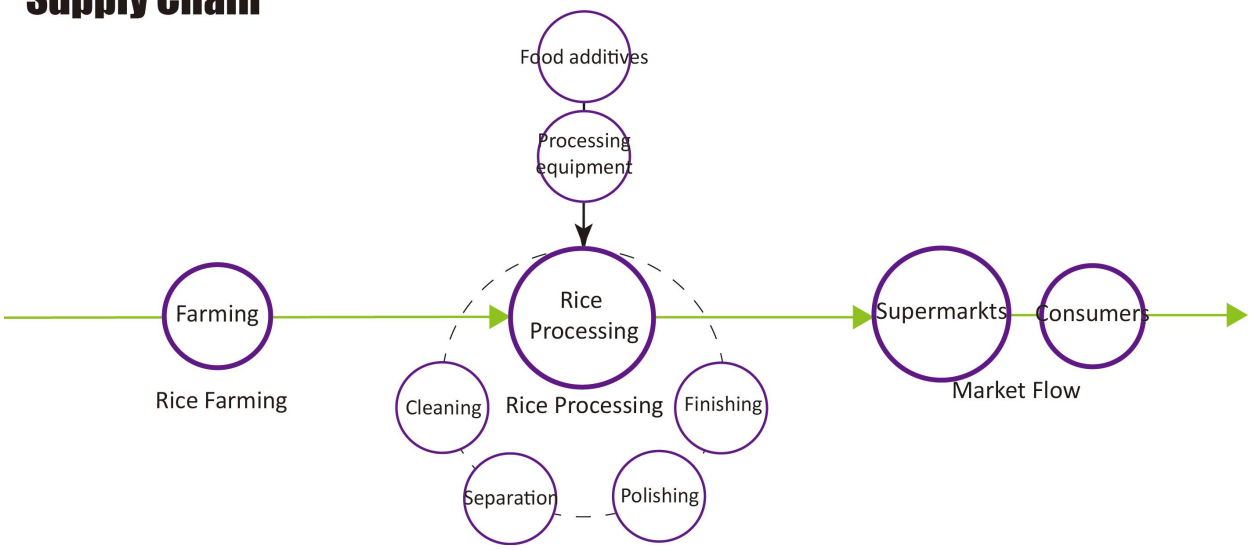
In the supply chain, as the discussion above of the food safety incidents, artificial problems caused by the illegal manufacture, including inferior rice become shoddy after over-polishing, as well as the polishing with mineral oil, which is harmful to human health.

Nevertheless, the over processing of rice is also exist, to change the rice quality facially; the flavor added rice can be sold a better price in the market. The lack of waste reuse, the profits and worth in the waste did not be regarded as something of value, which were usually treatment as nothing (Chen and Deng et al, 2017).

More potential problems may locate at rice packaging, such as no reuse, plastic based bag; besides, the society paid a little attention to rice safety, and if there is any problem, the public usually don't know who and how they should turn to.

Therefore, according to dairy and rice safety discussion, there are so many aspects of reasons causing food safety issues. Our agriculture, food industry, quality standards, government and policy, waste treatment, as well as our society, all the factors should be taken into consideration.

Supply Chain

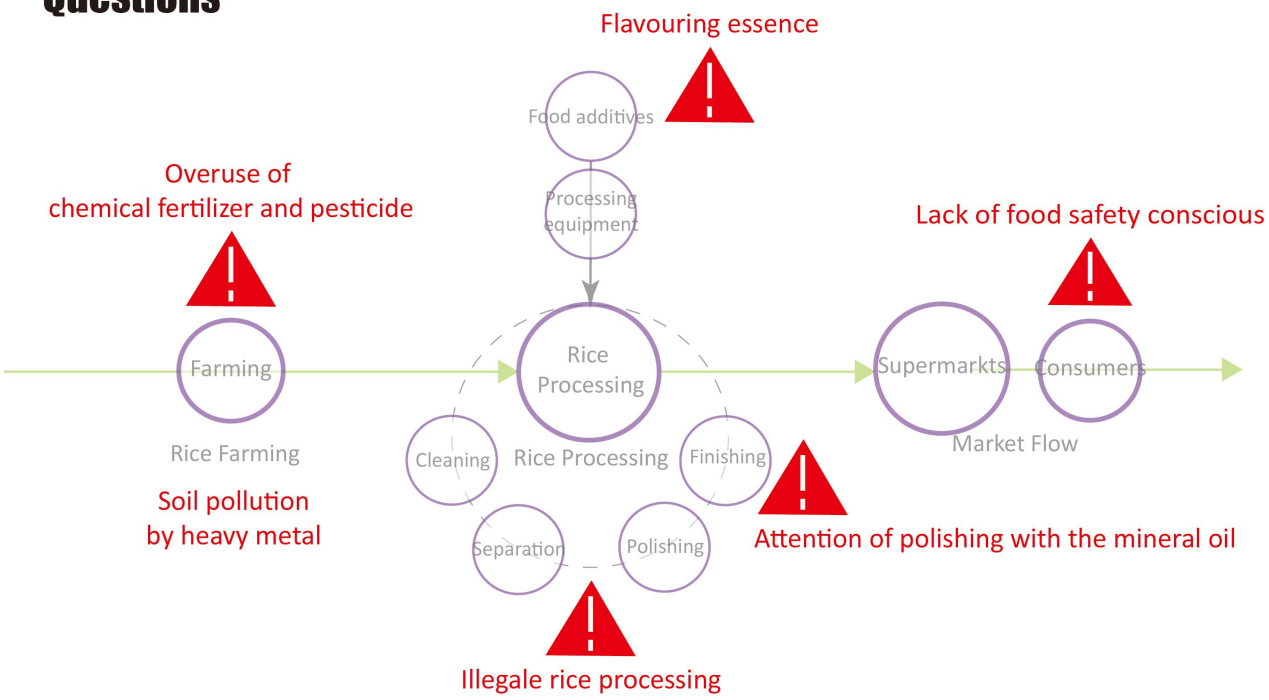


Map 30: the Supply Chain of Rice Industry

Key Point:

Attention overuse of chemical fertilizer and pesticide!

Questions



Map 31: The Question Map of Supply Chain

Without illegal food additive, but a good agriculture, Rice can be a good quality

4: WHY AND HOW

4.1 Summary

Discussion

Why are toxic chemicals and addictive so widely used in China's food industry?

"Chemical" foods

China's food industry has rapidly industrialized over the last decade, bringing many benefits to the country's consumers. But techniques originating in the chemical industry are being misapplied in food production, triggering many safety scandals (Liu, 2010). Along with industrial raw materials, the Ministry of Health's list included 38 non-food additives being misused in food, the bulk of them chemical compounds.

The motive for using these substances is the same – **profits** (Peng, 2003). The chemicals are used to make **poor quality products look better** so that they can be sold at a higher price. More worryingly, chemical compounds are sometimes used to transform a poor quality product into a fake version of a more expensive one. For example, the toxic chemical dichlorvos is added to ordinary sorghum spirit to make it smell like Maotai, which it is then passed off as.

The economic logic behind the use of industrial raw materials is simple – costs are much lower. When **price is everything and regulation is weak,** cheap raw materials translate into bigger market share and higher profits (Chen, 2006).

The Ministry of Health working group has also found that the misuse of legal food additives is widespread. Its list includes dozens of legal additives being misapplied across 22 different categories of food. The research shows that over-consumption of even legal food additives in a long term can increase risks of cancer, deformities and mutations (Luo, 2012).

One Step Ahead

In many cases, the methods used to make "chemical foods" are unimaginable even to the experts. Wang Shiping, a food science doctoral tutor at China Agricultural University explained that farmers couldn't have come up with the idea of using melamine in milk to

give the appearance of high protein levels, nor could the average technician. That scheme required familiarity with the Kjeldahl method, which is used in milk testing to determine nitrogen content and knowledge of the protein content and chemical properties of various additives.

Another case that left even the experts reeling involved bean sprouts, to which a hormone was applied to make them grow faster and without roots. The plump and white vegetables sold well, but a long-term consumption could have caused cancer or deformities (Luo, 2012). So who decided to use that hormone? Similar cases have involved pig trotters and tofu.

Li Yongjing is Dupont's director of nutrition and health for Greater China, deputy secretary of the Chinese Institute of Food Science and Technology and a senior member of the US Institute of Food Technologists. He noted that the manufacturing processes involved are beyond the abilities of the unqualified – they require **accurate quantities and timing to work.**

Zhu Yi and Wang Shiping agreed that methods of fakery used in the food sector have advanced rapidly, leaving regulators and consumers in the dark (New Century Report, 2012).

For instance, a careful use of industrial salt in soy sauce in a recent case in Foshan (Beijing Evening Paper, 2012), a city in southern China, meant that local quality control authorities tested the product twice without finding anything wrong. Similarly, the dairy firms Sanlu, Yili and Mengniu, along with many others, had all been using Melamine in their milk in a long time before the practice was exposed.

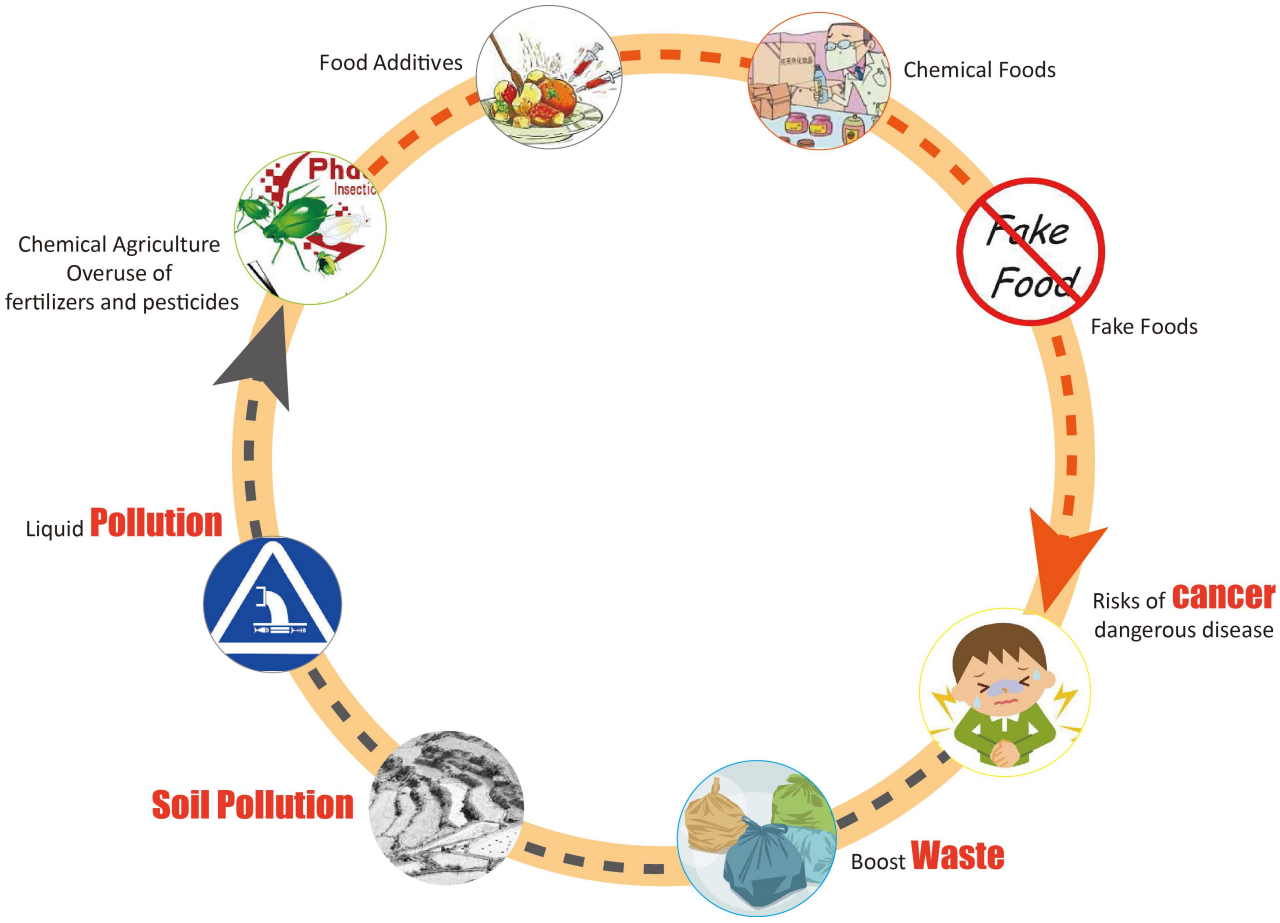
Zhu Yi said that these "expert" criminals continue to think up new uses in their pursuit of profit. Recent examples include additives to make dishes smell better, or to improve the taste of braised pork; and passing off cow fat as beef. Experts have found that each of these methods involved various combinations of illegal and unapproved additives.

Experts said the proliferation of problem foods rests on two key conditions. First, while the methods used may be harmful, most often they do not lead to immediate illness – the problems appear over a long term, and are not easily traced back to any single food sector. Second, when given the choice, people still prefer cheap food. Even though **China's huge**

and urbanizing population is moving out of the poverty, most of them still choose to buy the cheap.

On the other hand, there's **market competition**, driving illegal practices into the chain. Thus, Individuals or small factories decide to cheat, and their larger competitors – facing cost pressures – follow suit. Finally, large and medium sized companies joined in.

The punishments risked during this processing are nothing important when it compared to the potential profits. *Zhu Yi urged food policymakers to be aware of this pattern and should act to break it* (New Century Report, 2012).



Map 32: Summary of Food Safety in China - Vicious circle

To conclude, no matter what reasons are, why those producers chose an illegal way to processing their products, for money or to reach national food safety standards, the food safety in China is always difficult to be avoided. The only possible method is to design a better agriculture and industry system, to achieve a sustainable development. In a word,

Agriculture, Industry, policy, human should be considered together!

The complexity of the risks causing by food safety issues, has been fully known, as evidenced by the recognition of critical impact on the society and people, both of major features of food-safety problems and food-risks. In the beginning, it is reviewed the development of food-safety problems in China during decades of years, identifying the public hazard of ‘‘food poisoning to poisonous food’’, resulting in the social fear of food safety, which can be regarded as a key to understanding the changing patterns of food-safety problems in domestic China.

Although the traditional food problems persists and the requirement for health attention, unsafe food caused by modern production modes, from the initial cultivation, farming, to food processing and packaging, has quickly turned into the dominant and increasingly major cause of the food-safety issues affecting the health and living of Chinese people. While, it is the poisonous food that pushed a more serious challenge to the public trust, the regulatory governance and the general individual health. No matter the physical or psychological harm, those poisonous-food scandals have startled somehow the society and country, at both of domestic and international level. The risk of social distrust, has posed a more serious challenge to China.

The food safety problems, mixed of **agricultural and industrial risks**, to some level reflected a feature of modernization in China. Except of the public health risk, the disregard and distrust of producers and sellers, reflected in the making and distribution of poisonous food, is indicative of the ethical crisis during China’s social transition to a highly mobile one in which interactions with people and communities are increasingly threatened.

As what has been summarized in the food safety issue map, the serious situation of food safety in domestic China has waked the consciousness of the public. Even though the China government has published food quality and safety standards, there are numbers of illegal producers who ignored the laws while seeking for the profits.

As what has been discussed above, two more basic and critical food industries which are chose as the study objective to be under research further more **the dairy and rice industries.** Dairy acts as the ordinary and daily nutritional drink, especially for baby and

children, which is significant enough to be paid attention to. While, the rice, the most basic food for Chinese people, everyday and everyone, it is meaningful to be under conduction for researching its quality and safety.

Therefore, in this research has chosen these two important food industries to continue, and proceed **case studies in local Chongqing City** for more detailed investigation.

4.2 Control and Change

''China lacks a mature and modern consumer movement, and consumers as a group are relatively unsafe about getting their voices heard.'' (Chen, 2006)

As what has been discussed above, there are Four key roles, affecting the food safety in China:

Agriculture

In china, due to the modernization development over years, the people have already forgotten the original wisdom of Chinese traditional agriculture. Up to now, the China agriculture almost depends on the chemical. The reasons lay on our large population, our complicate food industries, as well as ourselves. While, the agriculture is always the foundation of human, if it is destroyed, how could we go on our living? What about our generation?

While in fact, we need to consider many other questions, such as the industrialization of food production, market regulation, administration and legislation. Obviously, everybody would like **chemical-free, clean food produced locally on a small scale**, but asks if that will be possible given **the size of our population -** This is the burning question.

Besides, in the world, almost all nations where the food industry has completely modernized have community-supported agriculture **(CSA)** movements, where consumers and producers are in direct contact and rebuild supply chains on a basis of trust. CSA is a civil-society attempt to create new channels to take food from farms to people. Needless to say, working in the shadow of the enormous food industry, these small scale efforts have only a limited

impact. But the Chinese people, embattled by frequent food safety scares, particularly the 2008 melamine milk scandal, are more desperate than ever to shake up the system. This is what the media calls the ‘‘battle for the dinner table’’.

Consequently, agriculture must be taken account into the following research, as its critical point in China food safety problems.

Industry System

The Chief expert of the Food Safety Risk Evaluation Committee Chen Junshi has repeatedly stated that‘‘good food is made by production, not only regulation’’. (CFSA Report, 2015)

‘‘Two-hundred million scattered farmers are raising all of China’s chicken, ducks and fish,’’ he said. ‘‘If that doesn’t change, pollution at the source cannot be dealt with. Also, most of China’s half a million food producers are **small and medium sized** firms – and if you want to ensure that levels of microbes meet standards, or that additives are not overused, you need to improve the standards of those workers.’’

Behind his words is the assumption that only further industrialization of **the food supply chain** will solve China’s food-safety crisis.

While, in China, A long supply chain stretches between China’s farms and its dinner tables: there are too many employers, too many products, too many points of sale and too many consumers.

Eight or nine authorities –agricultural, industrial and commercial, quality supervision, health and more – struggle to regulate the sector. Many food-safety experts say that the cost of **a food trace ability system** is more than the Chinese market will accept(Yang anf Qian, 2008) . But Zhu Yi is adamant that, if China is to ensure food safety, this is what it needs.

Li Yongjing and Zhu Yi both said that the Chinese public is **inadequately educated about food safety** (Global Financial Report, 2012). In the west, unsafe foods do occasionally appear, but are rarely chosen by consumers, and these cases attract little interest – consumers themselves decide that excessively cheap food is likely to be unsafe, they said. But in China, while up market food brands have been growing for years, the reality is that they still have

small market share and the bulk of consumers are very much price-led.

At a more basic level, China's penalties for producing harmful foods are too light, and the guilty are rarely caught. Internationally, it is understood that **food needs to be regulated** – but more, that you cannot stop victims from seeking judicial redress. Otherwise, Zhu Yi asked, how are we to prevent China's food market from becoming a race to the bottom?

Social Supervisor

According to an interview conducted by Yunxiang Yan (Yan, 2012), most people declared incidents of poisonous foods as such worries of their living quality, and almost without variation the interviewees wondered how someone thought that mixing toxins to processing foods only for the sake of profits. As the outcome of interview, this widely summarized as a strong distrust of domestic China food industries, and the disbelief was regularly expressed as many informants told.

> **According to relative reports:**
> *''Nowadays you never know what is inside a package of food; anything is possible.''* 1
>
> Outraged and morally disturbed, many interviewees concerned that they can no longer distinguish what was safe and eatable, and whom could be trusted.
>
> ''I am so panicked these days that I suspect every food-seller on the street and I only buy expensive and well packaged foods from supermarket chains,'' said another interviewee, ''but food scandals come from these supermarkets too. What can we ordinary people do?''
>
> ''I heard on the news that China has become the number-two most powerful country in the world and our state leaders are even more powerful than the American president, your president!''
>
> There is another village interviewee jokingly announced while with all seriousness: ''But why do our powerful leaders not protect us from those

> poisonous foods out there? This society is very dangerous, you know. You could die if you do not carefully watch the foodstuffs you buy in the market. No one can help you.''2
>
> ''I hate those people who manufacture or sell poisonous foods, especially those who deliberately poison the babies [referring to the 2008 milk powder scandal,'' a young Chinese mother said, with so angry during the discussion of food safety that she argued that she would punish the producers and sellers of poisonous foods without hesitation, if she had the chance. ''I just want to let them know how painful it is,''3
>
> 1Personal interview with a female accountant working for a foreign company, Beijing, August 2006.
>
> 2Personal interview, rural Heilongjiang, June 2008.
>
> 3Personal interview, Shanghai, 2008.

These individual investigations showed that the threat of poisonous food has stirred up social resentment, and caused a decline of social trust, even provoked a risk of trust that China may not afford during its developing to modernity.

In 2006, the State Food and Drug Agency admitted that more than 60 percent of surveyed consumers viewed food-safety conditions in China as bad or very bad. In 2007, an online survey conducted by the official Xinhua News Net revealed that 95 percent of respondents agreed that there are too many problems with the food-safety situation in China (cited in Mou 2007). According to a recent study on perceptions of food risks, the greatest fear of Beijing residents is the risk of consuming fake food, and the majority believed that food risks are highly likely to occur (Zhang and Zhao. 2011).

However, in a highly mobile and open society, most social interactions occurred among individuals related to one another by no any particularicity. While the trust among people, and the trust of social and communities, play such an important role in the way of China to success, which is not only the key to physical and mental health, but the critical point to international trust among the globe market.

Government & Policy

As what has been discussed above, except the Poisonous Food, the Risk of Trust, also

provoked the challenge to regulatory governance.

Presently, the phenomenon of poisonous-food became a new and negative development in Chinese food industries, as a failure of the illegal contamination of foods. The producers, processors, and traders knowingly mixed an array of toxic chemicals to normal foods or animal feed.

In order to make profits, they not only ignored government laws and regulations but more worse to hurt consumer health and social trust. Moreover, because they are obviously aware of the their illegality actions, the potential harm to consumers, and the punishment if the illegal food processing is revealed. The retailers of toxic foods tried to hide the secret of their foodstuffs but sell them as normal and healthy products at the same time.

These poisonous foods from other normal products that jumped the queue in the Chinese market, especially luxury goods such as fake cosmetics, watches, brand bags, and famous-brand clothing, which are sold as another open secret in China fake product market (for a systematic study of counterfeiting culture in China, see Lin 2009).

Perhaps the most unbelievable fact is the well-organized and large-scale production and distribution of poisonous food, which even involves the government institutions. Many people, majority of who ordinary work on the food processing front lines, and actively participate in the deliberate contamination of food. Others such as the economic or political elites, including entrepreneurs, managers, professionals work in quality-control agencies or government officials. The poisonous food at a higher level beyond the household workshop caused serious harmful impact on the public health and the social living, which even easily created national level panics, such as the 2008 case of the baby formula milk powder by the Sanlu Dairy Group, a leading joint-venture giant in the Chinese dairy market and business.

The most serious risk that poisonous foods, more than the food-safety problems, presented to **Chinese society may be the risk of distrust.** The cases of large-scale and organized production and distribution of poisonous foods, taking example of the contaminated milk powder by the Sanlu Dairy Group in 2008, are obvious in provoking the decline of trust as they expanded the distrust of food safety experts, the society, regulatory agencies, even strangers generally.

The biggest hurt to people may not be the producers or distributors, but the numerous China mothers, who cannot afford to trust the domestic dairy industry any more. The seeking of justice by the families of the victims remains an open wound (Barboza 2010; Yoo 2010).

Additionally, the toxic chemicals can directly threat the well-being of consumers, so that the poisonous food issues are socially because of the disregard of the health and safety of the public. The intention of seeking for more profits, even though it may harm the health of the public, increased the necessary for the production and circulation of such toxic foods in a secret way, besides, in the case of large-scale production and distribution of poisonous foods, the similar failure of the regulatory agencies that are closely associated with, promoted the flows of poisonous food.

Whist, after being exposed by the media or through the Internet, almost all of poisonous food incidents have caused large-scale panic and national wide scares, about eating and drinking. These food scares have resulted in a wide social distrust of both food producers and sellers, as well as a deep sense of unsafe. No matter eating or drinking, vegetables or fruits, meat or milk, at any moment or through any producing and selling channels, the consumption of food always acts without guarantee, and be easy to be harmful as food poisoning and even possible to death.

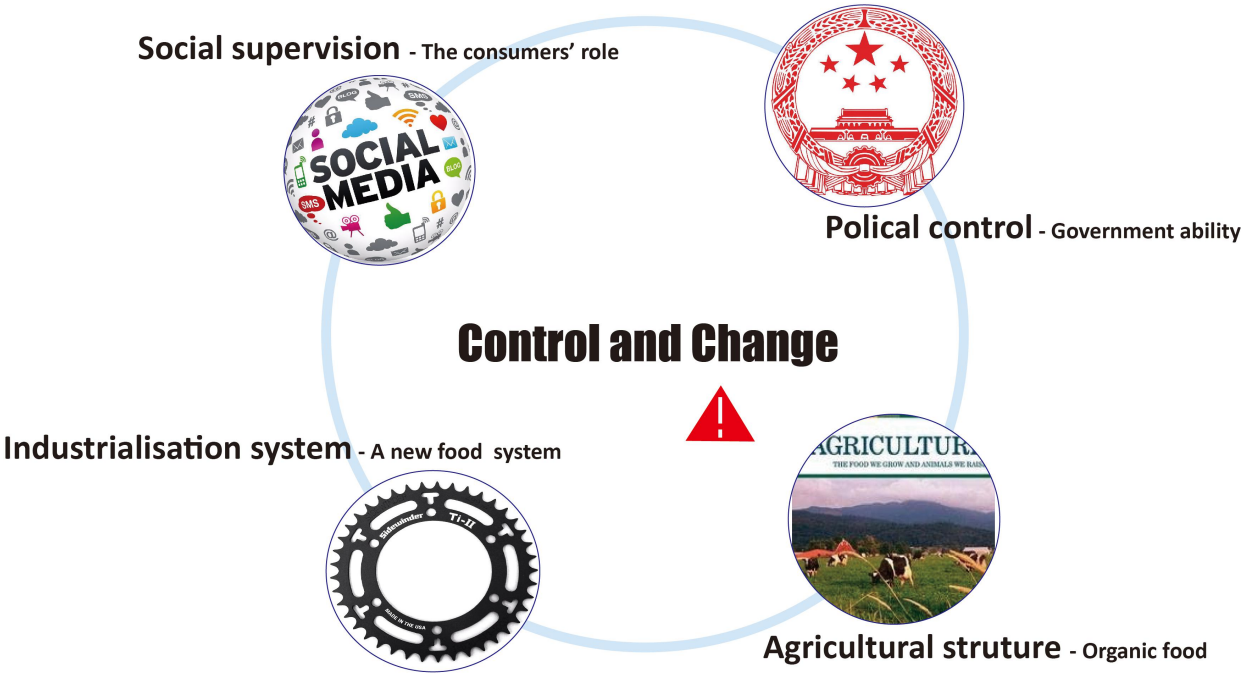
The rebuilt of social trust has become an urgent issue in contemporary China. The Chinese society as it rapidly developing, the more open and modern it become, the more safety it will require. Unfortunately, the realty is even though the market economy has developed rapidly, the social trust on the contrary has declined year by year. There was a Chinese sociologist who described the six types of distrust in contemporary Chinese society, contributing to the crisis of social distrust: the distrust of the market caused by low quality goods and low level service; the distrust of service providers or strangers; the distrust of relationship of friends or relatives; the distrust of law officers; the distrust of the law and legal institutions; and the distrust of basic individual moral values (Peng, 2003). The widespread production and distribution of contaminated or fake food products, as discussed above, has played an especial role in further affective distrust among strangers and social institutions.

Thus, so far the Chinese government seemed to pay effort to promote social trust and consumer confidence, rather than enhancing more regulations and establishing more regulatory agencies, for the aim to maintain the food-safety problems under control (Liu 2010; Tam and Yang, 2005). Due to the internal competition among regulatory agencies, and the employment and growth on safety and health management, the more important was the regular phenomenon of the corruption among government officials, so that the outcome of food-safety regulations is often ineffective and unsatisfied (Li 2009; Liu 2010; Tam and Yang 2005) and high-profile food scandals continued to surge (Barboza 2010; Watts 2011; Zou 2011).

Experts point out that western nations faced similar problems in the past, but that even so the number of cases in China is shocking.

How to solve the problems?

In this article, it provides two possible methods, one is to control, another is to change!



Map 33: The Key Points and Solutions

Control:

Food tracking is a common method for boosting food safety (Li, Jin, Chen, 2010). Li Yongjing said that if you buy a pear in America, you can easily find out which farm it came from; if you

buy a tin of pears, you can find out where the additives were sourced. But in China, this is almost impossible.

In the United States, large or medium-sized firms dominate every part of the food industry. But in China, agricultural products, meat and milk come from a myriad of small farms. Instead of the stable supplier relationships seen in many western nations, Chinese foodstuffs are bought and sold by **numerous individuals and traders.** Food products are made by individuals and in small workshops. Tens of thousands of small and medium businesses compete, and it's survival of the fittest.

Change:

These four key roles in the map, should be changed from individual to systemic. Not only should each of them become a system, but inside each should become a system, avoid output is only waste, and input without guarantee.

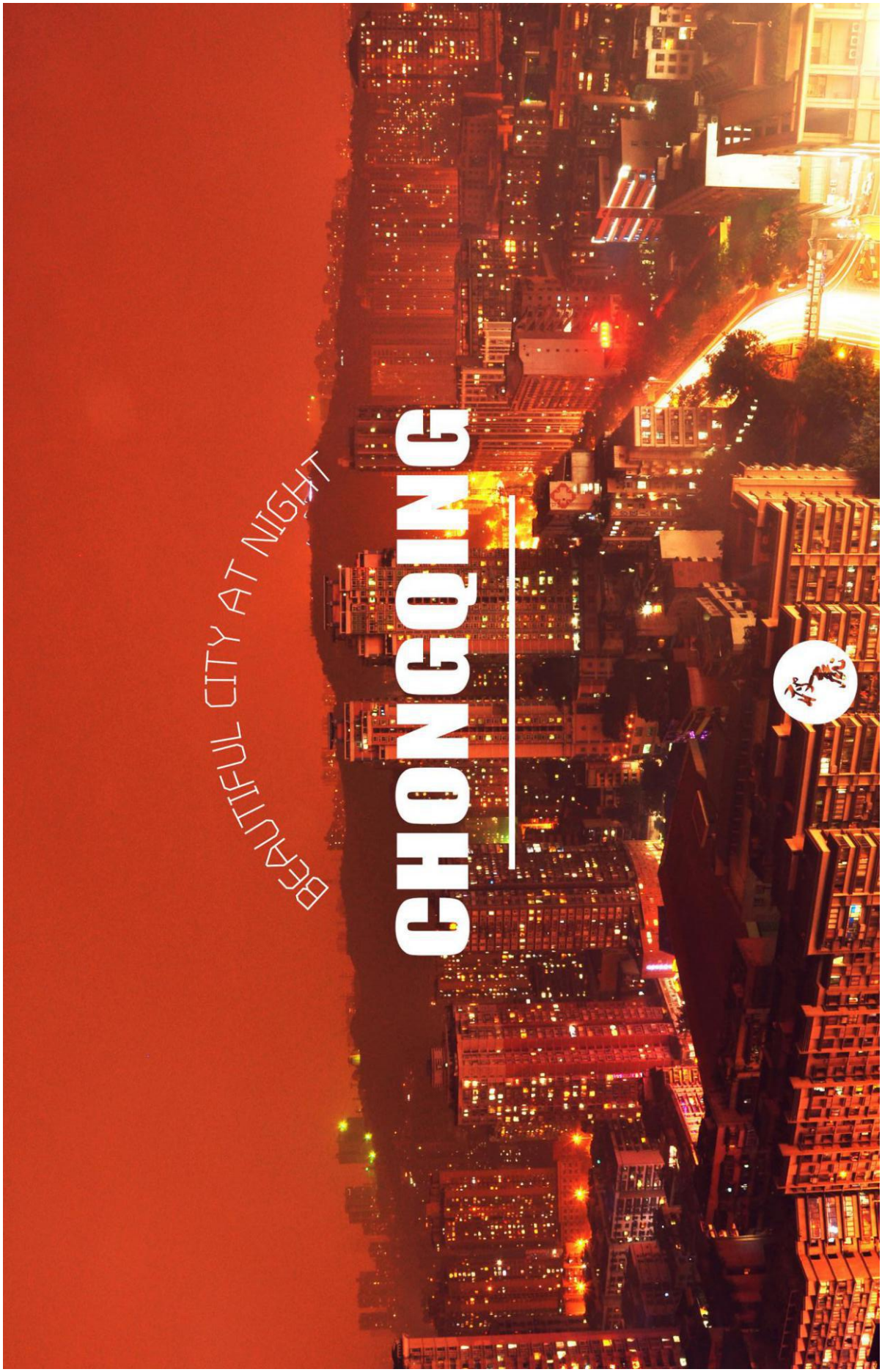
Consequently, there are **four aspects to provide the possible solutions:** Agriculture,Industry System, Policy and Social Supervisor. Policy and social supervisor, this article suggests a method: by coding products, which in fact, has already been used in man developed countries, such as Europe, America. They utilize this code to track the production of goods, so that it became more efficient to control the problem of food safety; agriculture and industry system, is proposed go on the researching on systemic design, to discuss another possible solution. The second part of article, would continue to case study of Chongqing city, which is more potential, due to its special geographic location, and political advantages.

Summary Map

According to what has been discussed, the food industry in China, has faced severe embarrassment over years. The low quality raw materials was one factor that encouraged adulteration to reach the national standards, for more profits; Microbial contamination may also be higher; several potential danger also exist, such as the over use of chemical fertilizer and pesticide, which may cause the issue of pesticide residues on food, finally become a chemical agriculture; the unsafe even poisonous material of food packaging, which will directly change the safe food into unsafe. On the other hand, the waste is too much, and no recycle, which means output is only output. Agriculture, industry, government and society are all individually, no relation, no limitation among them.

Even though the government and producers all have paid effort to change the negative situation, the food companies in domestic China up to now still struggle to survive in the competition of quality and safety, facing the challenge from inner food market as well as the external strong competitive powers of developed countries.

Therefore, the design for food safety may find its way to stand out, and new thinking and innovative approaches should be encouraged to show their value of turning the realty to a new revolution, more opportunities and more value. Especially, to consideration of China present situation and condition, design is more significant so that the real and specific problems and potential dangers can be discovered, and specified methodologies and application can be adopted and created to solve different problems. Thus, China is waiting for the design to change its structure and appearance.


BEAUTIFUL CITY AT NIGHT
CHONGQING

Scenery of Chongqing City

Part 2: CASE STUDY OF CHONGQING CITY

5: LOCAL DAIRY SYSTEM

CHONGQING CITY

Chongqing covers an area of 82,400 square kilometers, and has a population of 30,970,000, among which 10,750,000 people live in urban areas, and 20,220,000 in the countryside.

It locates at the western center of China, and is planned to be developed as a modern and commercial center. As in China, the ordinary commercial centers in China, such as Shanghai, Guangzhou, Shenzhen sites mainly around the edge of China and along the sea, due to its development and open strategies. While Chongqing is special point to real open China market, from inside to outside, to balance the inconsistent development between eastern and western China.

Map 34: The Location of four municipalities in China

Nowadays, the foreign investment to China is mainly focused on the eastern China, and

various foreign companies has sited their branches in Shanghai or Beijing. While in Chongqing, there are indeed several outside companies, from Taiwan or Hong Kong, while other European and American companies still keep their way to try their discovery of the inside part of China. Thus, not only Chongqing, and any other western cities are looking forward their new development depending on the new local strategy and international collaboration.

Map 35: The Landscape of Chongqing City

Therefore, the establishment of the Chongqing as the municipality in 1997 represented a major breakthrough of China's initiatives to speed up economic development in the central and western regions.

The Three Gorges Project which has positive implications in areas such as tourism, relocation of residents and environment protection has stimulated development of Chongqing's economy, as well as the western region as a whole.

5.1 Case Study of Chongqing Tianyou Dairy Enterprise

http://www.tianyoudairy.com/guanyutianyou.htm

Origin

In recent years, the quality and safety issues on the dairy industry emerged frequently in China, while Tianyou Dairy kept itself outside of the storm. Tianyou Dairy, the party secretary

Dr Rong Fu said, the reason was Tianyou always put quality and safety as the first, and set up a quality and safety control system from dairy farming, raw milk acquisition, production, processing, factory inspection to the cold chain transportation, which was throughout the whole dairy industry chain. From the source to the shipment, a full control of every levels of production strictly ensured the quality and safety of milk production.

General Information

Tianyou Dairy was founded in the 1930s, and after several reconstruction, is now the Southwestern largest dairy company. Tianyou Dairy in the southwestern dairy industry firstly has passed the ISO9001 Quality Management System Certification, ISO22000 Food Safety Management System and Dairy HACCP System Certification.

Tianyou Dairy, the state-owned holding company of a 70 year history, has built a standardized production chain from forage farming, cow feeding, raw milk collection, cold chain transport, to dairy production, in which the quality control has traced throughout the system. Besides, Tianyou has set up more than 200 service centers and more than 10,000 dairy communities of the sales network.

As dairy resource is the foundation of a company, in the end of March 2017, Tianyou Dairy has established **40 modern high-quality dairy bases** and **40 farming districts, 21,000 heads** of dairy cattles producing milk.

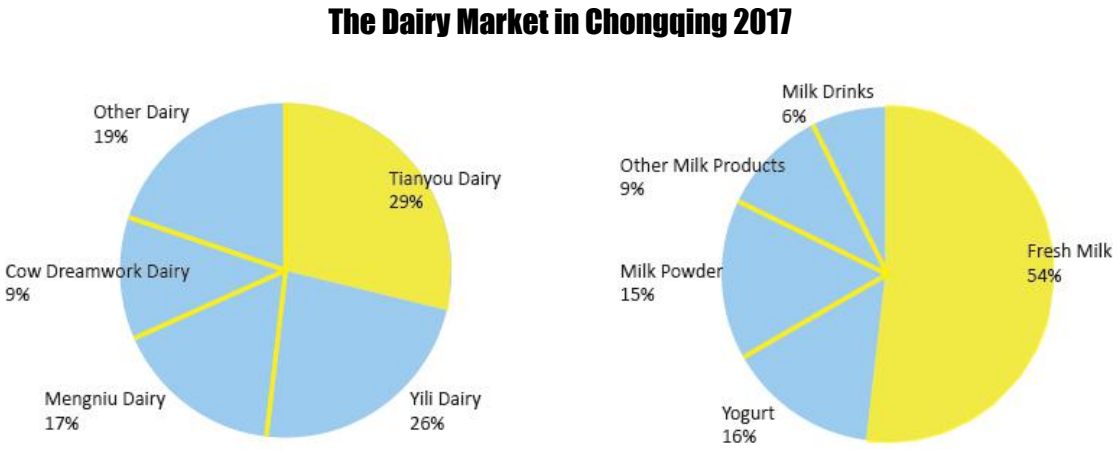
Tianyou Dairy decided to add finance of 55.15 million yuan, to start the

largest dairy resource project ---- introduced Holstein milk cows, Shanghai Guangming cows and Beijing Sanyuan cows as high quality dairy cattle for breeding; Created a thoroughbred breeding farm and 10 dairy farming Areas; introduced high-quality grass seeds, to build up five acres of pasture planting bases. It is reported that after the completion of the project, not only will add 26,000 tons per year of high quality milk, but will drive ten thousand farmers to engage in dairy farming and pasture planting. Meanwhile, the company also developed a policy to establish a risk fund for cow development, supporting more than 50,000 households of dairy farmers in the city.

In Chongqing, as the local biggest milk producer, Tianyou Dairy has the most advanced dairy equipment and processing lines, such as the Netherlands Stoke, International Paper, Swedish Tetra Pak, Dawson United Kingdom. And its business assets is worthy of 200 million yuan.

Economy

Up to now, Tianyou Dairy accounts 29% of the whole dairy market in local Chongqing, more than that of Yili and Mengniu Dairy, which are the two leader milk producers in China. It means Tianyou Dairy as the local dairy company has its absolute affection and trust of the public, and its market competition is relative strong. Besides, its products, such as liquid milk and yogurt are also sold well, and been taken as ordinary diets for people, due to its local production which can maintain the freshness of milk, and a cheaper price which is reduced because of the short transportation distance in local Chongqing.



Map 36: The Chongqing Local Dairy Market

In the end of March 2017, Tianyou Dairy has 4 large modern dairy factories, and a capacity of 500,000 ton/year; it has pasteurized milk, UHT milk, yogurt, yogurt drinks, vegetable protein milk, more than 80 varieties of dairy products. In average, Tianyou Dairy produced 96,672 tons of liquid milk per year, 40,179 tons of yogurt, 8,229 tons of lactic acid drinks, 68,738 tons of vegetable protein milk and 2,303 tons of milk powder.

To the aspect of sales, Tianyou Dairy established a comprehensive sales network, "fresh strategy" as the main direction, constructing the main city of Chongqing as the center, covering a radius of over 600km of surrounding provinces as sales market, to build the dimensional distribution network, which contained service center and retail stores as the guide, and supermarkets as assistance, and home delivery and the consumer group as accomplishment.

Except these advantages in the local market, there are still many problems affecting Tianyou Dairy, from not only market competition, but itself inner structure.

To analysis the latitude, climate and topography characteristic, Chongqing suitable for the development of dairy farming has obviously geographical advantages. Chongqing there is 3237 acres of meadow, 2876 acres of natural grassland available, stocking rates of up to more than 700 million heads.

Chongqing Dairy facing a dilemma of price

Over the past year, prices all over China are driven by the food industry development into a new round of increasing. From raw materials to finished goods, prices have been rising all along. Chongqing dairy industry was into a predication in this process of rising prices. On the one hand, a low price of raw milk decreased the cow farmers' enthusiasm critically, resulting in a large gap of milk resource. On the other hand, local milk in competition with Yili dairy and Mengniu dairy and other foreign dairies, its price was so high that it encountered an unfavorable situation, Chongqing dairy prices have been standing on edge of cliff.

* Milk price getting slightly higher, reasonable impact on farmers

In September this year, Chongqing Tianyou Dairy transferred the price of raw milk from 2 yuan/kg to 2.154 yuan/kg, which was purchased from dairy farmers. The raw milk price is affected by milk levels. According to the current development of dairy industry in Chongqing,

the milk quality of dairy farmers is generally not high, of which the production in purchase price of 2.154 yuan is not accounted for the majority. And in comparison of the price 2.154 yuan/kg in Chongqing, 3.20 yuan/kg in Guangdong, 2.40 yuan/kg in Shanghai, and 2.35-2.6 yuan/kg in Wuhan, this distance, means the raw milk price in Chongqing still belongs to the middle-lower level.

* Milk resource and location limiting the dairy development

Currently the pricing rising ratio of feed and feed ingredients is faster than that of raw milk price, and rising costs have made many farmers to give up dairy farming. Besides, with the rapid development of Chongqing local dairy industry such as Tianyou dairy group, the milk resource issue was also revealed. In Chongqing, the amount of dairy heads declined by years, now only about 24,500 heads, and in early 2005, the market goal of Tianyou Dairy was to sell 100,000 tons of dairy products, while the local production was only 91,000 tons. Consequently, in this calculation, originally the milk resource should have supplied three milk dairy enterprises in Chongqing, in fact only for Tianyou Dairy was quite difficult. In that year, the Municipal Bureau of Agriculture officials had expected: the next two years, the lack of Chongqing milk resource would reach at least 20 million tons.

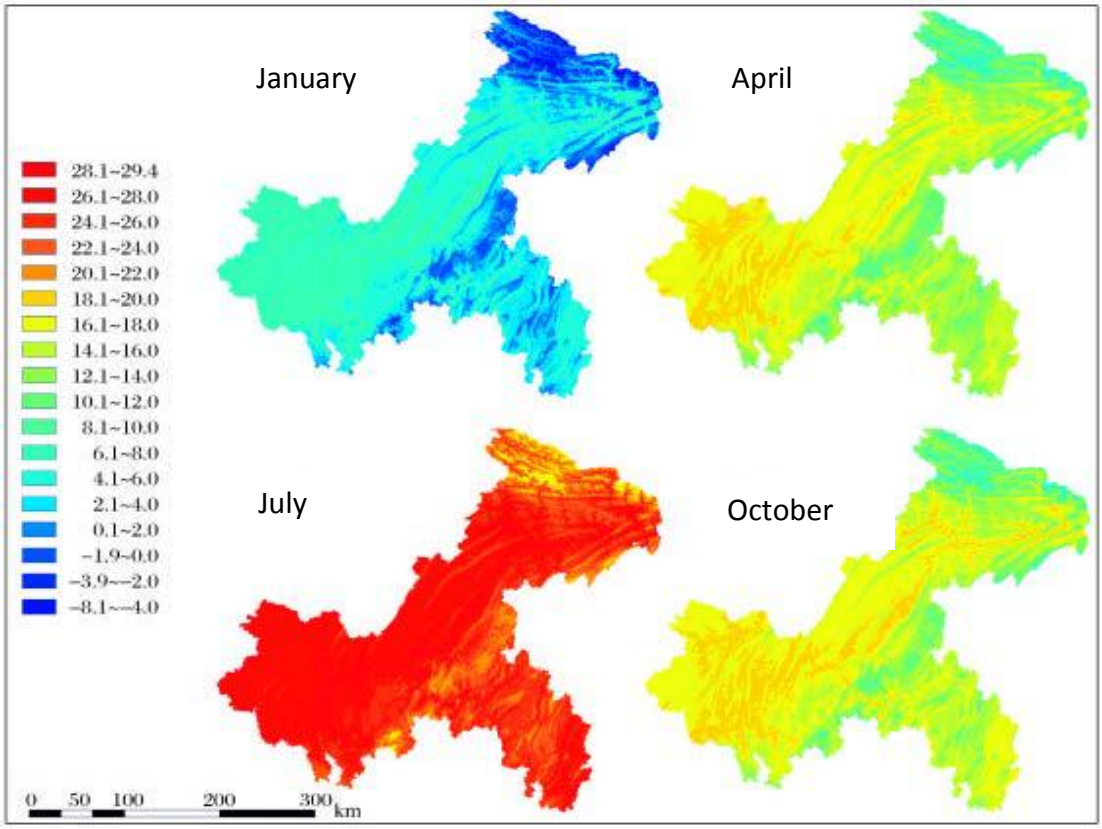
* The non-local dairy industry surpassing the local one seriously

In Chongqing, as the market position and industrial location, the dry dairy industry almost quite from the mainstream market; liquid dairy products are also declined from a 90% market share in 2010, to less than 60% after 2014. Chongqing local dairy in market share has dropped to 49.6%. In competition with non-local dairy products, the local ones have no advantage in varieties of species, but in price. 1 liter boxed milk such as Yili dairy, Mengniu dairy and other brands sells 5.2 yuan, much lower than that of Tianyou dairy 6 yuan. The competitive pressure makes the local dairy less of competitiveness unprecedentedly.

Farming

The Special temperature and geography

Chongqing has its special natural characteristics, such as high temperature in summer, humid air all around year, mountainous figure, two large rivers across one of the largest commercial centers. Due to the habit of enjoying life and strong purchase ability, the local economy has been developed rapidly year by year. To the aspect of the latitude and topography



Map 37:Temperature character in Chongqing, from winter to summer

Map 38: The Obvious Geographical Advantages of Chongqing Dairy Farming

characteristic, **Chongqing suitable for the development of dairy farming has obvious geographical advantages.** In Chongqing there is 3237 acres of meadow, 2876 acres of natural grassland available, stocking rates of up to more than 700 million head. While, the dairy farming in Chongqing has been facing the **challenges such as high feeding costs, high temperature and high humidity, heat stress.**

Therefore, the dairy farm construction is so important that the dairy companies recently focused on their effort to improve their own-built benches. On one hand, own-built benches can maintain the cow breeding quality and disease control level, on the other hand, the raw milk quality control can always in the hand of producers, from the raw milk collection to milk products finishing. Whilst, how to defeat the crucial high temperature is always a big barrier for Chongqing dairy producers.

Cow Species and Breeding

Over the past 40 or so years, the dairy cattle population has made its biggest achievement since the People's Republic of China was established. In 1949, there were only about 100 000 head of dairy cattle; by 1991, this number had increased to 2.945 million.

Map 39: Cow Breeding of Tianyou Dairy

Most Chinese dairy cattle (Chinese Black and White Cow) are derived from cross-breeding between the local yellow cattle and Holstein. According to data collected by the CDCA in

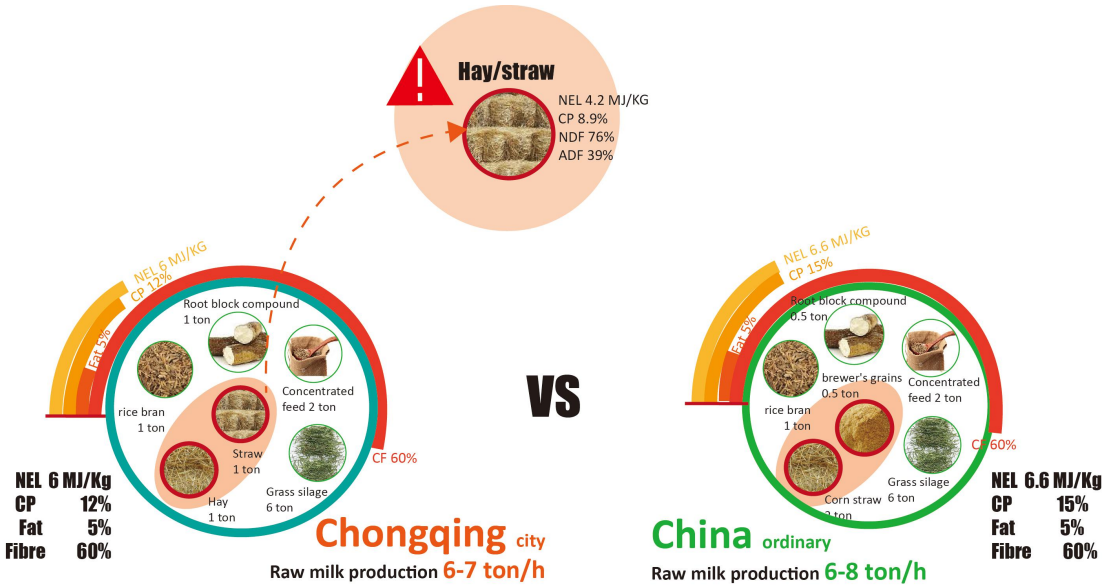
1981, in 28 provinces and the autonomous regions of China, adult cows have a height of 133 cm and weigh 550 kg, while bulls are 150 cm high and weigh 1 020kg, entirely meeting the breeding program requirements. On average, 80 000 cows produce more than 5 000kg of milk each per lactation (305 days). Of these, 22 000 are registered a yield of 6 400kg. On major breeding farms, the average annual milk production for the head reached 7000 kg/cow. For example, the 7 000 cows of the Shanghai Dairy Company produced 7393 kg/cow during 1984 while, among them, a specially reared group produced an average of 8 169 kg in the same year. In 1985, 326 cows produced 10 000 kg of milk in Beijing, which doubled the figure of 1982. One cow even produced 14 081 kg of milk on its third lactation. The average milk fat content of the Chinese Black and White is 3.5% to 3.6 %.

With government encouragement and support, especially for private initiatives in the industry, dairy production in China has developed steadily since 1979. Dairy farmers are emerging in large numbers: according to statistics collated by the CGBCWBDC, dairy cows in Heilongjiang Province in 1991 amounted to 618 000, an increase of 261% over 1983 and almost four times more than in 1982. Between 1983 and 1991, the Chinese Black and White cattle population in Beijing and Shanghai increased to 66 000 and 74 000, respectively, representing an increase of 100 and 180%. The Autonomous Region of Ningxia Hui had only two dairy cows in 1951. In 1991, their numbers had increased to 21 000. In Qinghai Province, Holstein bulls were crossed with the local yellow cattle and yak to improve milk production of the local breeds. By 1984, there were 20 000 head of improved cattle, resulting in an annual average of 32.5 kg of milk per head in the province.

Donbeitang Town in Jiangsu Province has been named "Dairy Cattle Town", since 702 families of the town rear dairy cattle. In 1984, the town's two farms raised 1 605 heads of dairy cattle, with yields of 5 300kg/cow on one farm and 6 273 on the other.

Over the past 40 years, China has achieved significant progress in improving the performance of the local yellow breeds by changing them into dairy cattle and by breeding dual-purpose breeds. For example, in order to increase its cattle population, Gansu Province introduced 127 head of Qinchuan cows from the middle region of Shanxi Province and crossed them with Holstein bulls. It is clear that the milk yield was improved greatly, but not

so the fat content. In addition, cross-breeds of Qinchuan cows can endure unfavorable feeding conditions and are well adapted to the severe local ecological conditions.



Map 40: The Ordinary Forage Comparison of Chongqing and China

To the aspect of breeding, as there are few forage of Alfalfa in Chongqing, in ordinary the local dairy cows only eat grass silage, Hay, Straw, Rice bras, root block and some concentrated feed. When contracted with the China forage standard, in this food formula, the normal Chongqing dairy cows eat NEL 0.6 MJ/KG lower , protein 3% lower than the standard. As a result, the raw milk production per head is 1 ton less than standard. Obviously, it is difficult that the raw milk production can reach the China dairy standard (the fat content of raw milk should not be less than 3%, protein content no less than 2.8%). Nevertheless, due to the different varieties of cows, lactation, seasons, feeding conditions, the real fat and protein content of the raw milk may not meet national standards.

Even though, it is usually before processing to standardize the raw milk, a good quality raw milk is the best solution. While to Chongqing Tianyou Dairy, this situation is better, because Tianyou has made up their mind to build their own pasture, to grow a better forage.

While without Alfalfa, the problem is still there. A more nutrient diet for dairy cow is urgent.

Local pasture construction

http://www.hesitan.com/story_cqty/0/0.chtml

The dairy farming in Chongqing has been facing the challenges such as **high feeding costs, high temperature and high humidity, heat stress**. While, these never stopped the

confidence of Chongqing cattleman, to constantly break the bottleneck of development. From the beginning of the 1930s, Chongqing Tianyou Dairy company, through efforts of nearly a century, has left a mountain cattle footprints in the history of the development of China's dairy industry. Chongqing Tianyou Dairy built an open pasture in mountains at an altitude of 900 meters, containing one thousand cows for sightseeing and demonstration, of which hundreds of heads of Jersey and Holstein Uruguay have rooted there.

Two Rivers Ranch is one of the new ranches built by Tianyou Dairy, to a design of 1000 heads scale, with a total investment of 70 million, completed in 2010. Two Rivers Ranch differed various from other modern ranches: not only allows everyone to "An Open View", but also to "An Enjoy Tour". In addition to providing the high-quality fresh milk for Chongqing citizens, it acts as a tourist ranch, and its characteristics can be visited from the special gate.

350 heads of Jersey and Holstein have rooted in the mountain city

"If a ranch plans to continue its steady and healthy, it is necessary to build a competitive core power of cows." Tan Wei, the manager of Tianyou Dairy, introduced.

Two River Ranch as a new pasture, has done a big effort to establish its core cow heads. In addition to the introduction of 300 Holstein cattles from Green Lotus in Beijing Sanyuan district, 150 Jersey cattles from Australia were imported, and 200 Holstein cattle heads were imported from Uruguay, to ensure an excellent performance and a high genetic productivity ability. The more important is the Jersey cows are adaptive to the hot and humid environment, although with a slightly lower milk production, the protein composition is relatively high, so that Tianyou Dairy planned to turn Jersey milk into a high-end dairy brand.

With these favorable natural conditions, and the foundation of modern equipment, the core heads and professional technical support, the Tianyou Dairy team has the confidence to reach their goal by the end of 2020 of an average yield of 8 tons.

Although Two Rivers Ranch is located in the high mountains, and the temperature is lower 5 degrees than in urban areas, and even with snow in winter, the heat in summer is eased to some degree. While the ranch is also equipped with the system to defend heat, and used the intermittent spray system and fans of a large diameter 1.2m.

Mechanized production improved the efficiency of breeding in mountain city

Chongqing is a mountainous region, not suitable for large-scale farm operations, and due to its high temperature, the location of ranch, its temperature and humidity should also be considered carefully.

Two well-known companies, Jingpeng and Quartet, joined to co-design the tourist ranch for Chongqing Tianyou Dairy, in a scale of one thousand heads located in two rivers. In order to improve the breeding efficiency, Two Rivers Ranch changed the traditional farming model, using a large-span barn, automatic scraping septic systems, biogas power generation equipment and automatic rotary milking machine, which greatly improved the mechanization level.

Main Products of Tianyou Dairy

Map 41: The Tianyou Dairy Basic product exhibition

Products

According to China statistics, in last year the total milk consumption of urban residents in Chongqing was 220,000 tons, 33.5 kg per capital consumption of milk, ranking the fourth in China. While, from a point of the whole city, the per capital consumption of milk is not optimistic. In the last year, the whole city's per capital consumption of milk was only 7kg, only a half of the national average per capital consumption. The Chongqing dairy industry is potential to be developed.

Quality Control

It was informed from City Farmers Investment Group, that during recently 2 years, Tianyou Dairy have invited 100,000 consumers from the public and industry representatives, into the company to take part in, to visit the factory line, and Tianyou Dairy quality and safety control system in the whole industry chain .

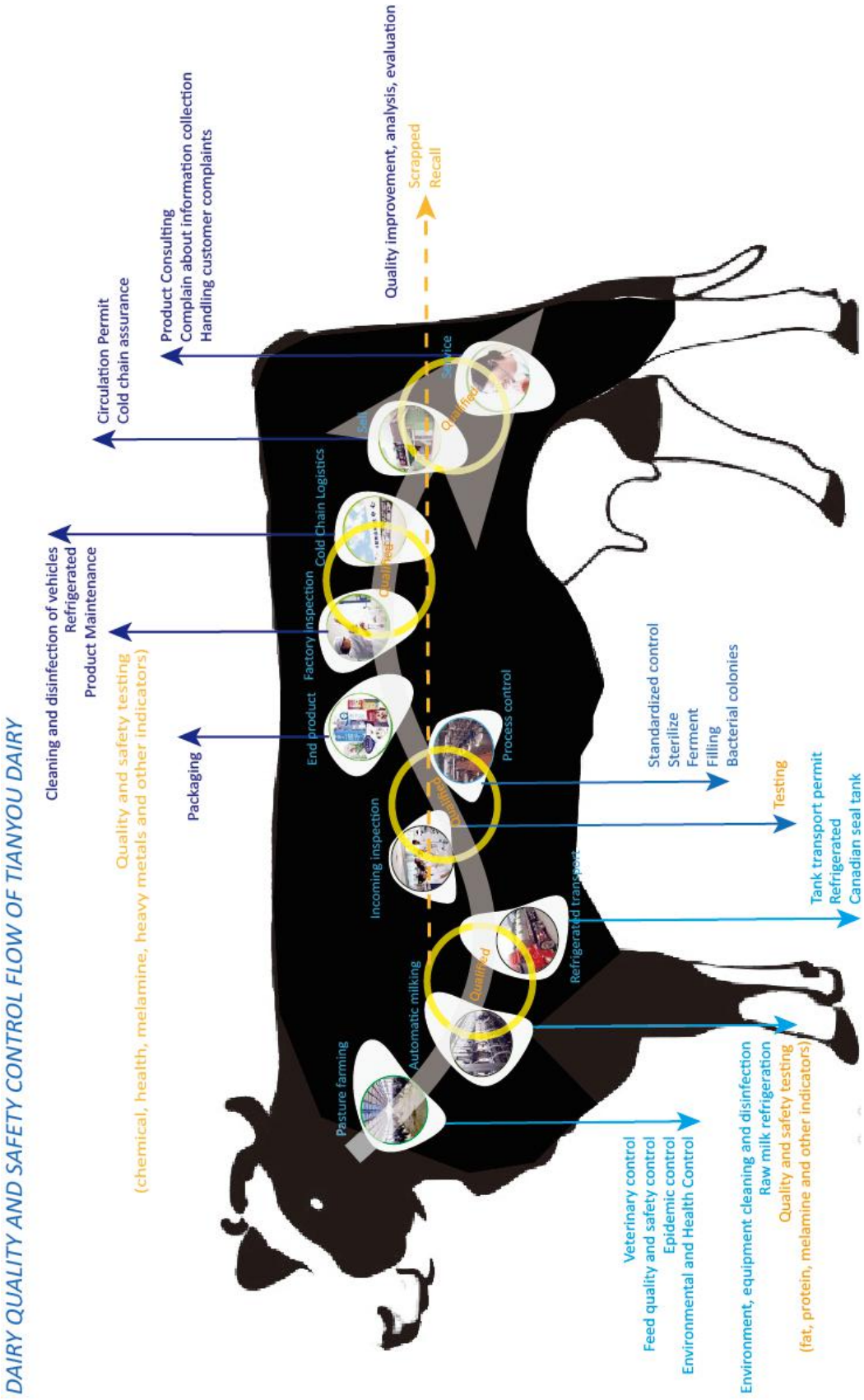
It is understood that this visit started from the March 14, and in a mouth, nearly 50 consumers and industry representatives walked into Tianyou "Transparent Factory" (Yang, 2014). From the dairy inspection center, the production line, and then cold-chain logistics, a through visit was conducted to get a full understanding of how to refine a high quality and safety milk.

This activity gave the public and specialists a good chance to interview the inside factory of Tianyou Dairy, to understand how the milk was produced and what the quality control system is, so that the public can relieved while drinking the milk produced by Tianyou Dairy. This is such an efficient way to maintain the trust of the local consumers, due to the milk incidents happened frequently recently, which has shacked the trust of domestic dairy products. Otherwise, the consumers may turn their minds more to the foreign dairy companies, and the competition in China dairy market will be more critical.

26 indicators are required before the fresh milk is finished.

In recent years, the dairy industry sand in trouble, made citizens worried over time. Reporters recently learned from Tianyou Dairy Co., Ltd., that the company purchased nearly 10 million yuan of advanced detection equipment for quality and safety test, such as Melamine, the β-lactamase, leather hydrolyzate, sodium thiocyanate, Aflatoxin, food additives, etc. The fresh milk from farmers to factory at least should be detected 26 targets.

In order to protect the interests of consumers, Tianyou Dairy opened up 400-8871716, service lines requiring service personnel to give consumers a reply in 24 hours after receiving complaints. As the logistics is the most likely problem to occur, the company has established a perfect cold chain control system, specially configured with more than 120 vehicles, to ensure that products can be sent to the sale market within 24 hours, freshly and safely. The company also improved the traceable manage system, from raw material numbering to product distributors, in which the traceable manage system was implemented throughout the control and management.



Map 42: The Quality and Safety Control Flow of Tianyou Dairy

Packaging

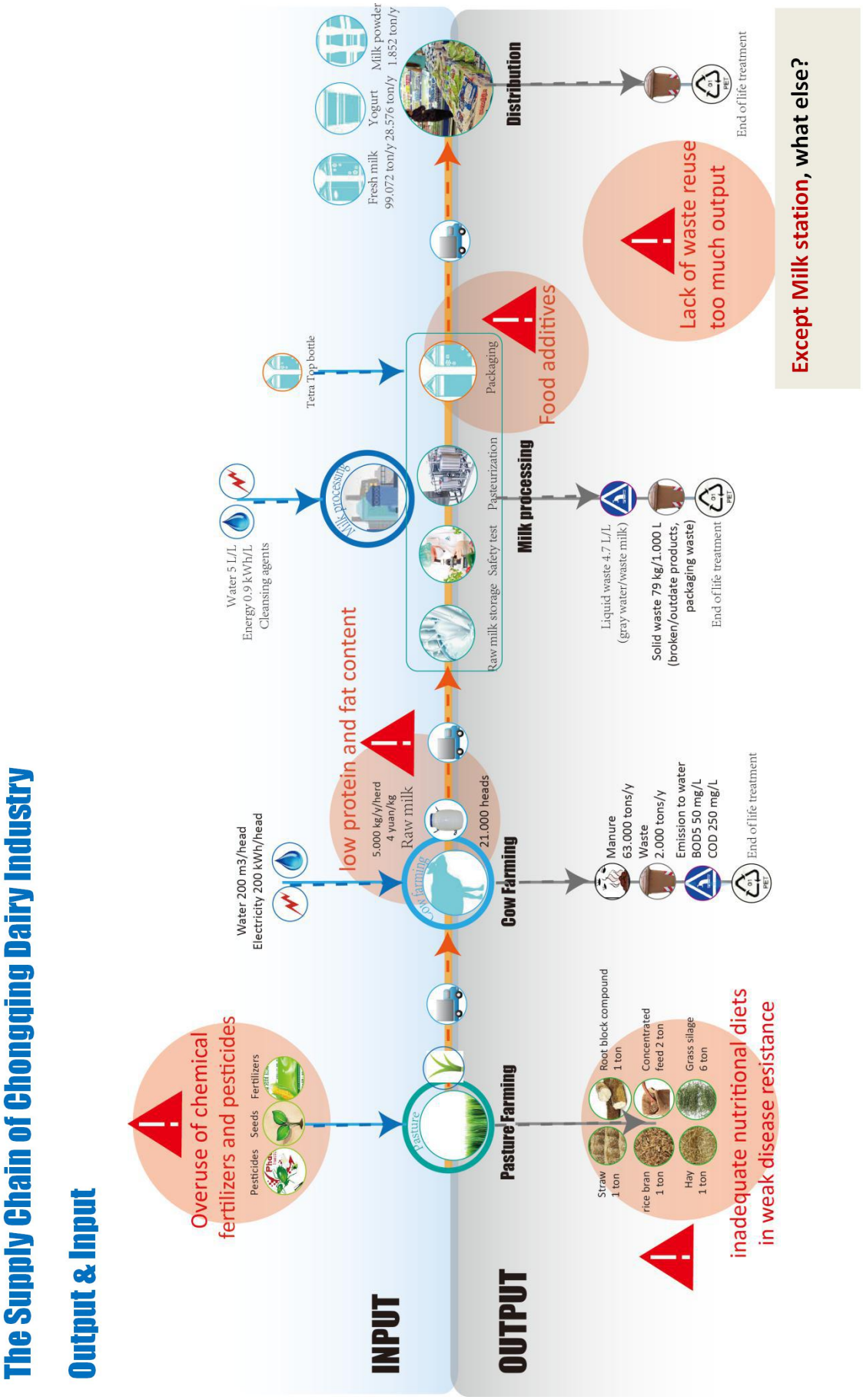
To the aspect of dairy packaging, in China, it is commonly to use Terra top bottles. This kind of packaging is proved with good competence of maintaining the freshness of milk. While, its cost is still relative high, so that there are many small milk producers prefer to choose material of lower quality, which may result in the worse quality of milk, especially for the fresh milk.

Tianyou Dairy controls its milk freshness, not only from the raw milk and milk processing, as well as the milk packaging. Thus, few unsafe incidents are happened due to the milk packaging, but it is still a potential factor that may affect the milk quality after processed.

Supply Chain

Raw milk in initial inspection: Weighing--Initial filter--Net milk--Cooling--Storage

Generally for the choice of the cooling temperature, after the milk delivered to the plant, it is necessary go through promptly the inspection, weighing, cooling and storage. The process from unloading to storage after the milk tank entered the factory required about 30 min, and the processing needs more time. Therefore, in order to coordinate the equalization of production rate, as well as prevention of processing stagnation caused by some special cases, the storage time from the raw milk is conservatively estimated one day. From the perspective of energy saving and storage time and the milk temperature, it is optional that the raw milk is cooled to 4 ℃.



Map 43: The Supply Chain of Chongqing Dairy Industry

Illegal additives in milk, are mainly from the milk station.

"The illegal additives, were mainly from the intermediate businessman. Somewhat irresponsible buyers for more profits, added antibiotics to reduce the content of the β-lactamase in raw milk, or sodium thiocyanate for the antiseptic effect, etc., therefore **the raw milk resource has become the key to the dairy safety.** " Argued the Tianyou Dairy responsible person. Besides, Tianyou Dairy implemented Safety Raw Milk Plan of 70,000 milk cows, and established the breeding cattle engineering center. The company controlled nearly 40 ranches self-owned, and all milk stations were self-built, to ensure product quality and safety from the resource. In the feeding process, the company carried out quality and safety testing for every purchased forages, and regularly checked cow disease for prevention and health control, to ensure the quality of fresh milk.

Milk processing: Raw milk storage - safety test - pasteurization - packaging

The dairy industry as a special food industry, with a short consumption period, requires the cold chain support, and needs a real-time dynamic inventory management database, and quickly understand of changes in the terminal market.

According to the staff of Tianyou dairy, the company spent 20 million yuan constructing the cold chain logistics and the distribution center. It is reported that the distribution center has a total area of 5,000 square meters, including 3,000 square meters of warehouse and nearly 2,000 square meters of low-temperature operation area, and a conveyor automation production chain with high-tech integrated, as well as 18 special cryogenic distribution ports, and logistics center of scheduling vehicles, and other facilities as a supporting construction.

More Details

According to the market analysis of Tianyou Dairy, the distribution is mainly depended on the supermarkets and own-built milk stores, which account for 55.05%; the traditional stores and bars, as well as the special sell places, such as hotels and schools, account nearly 40%. This means the supermarkets and own-built milk stores are the principle approach to sell milk. While, the supermarket has the advantage of more chance to advertisement the products itself among the dairy products, and the own-built store also has the advantages of local products, which can reduce the transportation fees and improve their own sell points for more profits at the same time.

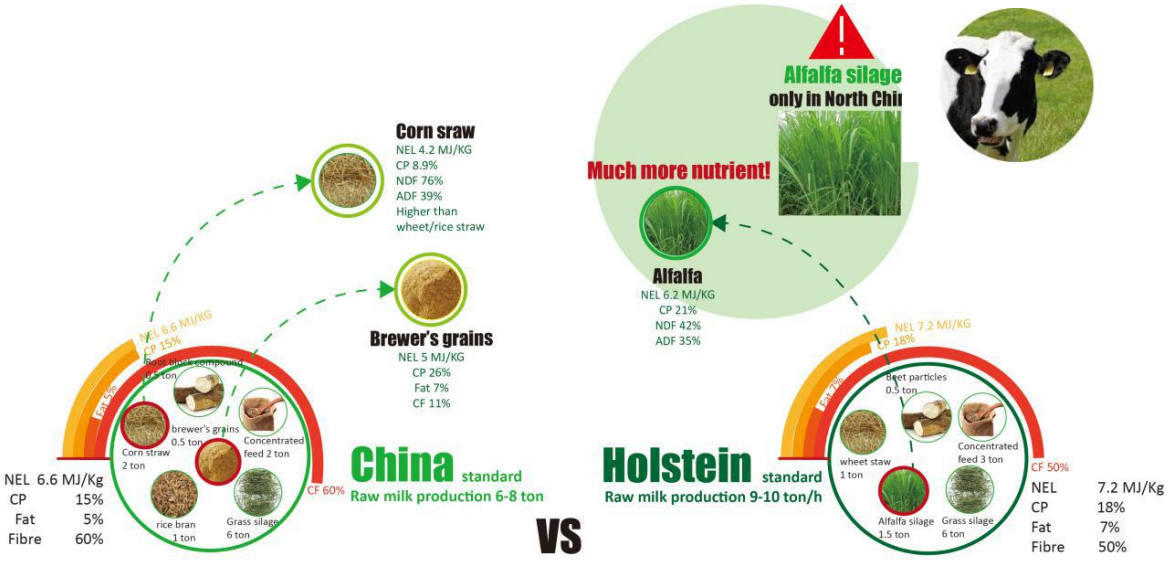
The raw milk and finishing product transportation depend on the company own track, with cold chain equipment, and the transportation area is covered the whole Chongqing city, both of urban and countries. Therefore, due to the own-built pasture and own-built milk stores, as well as the distribution system of Tianyou Dairy, the raw milk support and milk processing, and products distribution are all under control of the company, the product quality and safety have the guarantee during production and transportation. Besides, in this mode, the costs during raw material collection and production distribution and selling are also reduced, so that the company can benefit from the own-built system, their safe products, and offer more jobs to their own workers, in a word, more profits can be created.

5.2 Questions

Key points

As the discussion in Part 1, in the supply chain, the milk station acts as the key point, to control the quality of raw milk. **Except the milk station, is there any other critical point?**

It is necessary to have a discuss the reason caused the raw milk of a lower nutrient content. The European raw milk standard: protein content 3.22%, fat content 3.25%, 9-10 tons/head; while in China, the protein content is 2.8% - 3%, fat content 3%, 6-8 tons/head. Besides, in China, dairy cows are almost imported aboard, and the different environment affected the habit and living of cows, besides, the breed forage is also different, all of which affected the milk producing, both of quality and quantity.



Map 44: the Comparison of Ordinary Dairy Forage of China and Abroad

Obviously, the more nutrition, such as protein, fat and fiber, are taken by cows, the more and better milk they can produce. **Protein content:** EU raw milk has 0.4% higher than Chinese raw milk. **Fat content:** 0.2% higher than China raw milk

The critical point locates Alfalfa, which is special adequate for dairy cow to produce milk. In the south China, the breeding grass is almost without alfalfa, instead, the whole corn plant and other grass, such as wheat straw and grain straw, are used as the main feeding grass, which are not comparable with alfalfa.

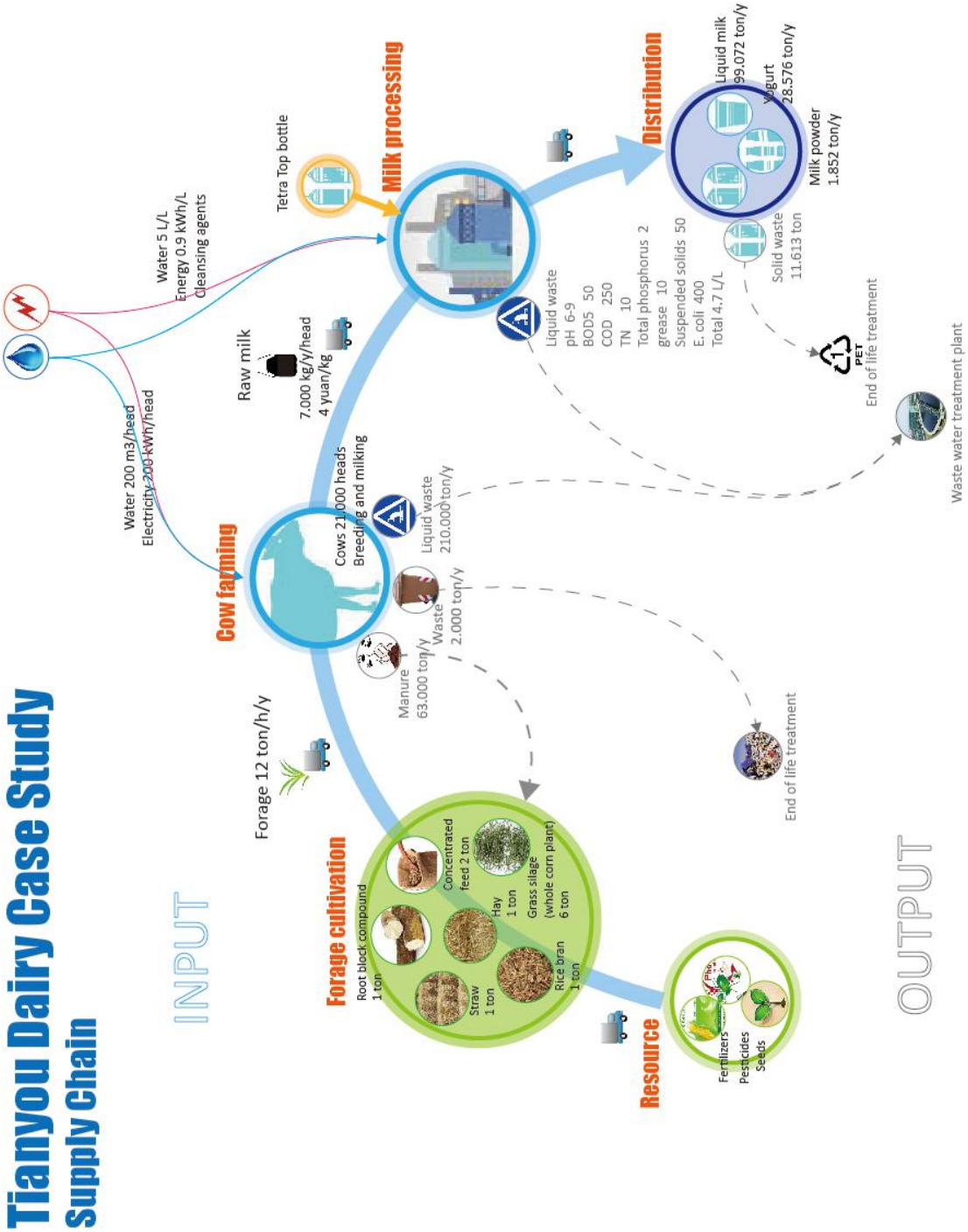
Therefore, a better dairy cow diet is required. There is another problem, that is based on the consideration of cost, it is better to use those local feeding materials, so that the local economy can also be developed at the same time.

Detailed problems

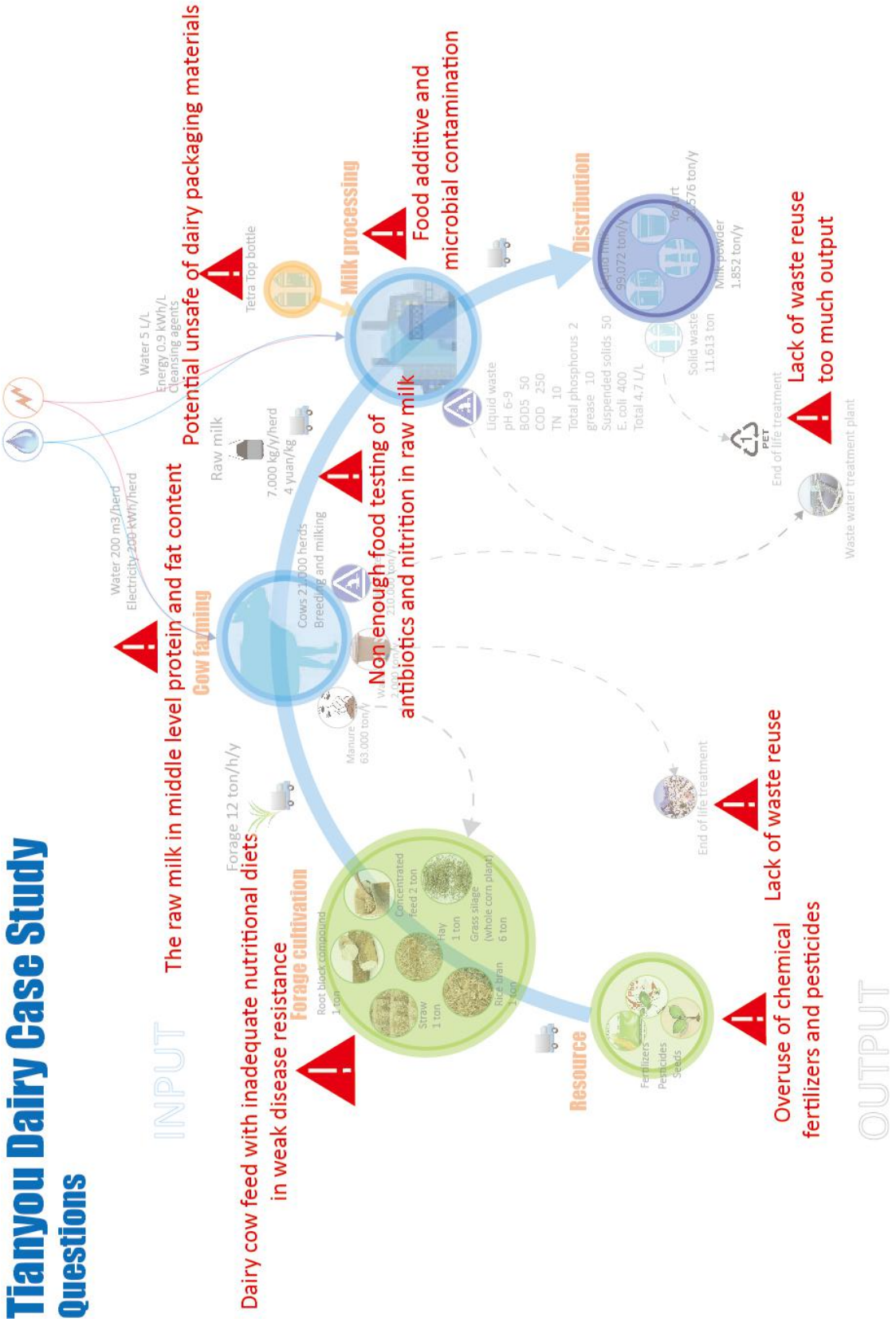
As it is shown in the supply chain map, **to the aspect of forages and cultivation**, according to the discussion above, there are several main breed forages, such as grass silage, rice bran, straws and hey, root block compound and concentrated feed, totally 12 ton per head per year. And each dairy cow can produce 7 tons/year of raw milk in Chongqing. This raw milk amount ranks in the middle level of average raw milk production in China. While, the nutrient of the forage has lower nutrient than that of China, which means the dairy cows eat worse than other cities. To reach the China Raw Milk Standard, it is necessary to design a better diet for dairy cows.

While in the **forage cultivation**, there is common in China to use chemical fertilizer and pesticide in a large number, and is often extremely beyond the necessary of the plant. Therefore, there is another well known word, "Nong Yao Can Liu", which means the Pesticide Residues. After several incidents caused by the pesticide residues on vegetables, this has become another severe poisonous food, vegetables and fruits, as well those animals fed with these poisonous forages.

To the aspect of waste reuse, the manure was considered as a natural Fertilizer returned back to forage cultivation, while the other waste such as liquid waste in cow breeding and raw milk processing are sent to the waste water treatment plant to be deal as normal waste water, regardless of their large number of nutrition of protein and fiber.



Map 45: The Simplified Supply Chain of Dairy Industry



Map 45: The Question Location of Dairy Supply Chain

Waste management/environmental issues

Dairy cows produce large amounts of waste in the form of excrement and urine. This can cause serious pollution to land, air and water. Unlike in other countries, in china, it is not permissible to spread manure on land (without proper treatment to ensure it is hazard free). In 2007, there was an incident in Jiangsu Danyang where the water source for human consumption was polluted with cow waste due to improper handling. Therefore, priority for large-scale expansion projects is usually given to dairy farms with a good track record of environmental management.

To the aspect of energy, 200 tons of water and 200 kWh are used in feeding cows; and in the raw milk processing, 5 L/L of water and 0.9 kWh are consumed.

Cost inflation pressures profit margins

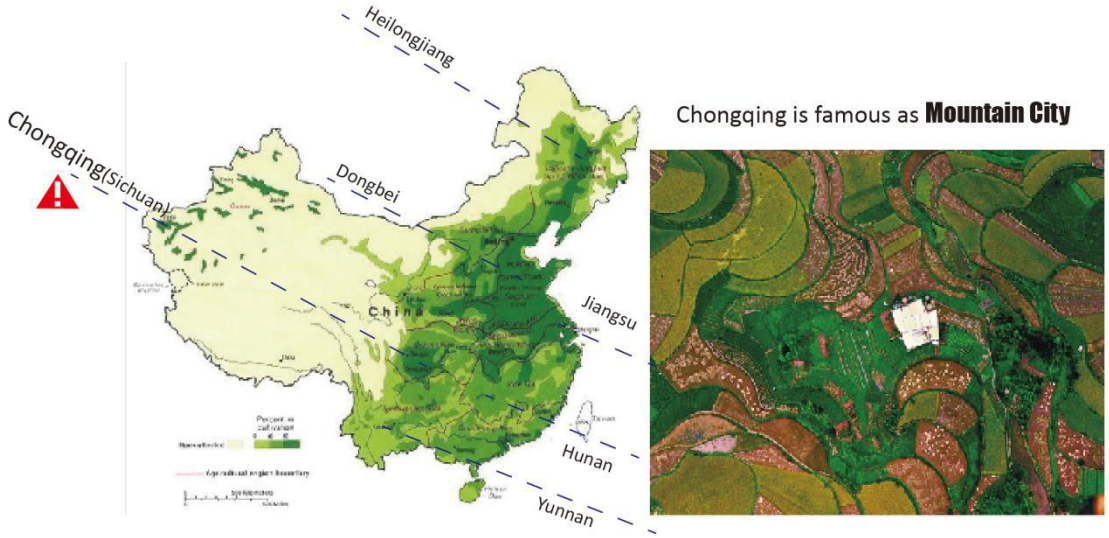
Feed costs account for a large portion of total milk production costs. Increasing costs of feed inputs will compress margins if farms are not able to pass costs on through an increase in prices to the processor. Large-scale dairy farms may be able to offset costs by applying more scientific feeding formulation using high-quality and nutritious feeding stuffs, such as soy meal and alfalfa, which heavily rely on the import market. Meanwhile, the domestic corn price support programme results in higher corn price in china than in the rest of the world. Rapidly increasing labor costs in china are also adding to the pressure on profitability.

Consequently, it can be understood from the problem map of the milk supply chain, that the main problems have affected the milk quality and safety, such as extra use of chemical fertilizer and pesticides, dairy cows fed with inadequate nutritional diets and in weak disease resistance, non completed checking for antibiotics and nutrition in raw milk, the raw milk in middle level protein and fat content, the food adulteration and microbial contamination in milk products. Besides, the problems of waste reused, both of liquid and solid waste, are almost without consideration.

6: LOCAL RICE SYSTEM

Introduction

Qiaoping town, in Chongqing is characterized of mountains and hills, accounting for 90%, and the flat area is less than 10%. Except the advantage of geography in Qiaoping town, there are several main problems for the rice industry in Chongqing, such as the hot temperature in summer and a humid climate all the year.



Map 46: The geographic Character of Chongqing

Main problems for rice industry, Chongqing city

* The climate impact on rice quality

There are several more critical periods affecting the rice quality, from booting to late flowering, grouting, maturity, especially the filling period. While this is at the high temperature period in Chongqing in the late summer season, the average daily temperature is high, and the temperature difference between day and night is small.

* Some rice processing is still in small scale, the product quality remains not high

There are many small rice processing plants in township, simple equipment, which are the major force in Chongqing currently processing the rice, leading the low rice yield, broken rice and big waste of resources. And the majority of enterprises have problem of backward equipment, financial difficulties, small processing scale and low product quality.

* Low production level in the soil of dry and cold soak land.

Chongqing has a hilly topography, with low mountains and obvious layering. Partial low-lying rice soil because of itself serious secondary gleization, is easy to form nitrate or acidified rice fields, even "cold, rotten, poisonous, string" field. Meanwhile, the city of Chongqing, with the extra high temperature in summer and poor irrigation facilities, severely restricted the increase in the rice production.

In Chongqing, the regional area above the altitude of 800 meters has about 90 acres of paddy fields, accounting for about 10% of the total area of rice fields. For a long time, as many factors limited, the distribution of rice regional test sites mostly is focused areas below the altitude of 800 meters, so that the selected rice varieties only can be promoted in low altitude areas. As the lack of high altitude rice varieties, farmers have to choose the species without the approval, based on their experience, and grow rice in low and unstable yields.

6.1 Case Study of Chongqing Qiaopin Rice Company

In Chongqing, represented by Qiaoping Town in Banan District, as inverted low mountains, the climate in the region because of the terrain of special soil, an adequate water supply, and virtually no pollution, is suitable for the good rice production (Chen, 2014).

More critical periods affecting the rice quality, from booting to late flowering, grouting, maturity, the filling period, are during the highest temperature period in Chongqing, mouth June - November.

In Chongqing, represented by Qiaoping Town, is suitable for good quality rice production.

Origin

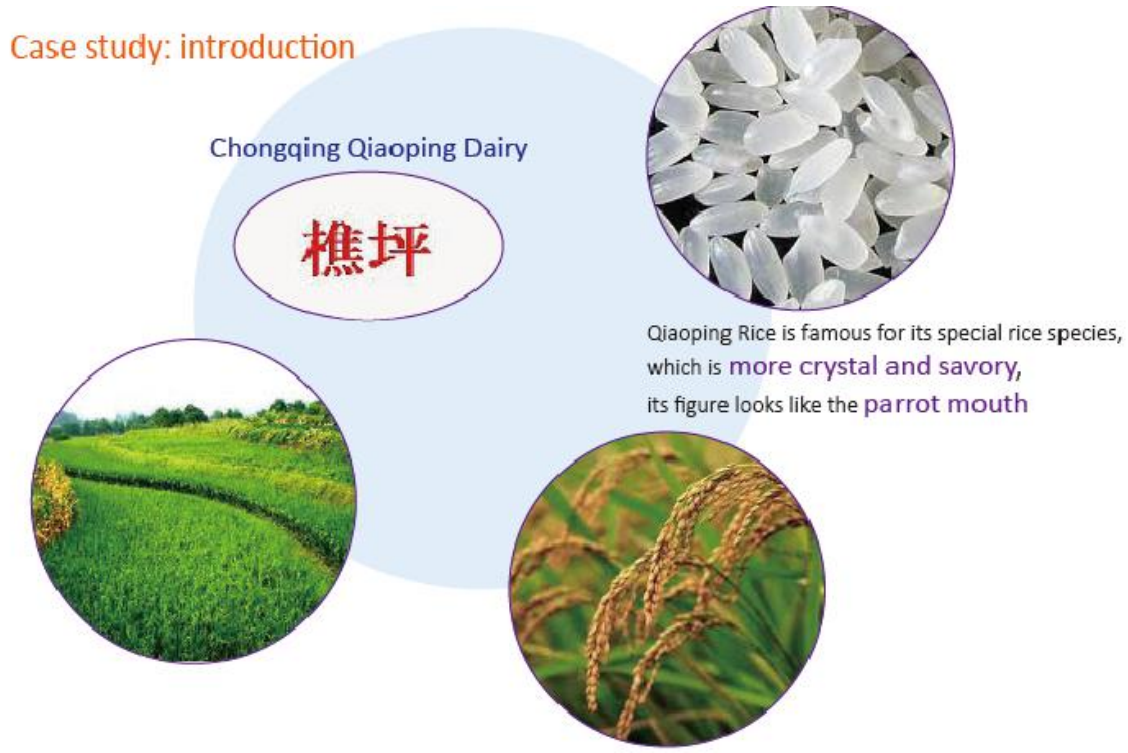
Qiaoping Rice Co., Ltd is state-owned enterprise, and founded by Chongqing Banan District Grain Bureau, in order to meet the grain procurement system, to form a new service mode of ‘‘food acquisition - processing - selling". The company began to operate in March 2002 and produce the good quality rice.

Up to now, the company has total assets of more than 15.70 million yuan, and covers an area of 10,000 square meters, a production workshop, 2 warehouses, the storage capacity of

over 5000 tons. Besides, the RDM color sorter was introduced from Japan, the Taiwan polished rice processing machines and other advanced equipment, all of which ensure the company to produce 100 tons of high quality rice, using GB1354-86 quality standards of production.

Map 47: Illustration of Qiaoping Town

The sale content includes the high-quality rice and its deep processing products, such as Qiaoping royal rice, Hanzhong rice, Qiaoping premier rice, Qiaoping optional rice, Qiaoping Pearl rice, Qiaoping Thai rice, totally eight species and more than thirty series, the annual sales of 10,000 tons, the marketing network covers all over Chongqing city, and products are preferred to consumers, and quite famous in the local rice market.



Map 48: Illustration of Qiaoping Rice

The following are the introduction and strategies of Qiaoping Rice to develop itself to a new revolution.

General information of company

* For the stability and development of the company, Qiaoping Rice according the modern enterprise management system, set the strategy of four into one (Finance Department, Purchasing Department, Production Quality Department, and Marketing Department associated into one office), and has cooperated with the city's major supermarkets, universities, military supply stations, other trading companies, to establish a whole marketing network. At present, the company's sales outlets in the city have reached more than 300.

* Since it began to run business from March 2002, the production, processing and sales has increased year after year. In 2002 only 10 months its production and processing sales was more than 5780 tons of rice; in 2003 over 8880 tons of rice was produced and sold; in 2004 the rice production, processing and sales was more than 9400 tons, with the

profit of 1,649,000 yuan, an increase of 28.2 over 2003, a profit of 162,800 yuan, accounting for 232.5% RC profit targets, so that the economic efficiency of the enterprise has reached a new level.

* In order to create "Qiao Ping" brand, and increase the market share and visibility, the company has invested more than 10 million yuan of funds, by advertising on Chongqing TV "quality line" and special reports on the "Chinese food", as well as participation in Chongqing famous agricultural fairs, and the Three Gorges Reservoir area famous special products trade fair, the China Green Food fairs, to increase the brand-name effect of ‘‘Qiaoping rice’’.

* In order to guarantee the product quality and a further advantage in the market competition, the company made full use of regions of Shilong, Fengsheng, Ersheng for planting high quality rice where have more than a dozen acres of high-quality rice field. Based on **"company + local farm base + local farmers** "format, named the "farming contract", the company has signed with farmers a" the green industrial high quality rice production in Banan District of Chongqing", the project contract, to conduct a implementation of high quality, and premier prices to purchase raw rice grain.

Economy

The comparative advantages of local rice industry in Chongqing

Rice production stands the upper level in the country. In Chongqing, the rice acreage, single and total production, and rice proportion of total grain production in China are the previous ranking. The acreage and total production rank the 13, and yields ranked the 11.

Production costs in the country belong to the low level

According to statistical data analysis, in 1999, the Chongqing rice cost was 378.27 yuan per Kg, lower 57.98 yuan than the national average cost of 436.25 yuan. There are two main reasons: First, labor costs were lower than the national average. The Chongqing labor costs were 202 yuan, while the national average was 250 yuan. Chongqing labor costs accounted for 54.3% of the total cost, while the national average costs were 57.5%, 3.2% less. Second,

the lower material costs in Chongqing rice production were about 176.27 yuan, 9.11 yuan less than the national average.

In the rice market, it is common that rice sell in bulk, and there are lots of bulk rice from all of China, so does it in Chongqing. While, recently, along with the development of China economy, the requirement of higher level of living provoked the appearance of royal packaged rice, which is so-called **"Tiny Packaged Rice"**. This tiny packaged rice is processed in a better quality and packaged in vacuum compression, so that it becomes more fresh, and can be sold in higher price. Besides, due to the contemporary people prefer to diets more complex and more nutritional, so that the rice right now does not act as the so important as before, sometimes be instead of vegetables or meats. Therefore, the rice market has already changed a lot.

In Chongqing, Qiaoping Rice Company not only needs to face the conflict of the other rice companies, but from itself. Qiaoping Rice Company is famous for its special rice species, which is more crystal and savory, and its figure looks like the parrot mouth. This advantage promoted this company to be loved by the Chongqing people.

While, the various incidents of rice safety issues, and the appearance of tiny packaged rice, stand in the way of Qiaoping Rice to development. How to maintain its rice quality and safety, and how to stand in the new stage of high quality rice market, all are waiting to be solved.

Farming

Multi-natural climate and various soil conditions, in Chongqing, give advantages to produce different grades of rice.

In Chongqing, represented by Qiaoping in Banan District, Longtan in Fuling District, Daguan in Nanchuan City, Hengshan in Qijiang District, as inverted low mountains, the climate in the region because of the terrain of special soil, adequate water supply, and virtually no pollution exists, the production of green best boutique rice. The area is located in the inverted low mountain paddy area has more than 200,000 hm2, the development of green boutique meters on the market is highly competitive.

Qiaoping is located in **an inverted low mountain, fresh air and foggy and humidity**, in a good air circulation, the average annual temperature is <14.5-17, which leads a special quality of the rice. No matter what kind the breed is, its quality naturally is different from that grows in hilly areas.

First, the rich water resources is suitable for rice production, and has developed of an area of high quality rice of 10 million tons, a low-cost input. Second, there are many hilly gully dams fertile land in the area, very desirable for rice production, so that Chongqing is a major area of rice production of goods. Since Chongqing special three-dimensional natural climatic conditions, can produce different grades of rice, with a good quality and, to a certain extent, can meet the different levels of market demands.

Products

Qiaoping Rice looks like covered by natural oil, crystal and jade, and uniform particles, a shape like a parrot mouth. After cooked, the rice loose moist after cooking, soft as cotton, as well as fragrant, comfortable and delicious, which can increase the appetite, and not sour overnight, been called for "Rice King".

In 1985, the Heads of State Norodom. Prince Sihanouk and royal family members visited Chongqing, and had eaten the Qiaoping rice. Qiaoping rice has a specific quality, due to the soil and water. Qiaoping located in the inverted low mountains, and the air is crisp, fog humidity, good air circulation, with an average annual temperature of 14.5 ~ 17 ~ C, 600 to 700 meters above sea level. In this environment, the planting rice, no matter what the breed, its grain quality obviously differed from that grows in the shallow hill and hyper region.

In 1986, the government of Banan district in Chongqing, has announced that Qiaoping from then on would be maintained as the production base of the high quality rice. Since then, the commercialization of Qiaoping increased year by year, and the rice production gradually increased, and became famous all around Chongqing, and now has become a major specialty of Banan District.

Map 49: the Introduction of Qiaoping Rice Products

Packaging

To the aspect of rice packaging, the traditional way to keep rice is in the use of ordinary plastic without vacuum compression, so that the rice is easy to lose its natural quality, which has to be sold in lower price. As the cognition of branding, the rice company developed their products into royal ones. The better packaged, better the rice quality, higher the price.

Why is hard to keep rice?

Several problems that exist in the normal rice products in plastic packaging.

There are several reasons, such as the loss of shell; Rapid metabolism; Simple packaging; Containing insect eggs; Bacteria; Environmental catalysis

Therefore, it is necessary to improve the quality of white rice as well as its packaging. The normal plastic packaging cannot satisfy the requirement of rice nutrition maintain, while the tiny packaged rice is sold in a much higher price because of the high cost of packaging method and materials.

Production Chain

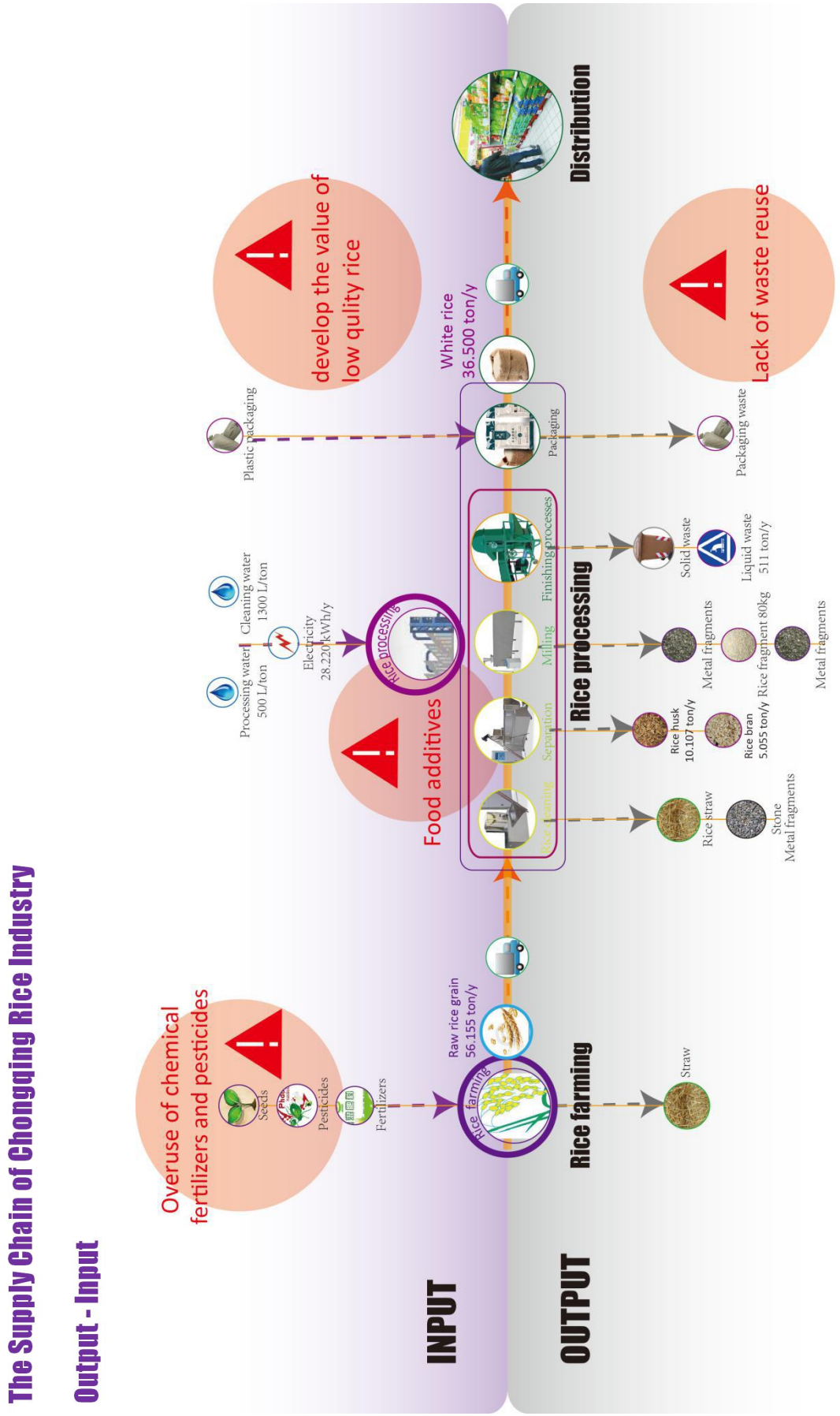
The detailed processing procedures are performed in the processing map, of which the processing steps such as: Stone separation---mill shelling --- milling---Screening --- polishing --- color selection --- Packaging --- Finished products, are in brief for the more important explain of input and output.

Supply Chain

Since in Chongqing the rice is basically a subsistence production, it is almost relatively short distance transportation, quick commodity circulation, low transportation costs. From outside the city or transferred abroad, even the price is lower, but transportation fees increase, there is not much advantage of outside rice in Chongqing. The supply chain of Qiaoping Rice, is used normal traffic car, due to the company is a local one that has the benefit of short distance and low transportation fees.

The rice distribution has covered a large region of Chongqing, and it is common to see the Qiaoping Rice brand in normal supermarkets. Due to the local rice industry, from the raw rice grain cultivation to product distribution, the whole supply chain benefit greatly from itself, the own distribution system, the local transportation distance, as well as the preference by the local people, all of which promoted the Qiaoping Rice to a relatively stable development in the Chongqing rice market.

While, along with the new requirement of higher quality living, a better packaged rice is appropriate necessary, though it sold in higher price. Profits always act as the critical point for producers to develop their products and service, so that, the rice products may face the problem of dividing into different levels to be sold in different prices.



Map 50: The Supply Chain of Chongqing Rice Industry

Consequently, the high quality rice can be packaged in better figure to be the royal rice for those people who seek for relatively healthier living, and the middle level rice can be sold in bulk, for those people can afford a normal living. While to those rice in low quality, such as non fresh, fragment, less favor, there should be the real legal and health way to solve the problems of rice safety, which means the lower quality rice should not be processed illegal only for more profits. Over polishing or food addictive only change the outlook of rice, but not the real quality, in which the profits come from the damage of the public health.

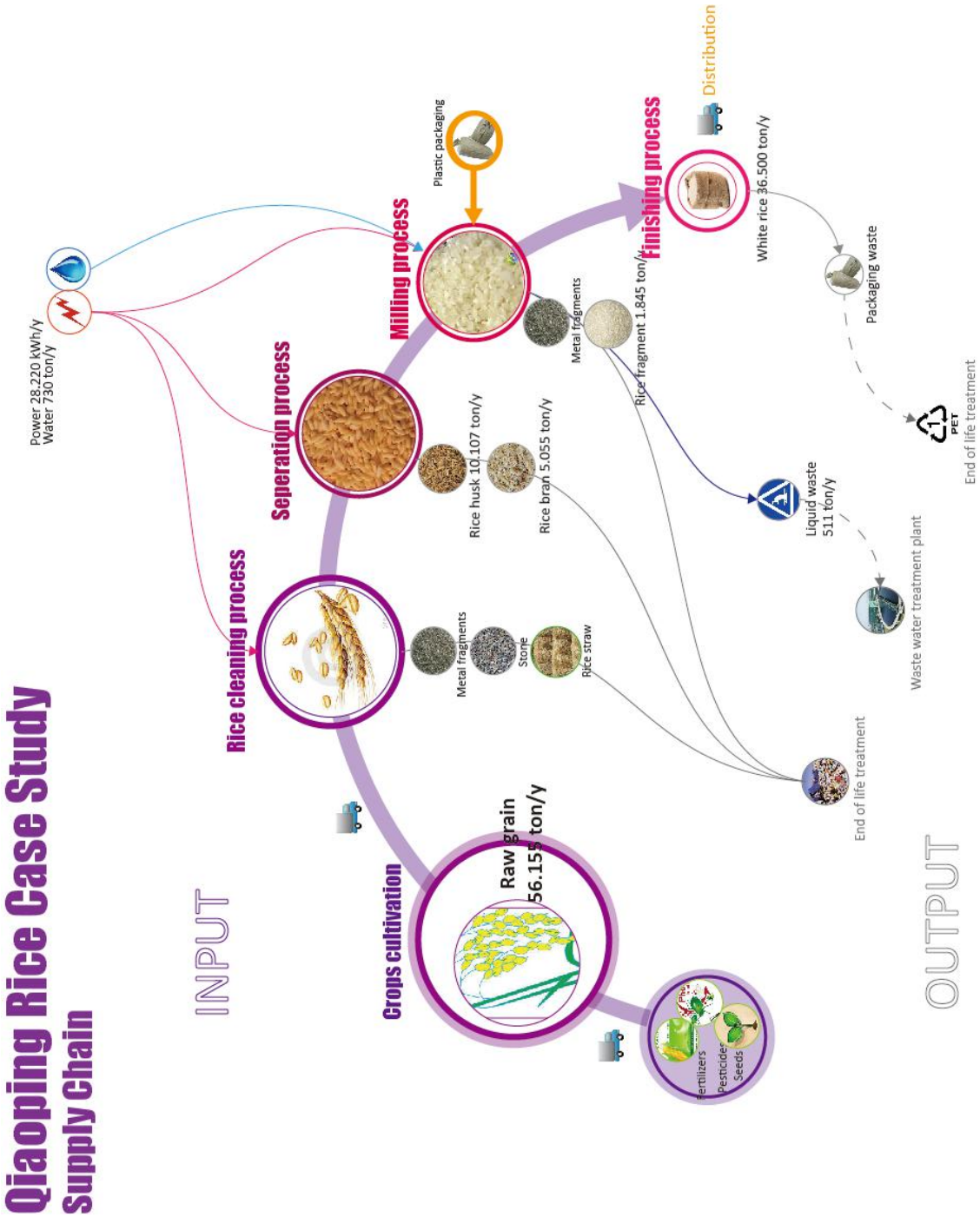
Thus, **the lower quality rice needs another way to reveal their value**. To solve this problem, the next chapter discussed a systemic design approach to discovery a possibility of a new development in rice industry.

While, the problem of heavy mental exceeded, it should be treated as such a critical point to be control by government and the rice producers. Rice as the most ordinary diet for Chinese people, the quality and safety is too important to be ignored. Thus, how to invest the heavy mental in rice and avoid the soil pollution still are big problems waiting to be solved under the cooperation of government and stakeholders.

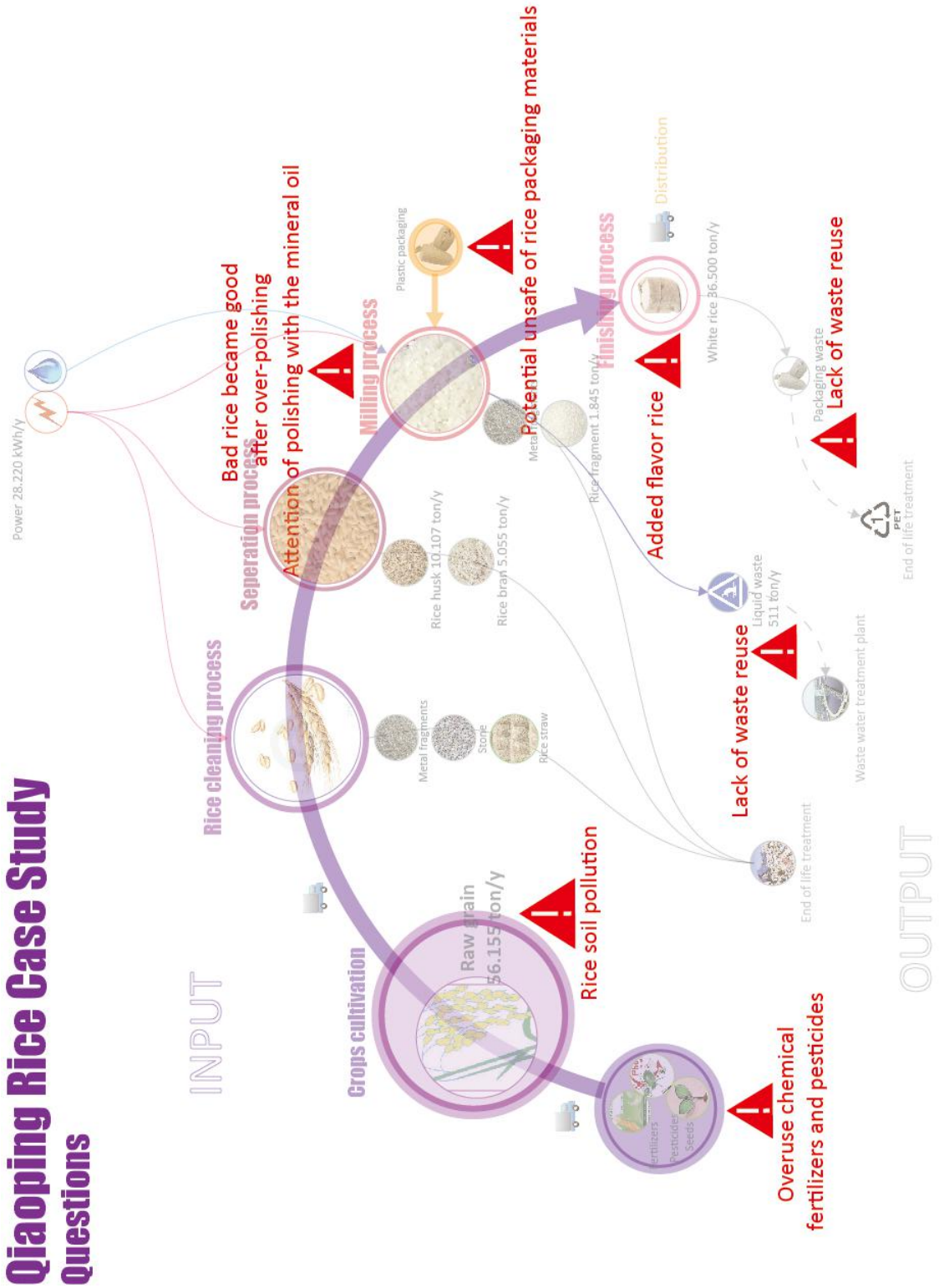
6.2 Questions

Following are the rice processing map and its relative problem map. It was performed to illustrate its main processing steps, and the input and output from each step. According to this research, the problem existing in each procedure, from its raw grain cultivation to product finishing, become the design point to go on the next chapter of systemic design.

To the aspect of rice grain cultivation, fertilizers and pesticides are used for the rice grain quality, while in China, the over-used pesticides is constant a big problem which leads to the problem of over pesticides rested on rice. Nevertheless, the over-used pesticides will also pollute the soil and field, which can become a worst problem over years. Just as the example of cadmium pollution by the heavy metal industry which did have a good management of the waste water, leading to the heavy metal pollution after many years, this incidents happened both in Japan and China, causing serious public health issues.



Map 51: The Simplified Supply Chain of Rice Industry



Map 52: The Question Location of Rice Supply Chain

In the rice processing chain, there are several main steps, from which different materials will be separated as the output of the processing. The first step is rice cleaning processing, and in China, the air separation machine is used for raw rice grain cleaning. After the processing, the mental fragments, stones and rice straws can be separated; and in the separation processing, the aim is to separate the rice and rice husk, rice bran; there is a more important processing affecting the white rice appearance, the milling processing which can separate the mental fragments and rice fragments. Besides, in this step, water is necessary for milling, so that the gray water needs to be collected and transported to the gray water treatment plant.

To maintain a good appearance of rice products, it is potential to add food essence, to change the outlook of the rice, and sell at a higher price. The solution to keep a good quality of rice, is to offer a good agriculture, while to avoid illegal processing, the social supervisor can play an important role;

To the waste reuse, during the rice processing, there are many materials separated, while usually they was been regarded as waste, no recycle. While in fact, many of them can be used in many other ways to realize their value;

To rice packaging, the plastic material has problem in keeping rice quality as been discussed above, while good quality packaging costs more than the ordinary. It is suggested that design a better packaging is reasonable.

Summary Map

According to the case study in Chongqing city, more detailed problems have been revealed, it is not difficult to find that China food safety have many factors, all of which is not a simple problem. While most countries monitor food safety at the farm and the factory. But in China food safety issues can arise anywhere.

The Chinese people have had their imaginations challenged by a series of food safety scares. Over a decade, we have seen alcohol which is actually methanol; seafood soaked in formalin; the Fuyang milk-formula scandal, the Sudan Red scare, the Melamine scandal, ‘‘Gutter oil’’, and gelatine rendered out of used shoe leather (Yan, 2012).
None of us can be certain that any foodstuff is safe, from baby milk powder through to cooking oil. Nor can we be sure that any company be it a backstreet workshop or a big state-owned firm – is producing safe food and drugs. Consumers were originally shocked. Now, they are simply numb. It seems the Chinese have got used to poisoning each other.

Finally, It is the **nature of the problem** itself that has allowed it to become so widespread. China's food safety problems are structural, caused by a number of different factors and actually exacerbated by the system.

Why is there no single response to any one incident will provide a solution?
* **First, let's take a look at the economics of food safety.**
We must ask the most basic of questions: why do companies manufacture and use toxic foods? Why do even officially registered companies, even those of considerable size, do so? The answer lies with our overall economic structure.

In China, sectors such as energy, heavy industry, chemicals and communications, often very profitable, have high barriers to entry in order to protect the interests of state monopolies (Chen, 2006). There is little space left for private firms and small and medium enterprises (SMEs) – and when too many companies chase the limited opportunities remaining, excessive competition results.

In the food sector, the financial and technical barriers to entry are low. This creates a structural problem: companies tend to be small, scattered, of low quality and unable to innovate. And so they compete dishonestly. Excessive competition leads to a race to the

bottom, with costs being cut through fake and inferior products. Any firms that actually care about safety become less competitive and eventually go under.

Not only does the money drive out the good, food and drug manufacturers are under a massive tax burden. From ordinary taxation (higher than in other nations), to more China-specific costs including road and bridge tolls, business registration and inspection fees – **profits are wrung out** at every stage of the food industry. Before a food reaches the consumer, huge additional costs are incurred for raw materials, transportation, production, distribution and retailing, preventing both manufacturers and retailers from growing. With food supply chains becoming more complex and the market more open, those burdens are passed onto the consumer by fair means (increased prices) or foul (cheap but toxic products).

Our lives and the safety of our food are determined by the structures we live in, writes Tang Hao (Professor of South China Normal University). Without systemic reform, there is no point increasing enforcement powers.

* **Second, government regulation.**

A developing market economy and continued government involvement in that market mean greater government ability to obtain income. But the ability to manage has decreased. There have been obvious legislative successes: the Food Safety Law, the Drug Control Law and the Regulations on Supervision and Management of Medical Equipment have all been promulgated, and a number of national standards are now in line with international practice.

But these ever more detailed laws have failed to improve food safety. The problem is implementation. Several government departments are responsible for food safety, and powers and responsibilities are fragmented. The Ministry of Health is in charge of overall coordination and risk evaluation; the Ministry of Agriculture covers agricultural products; the General Administration of Quality Supervision, Inspection and Quarantine monitors imports, manufacturing and processing; the Drug Supervision Administration is in charge of medicines; while food products on the market are mostly the responsibility of the industrial and commercial authorities.

This leads to two problems. First, overlapping supervision increases costs for the companies. And second, when problems arise, the authorities pass the buck. Fees are taken – but not responsibility. Both of these problems make it harder to guarantee food safety. On a trip to America, former premier Zhu Rongji paid a visit to the US Food and Drug Administration (FDA), a powerful government agency that has been in existence for a century (China News, 2008). On his return to China, Zhu set up a similar body in China, but for various reasons it failed to play its hoped-for role and was broken up.

In China food safety isn't just a question of economics. It is also a matter of regulation, and more, a matter of our political and legal system. Management of these structural issues without overall reform, with just the blind expansion of enforcement powers, will be useless.

Major design flaws at the top worsen problems with implementation at the grassroots. Laws and national standards are not, generally, strictly enforced.

Local officials are lack of motivation to enforce these rules and often act on behalf of dishonest companies as much as on behalf of the state. National law becomes the basis on which those officials draw benefit from business – in exchange, **laws are laxly enforced, or simply ignored**. This extra cost for the companies may then be passed on to the consumer in the form of lower-quality products.

Therefore, local officials become part of the low quality food chain and share in the profits. Naturally, they have no interest in eliminating the problem. This is not just apparent in the food and drug sectors. The recent cases of pyramid scheme fraud in Beihai and Nanning, the sex industry in the Pearl River Delta – these sorts of problems are also tied up with the interests of local officials. Government aims and objectives are not implemented and so governance fails. Worse, with this culture already entrenched, strengthening enforcement in any one area actually gives officials more power to extract benefit creating the opposite effect to that intended. The more invested in enforcement, the more power the officials have, and the less effective governance becomes.

* **Finally, consumer and public supervisor**.

China's particular policy and legal environment cannot meet the political needs of a modern society and citizenry. Media supervision and public participation are limited,

non-governmental supervisory groups cannot act, self-regulation by industry groups is underdeveloped and public law suits against food and drug firms fail to get through the courts. The food and drug industries lack the pressure of social oversight, and so the final and most direct line of defence is lost – and safety problems just get worse (Yoo, 2010).

Our lives are determined by the systems we live in. In China food and drug safety isn't just a question of economics. It is also a matter of regulation, and more, **a matter of our political and legal system** (Zuurbier, 2008).

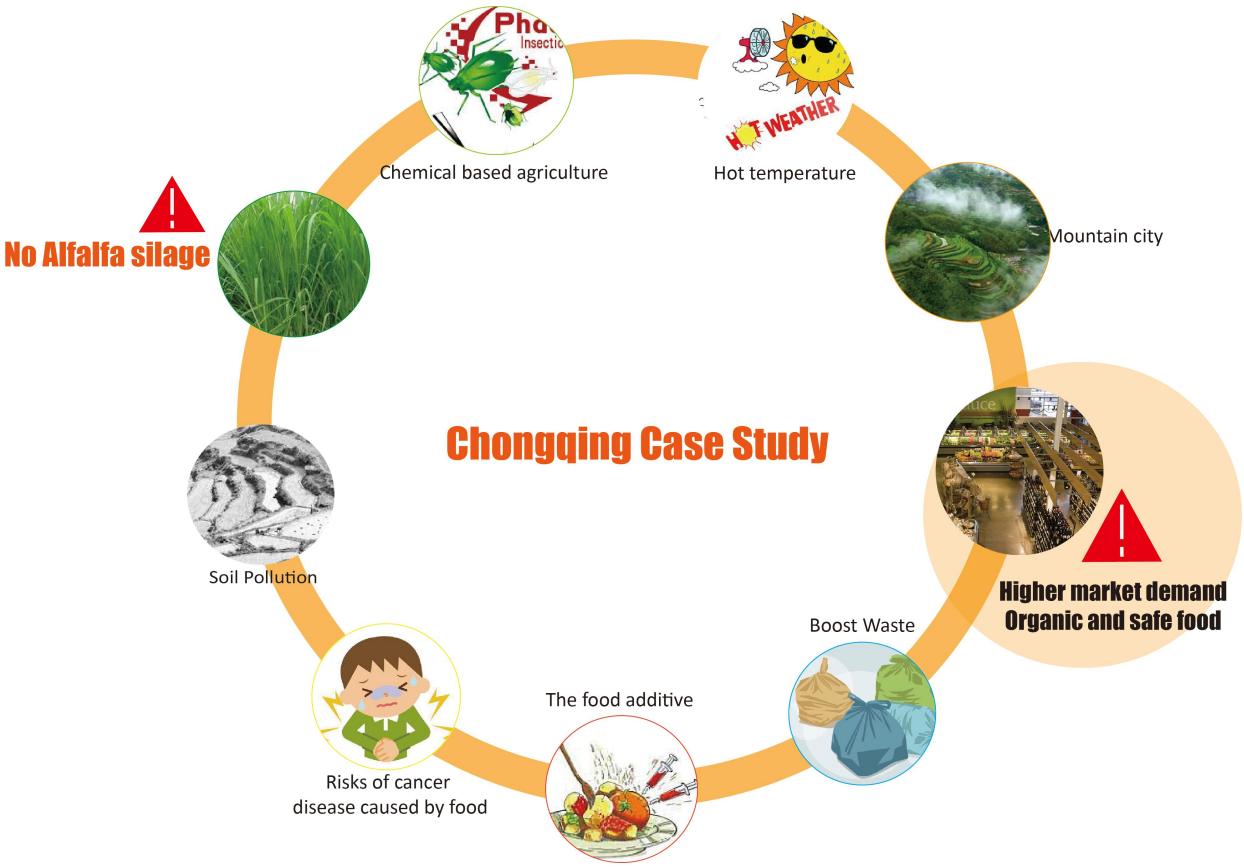
Changing this system through economic, administrative, social and legal channels needs the continued participation of the victims – the citizen as consumer. And this participation must extend beyond supervision and enforcement in the food and drug sectors into all other areas: demanding economic justice, breaking up monopolies and widening market access; shutting down production, pursuing criminal liability, and demanding huge punitive damages; seeking judicial independence, improving law and regulations, expanding legislation, and promoting the rule of law; launching citizen movements, establishing NGOs, and promoting the political reform.

Only widespread participation and overall reform can provide the hope for a complete resolution. This will be no easy to take, but when it comes to structural problems there are no short cuts.

According to researches, **making generalizations about China's food industry is difficult** (Zhang and Zhao, 2011). Several thousand modern, large-scale, multinational and joint venture companies and farms that use best practices and sophisticated equipment operate alongside millions of small independent farms, workshops, and merchants that use crude equipment and techniques. China has some 200 million farming households with average land holdings of 1-2 acres per farm and at least 400,000 food processing enterprises, most with 10 or fewer employees. Millions of people and businesses are involved in the handling and transportation of food beyond the farm gate,. The vast number of food suppliers increases the challenge of disseminating standards, monitoring production, and tracing problems to their source. In China's food sector, farmers and entrepreneurs frequently enter new industries and worker turnover is high. Consequently, many participants in food supply chains are unaware of standards and proper practices. Some producers and

merchants in China's highly competitive market cut corners, add toxic substances, or skimp on safety controls to fatten razor-thin profit margins or gain some other competitive edge.

Besides, the general level of food safety in China seems to be improving, but it is difficult to assess the seriousness of problems or the degree of progress since information is closely guarded by the Chinese Government. For example, the Ministry of Agriculture's testing of vegetables, meats, and fish in domestic markets for pesticide and drug residues reported impressive compliance rates ranging from 91 to 100% in 2007. However, few details about the testing are made public, so the results are difficult to evaluate. China's Center for Disease Control and Prevention conducts extensive surveys of diet and nutrition that can trace intakes of toxic substances to types of food and regions, but these results are also not widely publicized. Liaoning Province has a database of soil, water, and air pollution test results that identifies areas suitable for organic or "green" crops, but the information can be accessed only through government authorities.



Map 53: Summary map - Chongqing

Especially, in Chongqing City, the food safety problem may not serious as other cities in China, but on the contrary, the local problems are still complicate (Yang, 2014).

To the aspect of dairy, the forage agriculture is not enough, because of the lack of Alfalfa, as well as its low income; the overuse of chemical fertilizer, is also a big problem; Another key point is the basic cow diet formula, obviously not nutrient enough, which affected the level of raw milk.

Agriculture is always a big problem in China, as well as in Chongqing, the soil pollution, chemical fertilizer, overuse of pesticide, which harms our health finally; the processing, is also a big problem, too complicate, too difficult to control, even illegally, which means we need the help of the public; the society should understand their role, which can also keep safe by themselves.

Chongqing has already been developed into a modern city, which also pushed the people to ask for a better and high quality live. Thus, those low quality and unsafe products obviously cannot match the requirement of the people. As a consequence, the agriculture and the industries should be reconsidered about their relation, about how to solve the problem of unsafe output from industries finally returning back the origin - agriculture. Otherwise, the food safety problem will always exist in China.

Nevertheless, the waste is usually without treatment, which means output is just output. The more industries there are in Chongqing, the more waste they will produce. This will destroy our local environment and ecology system, so that it is important to change.

The next part will focus on the systemic design for China agriculture and food industry, anyway, our consumers should be regard as the core, in the whole system.

PART 3: SYSTEMIC DESIGN

7. A POSSIBLE SOLUTION

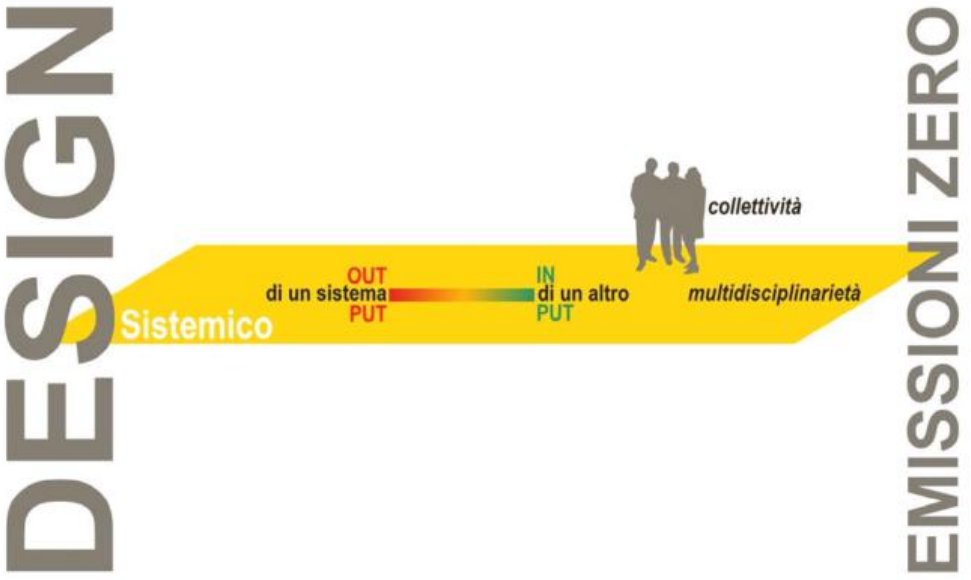
Systemic Design And Food Safety

As what has been discussed, the problems of dairy and rice industries in China, such as the poor diet of milk cows, low protein content in the raw milk, the soil pollution, over use of pesticide, illegally food processing, food addictive and adulteration, too much waste without reuse, gray water treatment, all of these are under consideration in the following systemic design.

Food industry is not only simply related to producers and consumers, but a system to combine and affect each other, and the food safety can benefit and developed due to a better food industry system. More profits and jobs can also be created through it.

Systemic Design Concept

‘‘The design can be taken just as this innovative approach of project in flows of materials and energy, investigating the positive changes in production processes and becoming ***Systemic Design****. ‘‘*



Map 54: The Concept of Systemic Design

In this renewed and smooth "flow" of materials can give rise to a new economic model, paying more attention to local resources, and will restore life and raise the cultural and territorial identification (Luigi Bistagnino, 2008).

Systemic Design is the ability to know:

* Outline and plan the flow of matter that flows from one system to another in a continuous metabolization that decreases the ecological footprint, and generates a considerable economic flow;
* Organize and optimize all the parts within an ecosystem so that they can evolve coherently with each other;
* Accompany and manage, in all phases of project development, the mutual dialogue between the various actors on this new cultural terrain.

We base (see previous diagram of the Systemic Design guidelines) **on simple principles:**

* The outputs of one system become inputs for another,
* The relationships that are established generate the same open system (the closed systems are the current linear ones),
*Open systems, which are put into action, support and reproduce themselves autonomously co-evolving together,
* The context in which it operates is fundamental and priority with respect to the outside,
* Man, related to his context, is the center of the project. The result is a very dynamic and complex relational system that with the progress of the connections between the parties acquires strong cohesion and awareness so as to acquire a self-generating force (autopoietic) of all the actions implemented.

Design can take this innovative project approach of material and energy flows, investigating positive transformations in production processes and becoming systemic design.

In this renewed and fluid **"Flow" of matters** we can give life to a new economic model that, paying greater attention to local resources, will restore life and relaunch to the cultural and identifying territorial peculiarities.

Another important occasion, which derives from the outlined orientation, turns out to be the change of approach on the outputs of the production systems. Currently the existing regulations are based on the fact that the waste from industrial processes is something of little value, compared to the product, or strongly polluted, so much so that manufacturers consider them as a problem to be solved in the quickest and least expensive way possible. So we understand the will of the legislator to protect both the environment and people through mandatory rules that intend to track all the path taken by substances considered harmful.

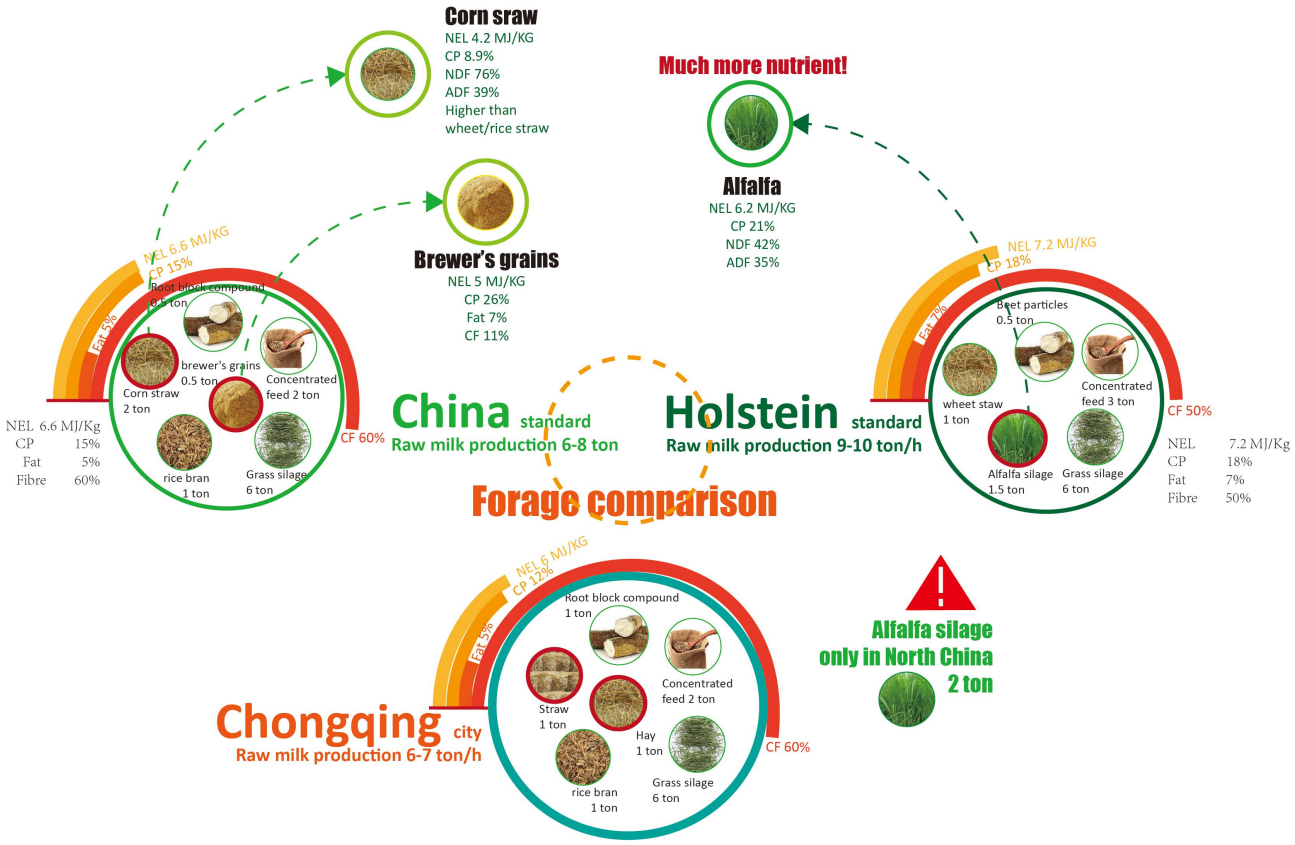
If instead the problem outputs become a resource, with consequent economic value, the interest in considering them an active part of a process would arise. As such we would try to enhance their intrinsic qualities and would be so inclined to modify processes or processes that degrade them. One would be very careful to maintain unaltered the properties that make them attractive in order not to lose their economic value of exchange, and at the same time a formidable result would be obtained: a productive culture tending towards **ZERO EMISSIONS.**

For man, food is something irreplaceable, a value that goes far beyond its simple function of fuel for the body. The very process of industrialization of the sector, which has transferred the style "designing the product" to food, has ended up depersonalizing food, emptying it of its most ancestral meanings and also of "systemic", if we mean food as a an element deeply connected to a remarkable variety of human activities. "Designing the product" in the agri-food industry has ended with the worsening of the quality of our lives. While solving a problem like the gain of time or the comfort of a certain type of packaging, on the other side of the coin the intrinsic quality of food worsened, the ecosystems were undermined, whole agricultural societies were destroyed, and with them all the values and knowledge of which they were carriers. In design, both industrial and social or political, it is really essential to resort to **"Designing Man"**, using the new humanism mentioned previously. After all, "designing man" and "designing food" should not be two processes so distant from each other.

One of the long-term solutions to limit the negative outputs of the industrial and global agri-food system, probably "the" solution, is precisely that of a localization of production on a local scale, taking advantage of production traditions, technological innovation applied to small scale, local resources both in terms of human knowledge and raw materials. This leads

to the creation of a set of much more productive and effective local systems, integrated with the production of non-centralized energy, respectful of both biodiversity and cultural diversity. It is a way to limit waste and reverse the consumerist tendency, to organize food production according to the characteristics of an ecosystem and the local population.

7.1 The Breaking Point



Map 55: The Forage Comparison of China, Europe, Chongqing

In the comparison of different dairy cow diets, the nutrition components of the diet, are NEL 6 MJ/kg, CP 12%, Fat 5%, Fiber 60%, which are relative **lower of the protein and fat content** while compared with the China average cow diet components; the EU dairy cow diet components relative higher than China average cow diet components, which contains NEL 7.2 MJ/kg, CP 18%, Fat 7%, Fiber 50%. In the comparison, the EU dairy cow diet can provide the cow to produce the raw milk of 9-10 tons, reaching the high production level, as well as a high quality; the China dairy cow with this diet can only produce a middle level amount of raw milk of 6-8 tons, while compared with the middle level of EU dairy cow production of raw milk, which contains lower protein and fat content.

In the map, it can be concluded from the dairy cow diet that EU has paid much more attention and costs to take care of their cows as they understand that the raw milk resource in practice is the most critical point affecting the milk quality and safety but not only the quantity.

There is a point that has to admire that China cannot catch up with those developed countries those have a much longer history of breeding dairy cow and drinking milk. In most area of dairy cow branches in China cannot provide the alfalfa to their cows, as the alfalfa is the most nutritious forage for cows to maintain the protein and fat content of the raw milk, so that the branch owners has tried to different local materials to feed their cows, helping the cows to adapt themselves to the local environment and local diet plans. In ordinary, different provinces in China have different diet plans, which is displayed in the table.

Besides, the China government has also decreased the requirement of the protein quantity of the milk, to reduce the stress of dairy cow farmers who cannot maintain the high protein and fat content of the raw milk according to the national raw milk standard. Nevertheless, there are a considerable a number of Chinese people who have the problem of absorbing the protein of the milk, while another part people without this problem have the requirement of high protein content. Therefore, there is a problem of how the balance the costumer requirement and the milk production. While, the dairy companies have produced different types of milk of various protein and fat content and gust to satisfy the costumers, the problems of the milk safety should be seriously under control, such the protein powder addictive, flavor addictive.

Design for Food Safety

As a designer, the concept of sustainability has been regarded as a core value of a project. According to the systemic design methodology, which treat the output from a system as a new raw material able to input a new system. New products and more jobs can be achieved while designing the new system (Luigi Bistagnino, 2008).

To the aspect of sustainability, systemic design is focused on the local industries, thinking local, while acting global. Each industry can obtain some new meanings, not only from itself, but from its partners, which means the problem in itself may be the innovation to others, similarly, every critical problem may become breakthrough for new opportunity, finally

leading the way of sustainability.

This article has adopted the systemic design methodology, due to its advantage in solving the problems in agriculture and industry, as well as in more profit and more jobs.

To the dairy industry in China, the problems in the low level condition of agriculture and processing still act as critical point to be solved. The following systemic design is focused to practice as the key to the problems, which concentrated many other local industries functioning together, for the same aim of better food safety and more economic development, less environment impact. In this new system, the output has been reused to create more products; the input of the farming has been improved at the same time .

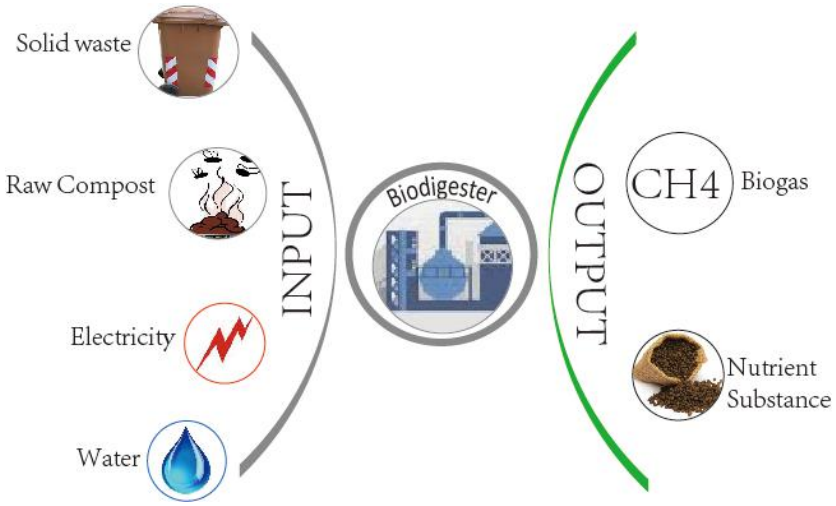
In the systemic analysis, a cow diet comparison between EU and China was conducted, to make the design more reasonable. EU is known as the high quality producer, in many aspects of industries, food, fashion and architecture. For the dairy industry, the dairy cow feeding is scientific to maintain the quantity and quality of the raw milk, so that it is acceptable to be considered as a standard to develop the low level of cow farming in China. For the dairy cow diet, it has been found that the protein, fat and fiber in the diet are significant factors, which affect the protein and fat content in the raw milk and its products.

According to the Part 2, several points are discussed to conduct the systemic design:

* The first, **the dairy cow diet acts as the critical point** affecting the raw milk quality and quantity basically (Kolver and Muller, 1998). The more nutrition, such as protein, fat and fiber, are taken by cows, the more and better milk they can produce. While in China, dairy cows are almost imported aboard, and the different environment affected the habit and living of cows, besides, the breed forage is also different, all of which affected the milk producing, both of quality and quantity (White and Benson, 2002). For instance, the most important breed grass, alfalfa, are cultivated almost in the north part of China, so that the dairy cows bred in north China, such as Hebei province, Heilongjiang province and Beijing city, can get the benefit of alfalfa which contains a lot of nutrition that cows need, as well as much more protein and fat contents than any other grass. Therefore, in the south China, the breeding grass is almost without alfalfa, instead, the whole corn plant and other grass, such as wheat straw and grain straw, are used as the main feeding grass, which are not comparable with alfalfa (Xu and Zhang, 2011).

* The second, due to the rice industry in China is not only the traditional but the biggest business in domestic market, also exported a large amount from aboard. In Chongqing, rice industry is also a main stream food production, and it linked with another industry, which has a long history in Chongqing, the rice wine. The rice wine is different from other wines, such as red or white wine, and beer and liquid, while it is original made in China, and its consumption is relatively high in Chongqing (Wu, 2009).

Nevertheless, the distiller's grains can act as the basic material for mushroom cultivation, at the same time, mushroom contains many nutrition which can be absorbed by dairy cows, as well as the low content of fiber. Besides, the distiller's grains can also be regarded as a diet for cows, as the high content of protein and fat, and less fiber can promote the quality of raw milk production (Anderson, et al, 2006). To the aspect of distiller's grains taken as diet for cows, this is already experimented in many other cities in South China, such as Henan, Hubei, Shanghai, which turned out that the cows fed with distiller's grains can produce more and better milk, and its meat is also in high quality.



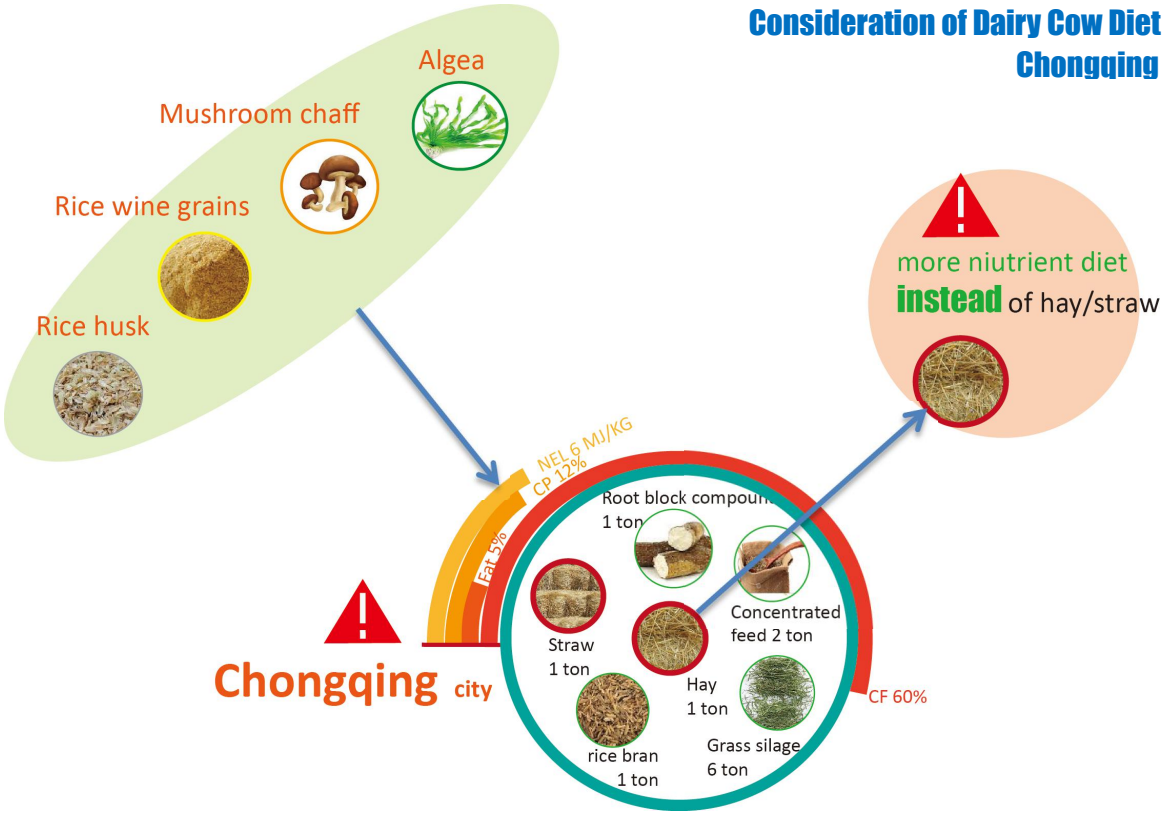
Map 56: Input - Output of Biodigester

* The third, **the waste reuse in China is always a big problem**, because of the ignorance of environmental protection and the financial consideration. While, the reality is that the reuse of waste can also produce profits and works after the systemic design of food industries. The the nutrition of the waste can be used to feed the algae and fish after the treatment of bio-digester. The algae contains a lot of micro elements which are nutritious to humans as well as cows, due to the high content of protein, low content of fiber. While the algae can also be used as the breed for fish, therefore, fish now acts as an extra products created

during the systemic design. In this field, the fish can not only be sold to supermarkets but its manure and waste can be used back to the rice and forage agriculture, which is appropriate the concept of systemic design, letting the output returning back as the input, during which much more profits and jobs are created, as well as the problem of food safety can be solved in the new systemic industry design.

* Finally, the organic waste has been changed into valuable materials **coming back to field**, as the natural and safe fertilizer; at the same time, the crops also can be taken care better, instead of only depending on chemical pesticides, but the real organic cultivation; during food processing, the natural and organic materials can be preferred by producers to process foods in a much more safe way, maintaining the nutrition of the raw materials and after a good perform of the processed food; while finishing, thee safe and organic packaging also should be considered to keep the freshness and nutrition, as well as safety for consumers, no matter what material is used. Thus, from the beginning to the end, the whole food production chain become a real system, and each step of which is necessary to be under control, considering its natural, fresh, odor, appearance, quality and safety.

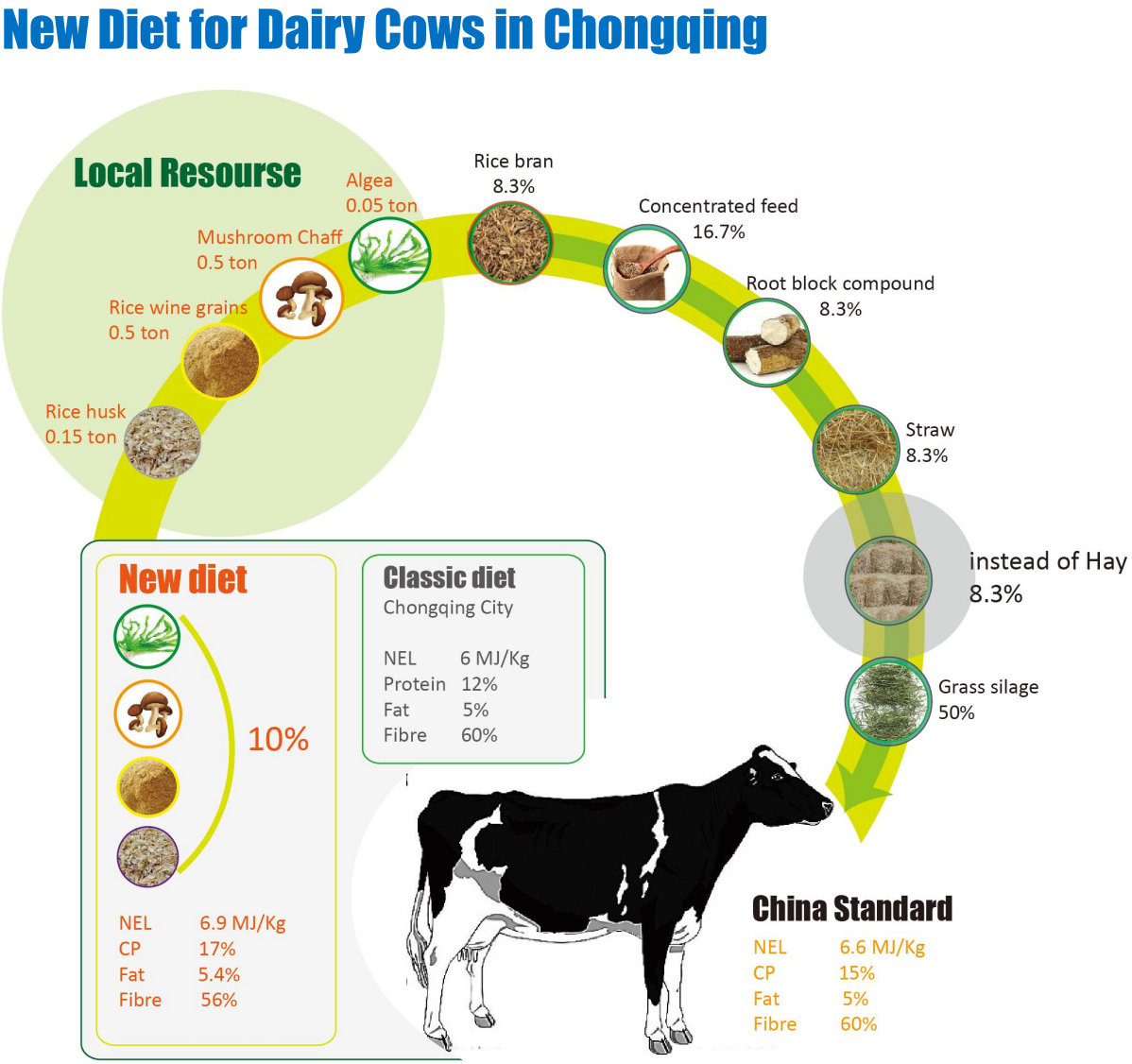
Local resources



Map 57: A New Diet designed by Tianyou Dairy, with Local Materials of Chongqing

Based on the real situation in China, the alfalfa feeding dairy cows is **instead of the corn or rice straw**, which has been tested that its nutrient content is lower than alfalfa, while higher than other grass forages, such as wheat straw.

According to Tianyou Dairy and researches, ***Algae and Mushroom chaff, Rice Wine grains, Rice husk*** *are rich nutrient, can improve 10% more milk production of dairy cows!* In a word, these local products can be related together, to gain more profits.



Map 65: Systemic Design Map - Cow Diet Comparison

To the aspect of dairy cow feeding, the China and Chongqing ordinary diets contain much more fiber, while low protein and fat, in contrast, the European dairy cow diets offer more protein and fat, less fiber. Thus the raw milk is also produced different. In ordinary, China's

dairy usually produce a middle level milk, while EU commonly produce a high quality and quantity milk. According to experiment by Tianyou group , a more nutritious diet special for dairy cows is performed as above, in which hay and straw can be instead of new materials, accounting 10%. Thus dairy cows can be cared in better way with **better diet to produce milk of a higher quality and quantity**.

Rice Wine Industry

China rice wine, so-called Shaoxing Wine, is one of the ancient wines in the world, original from China. It is made of rice, alcohol 14% - 20%, and good for heath, the blood recycle (Wu, 2009). In Chongqing, people not only have the habit of drinking the rice wine, but cook food also with it, because rice wine has a special flavour that will develop the taste of food. Based on systemic design, Input: rice, water; output: rice wine, rice wine grains (instead of brewer's grains).

Map 58: Input - Output of Rice Wine Industry

Mushroom Industry

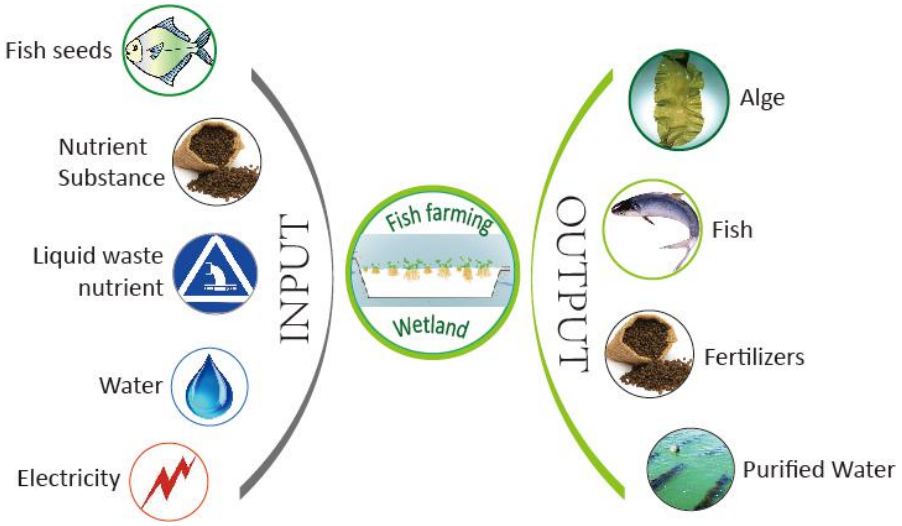
In Chongqing, due to a wet weather, it is suitable for mushroom cultivation. As a mountain city, the people like to eat these kind of food from the mountain, which is nutrient for human, improving the immunity. The mushroom chaff is very nutrient, and its protein, amino acid, calcium, cellulose amount are even higher than that of corn and rice, which has been tested is good for dairy cow breeding (Li and Jiang, 2007).

Besides, it is really cheap, even is regarded as a kind of waste, while is useful for cow farming. In the cultivation, input: seed, nutrient solid (rice bran, wine grains), water; output: mushroom, mushroom chaff.

Map 59: Input - Output of Mushroom Industry

Algae Industry

As the introduction, Chongqing has two large river across the city, which is also suitable for algae cultivation. Algae is also very nutrient, and requires a simple equipment to rise. The more important is the algae has the ability to change the useful components in the water, into itself and nutrient substance (Zhang and Huo, 2007). In the cultivation, input: nutrient liquid; output: algae, nutrient substance, and purified water.



Map 60: Input - Output of Rice Fish farming and Wetland

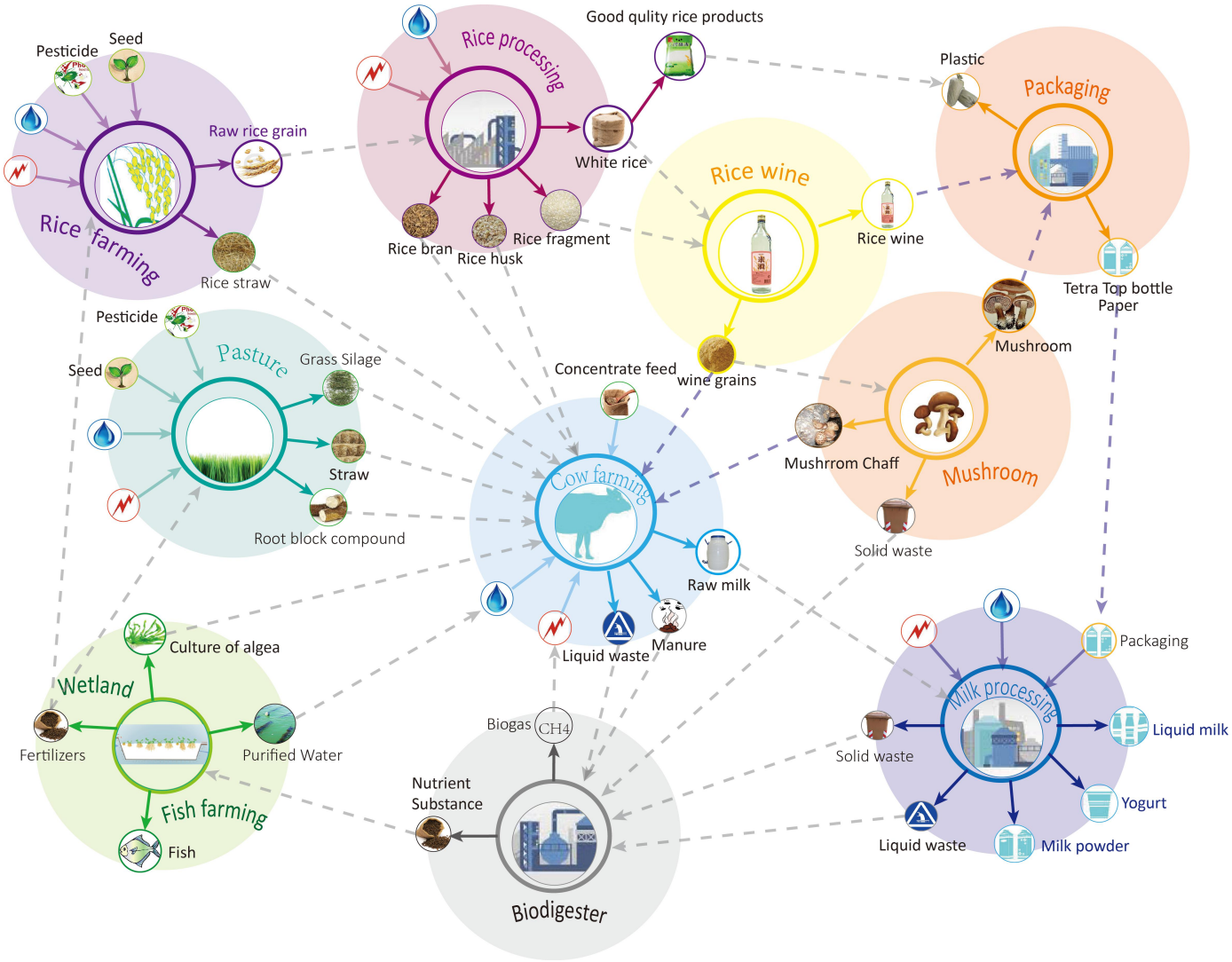
Rice Husk

The rice husk is usually regarded as waste, while due to its high fibre content, it can be used to feed cow in a adequate amount. At the same time, it can be used to cultivate mushroom as solid basement.

Systemic Approach for Dairy and Rice Industry in Chongqing

To the aspect of food safety, according to the systemic design approach, the dairy industry can benefit from the new diet to solving the problem of cow breeding with low quality forage that affected the raw milk producing in low quality and quantity. The rice industry can benefit from the rice wine industry, on one hand, the lower quality rice can sold to rice wine factories, the high quality rice can be sold as premier rice in a better packaging, which is already appeared in China rice market that the high quality rice is sold in higher price due to its quality and safety guarantee. Consequently, the producers has no need to add food addictive into the raw materials, and no need to reproduce the low quality rice into better one by means of illegal methods.

Systemic Consideration



Map 61: The Flows of Materials of Local Industries of Chongqing

Not only are the dairy industry, but rice and rice wine industry, fungi and algae, fish industries associated to produce more products. At the same time, the environmental impact of the industrial waste is reduced, and dairy safety found a new way to be solved.

After the comparison of EU and China dairy cow breeding forage, the analysis of output - input of relative industries, according to the systemic design, the value of the output can be regarded as a new material that can be reused as input returning to another system to create more profits and jobs.

Output - Input

To the aspect of waste reuse, the liquid waste is focused to recreate more profits by the way of feeding algae and fish. Next step, the nutrient waste of fish, can used as fertilizer coming back the forage farming, to grow more grass forages; the purified water can also come back o irrigate the forages; The manure of diary cows, other solid waste, can be collected to biodigester, to produce biogas.

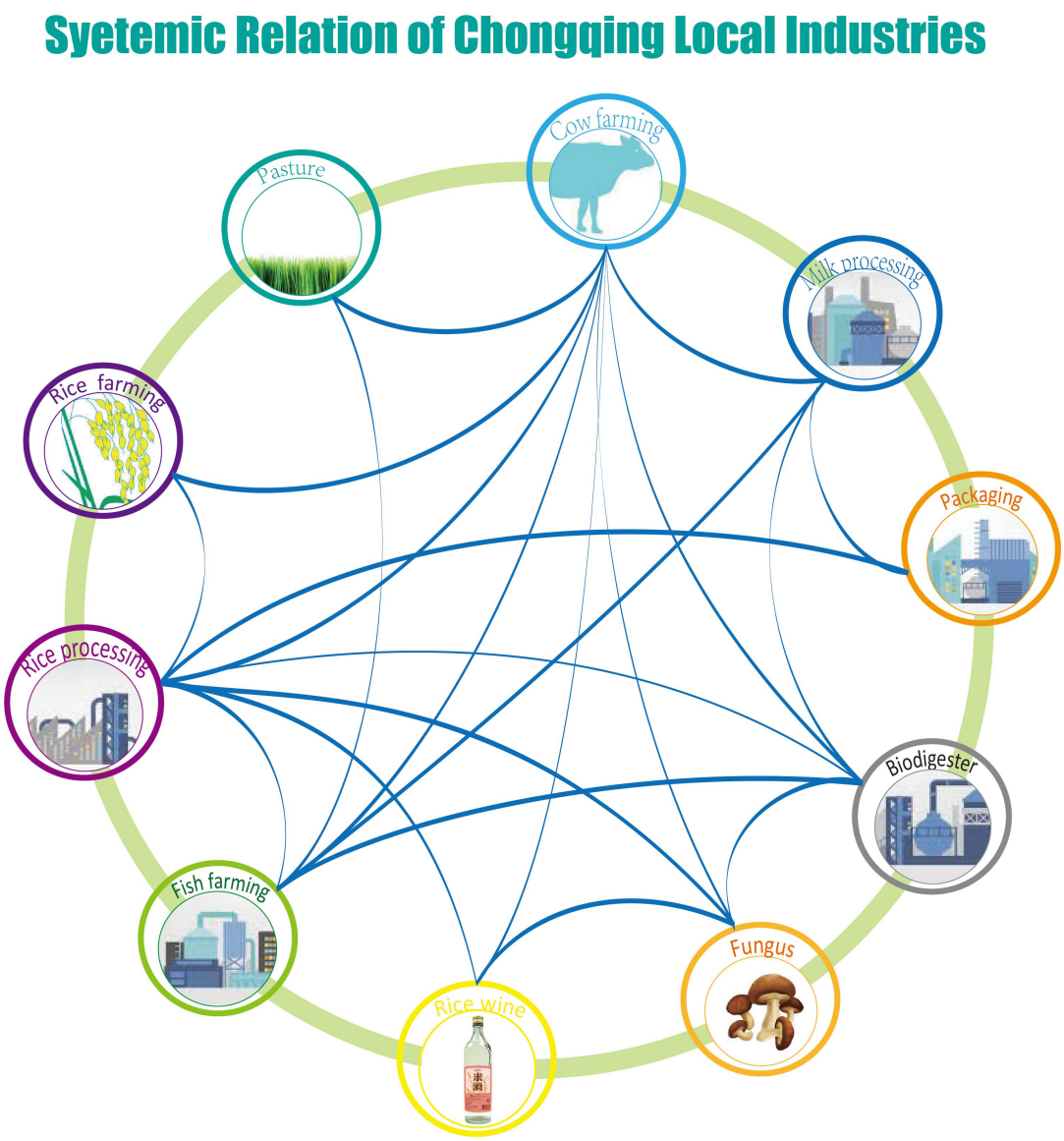
Finally, **the output comes back as input to become a sustainable recycle, in which economy and jobs are both developed.**

7.2 A New Industry System

As in China presently, the public are willing to purchase products in a higher price, which is changed a lot from the past. In the past, as the low income of ordinary people, they preferred to buy goods at a lower price, regardless of their quality but only price. Comparably, along with the development of China, the income of ordinary people has upgraded many times, so that they can afford goods at a higher price and a much better quality. Therefore, it is easy to found in China, goods are sold in a various of price and quality, and a large number of people chose to buy what they prefer, the better one, which means a better living and a healthier life.

Totally, all the products developed the whole industries, to benefit not only the producers but the local people. The public can enjoy the better quality milk and rice **without any**

addictive and over processed illegally, as well as the ecological fish and mushroom, because all the products will be bred and processed in a safe and health method, instead of the low level industrial condition and illegal processing only for more profits.



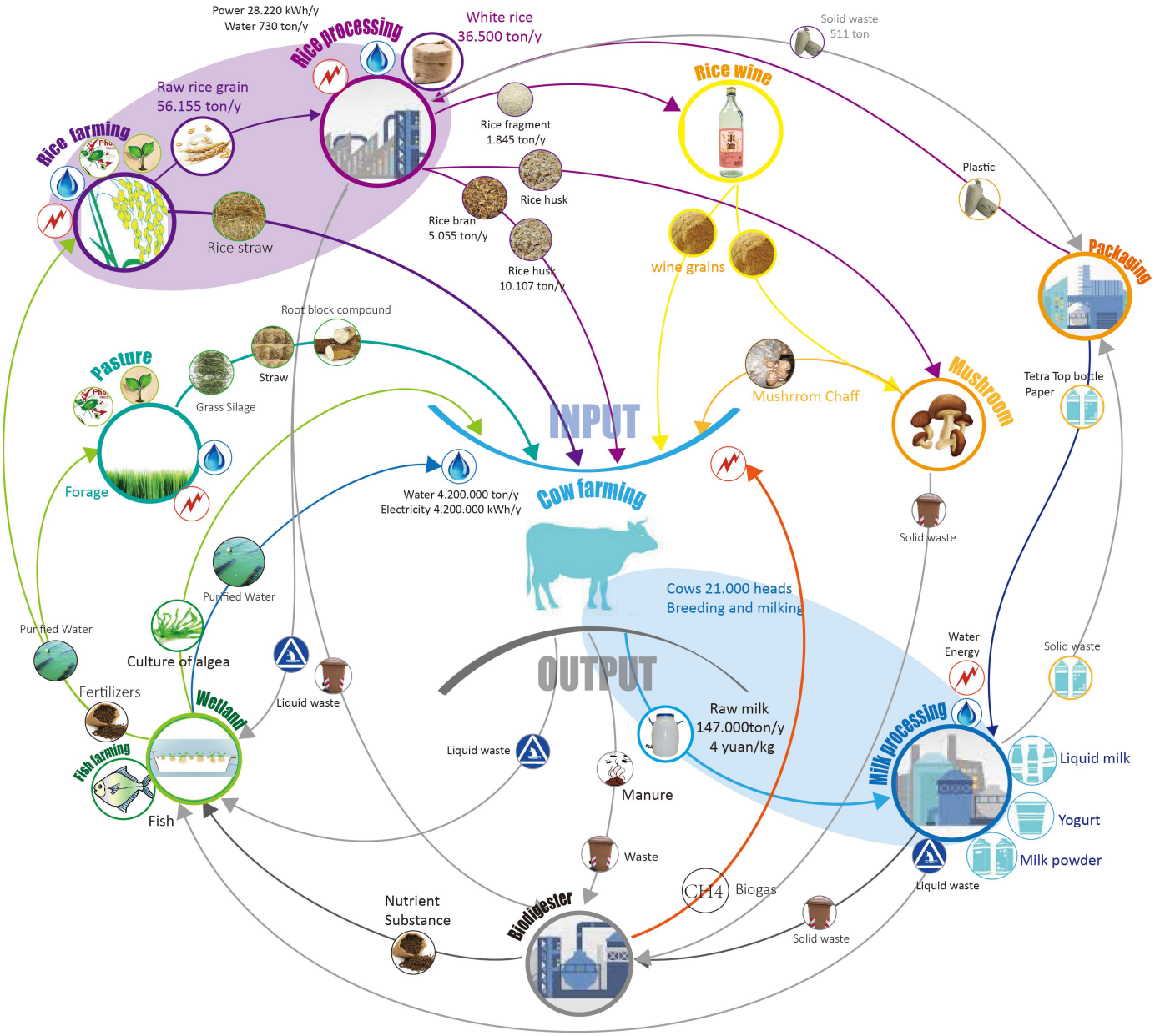
Map 62: the Relation of Chongqing Local Industries

Industries will also be under stress from the public, due to the requirement for better and safe goods, so that systemic design can benefit the industries to **think and work together**, for their same goals to produce better products and create more profits in the right way. Thus, more industries are concluded in this new industry system, to function as a whole.

There is another advantage, which is if someone in the industry system produce their products in a low quality or unsafe method, the following industries will all be affected

afterward, in the end, the worst affection will go back to the original agriculture itself. Thus, none of the industries in the system chain has the confidence to adopt illegal method or unsafe raw materials to produce their products. Therefore, it is obvious that public and government, as well as food producers can all benefit from the systemic agriculture and industry, as the strong relation among their products.

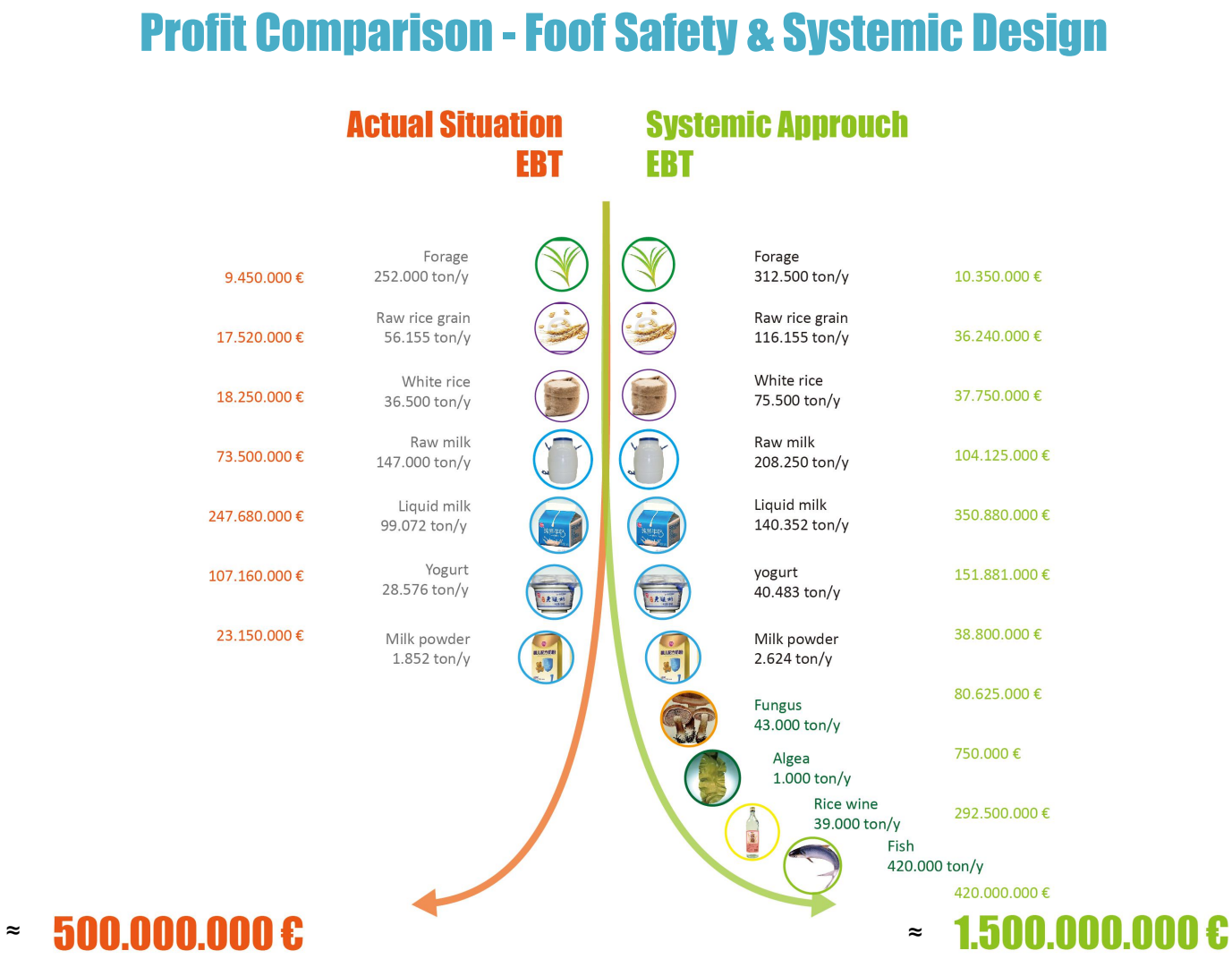
Systemic Design Map



Map 63: Systemic Design Map - A New Industry System

As the illustration shown in the map above, in the new designed agriculture and industry

system, the forage and rice grains can produced **more ecological** due to the use of organic fertilizers from fish farming. Besides in cow feeding, the utilization of wine grains and mushroom chaff, as well as the algae, will give the advantage to dairy cows of producing more raw milk and containing more protein and fat. Nevertheless, the rice company can divide the rice into different levels of quality, the lower one can be sold to make the rice wine, while the better one can be packaged to be sold at a higher price.



Map 64: Systemic Design Map - Profit Comparison

To the aspect of profits, the forage income has increased by 24%; the raw rice grain has increased by 106.8%; the white rice has increased by 106.8%; the raw milk and its products, such as liquid milk and yogurt and milk powder, all have increased about by 40%; new products such as mushroom, algae, rice wine and fish, have added income about

800.000.000 euro. In summary, the total income of the whole industry system has increased about 3 times, which turned out a much more profits to encourage the producers to guarantee their legal processing and the product quality. (Data is estimated according their farming and producing)

As result, a better agriculture and industry system in Chongqing is done according to the systemic approach.

PART 4: CONCLUSION

8 SUMMARY AND DISCUSSION

8.1 Summary

Food Safety Problems in China

*** 1. The Probable Reason Arousing Food Safety Problems in China**

As it is summarized in the Part 1, the fundamental problem was the origin of food industry, the raw materials. For the dairy industry, the original problem was the dairy cow breeding situation, such as the dairy cow diet and living environment; for the rice industry, the original problem was the soil pollution, and natural environment. As these original problems, the products processed from these raw materials, performed in low quality and even unsafe problems. Whilst, the producers considered these low quality products as a possibility for more profits. Therefore, the producers refined their low quality products illegally in to good ones, to be sold in higher price. Consequently, the issues of food safety appeared in China, and did harm to the health of the public.

Such as the issues of Melamine, the "Protein Powder" was used to increase the protein content in raw milk that cannot reach the national protein content level **(**Fred Gale, 2009); the issues of heavy metal in raw rice grain, were caused by the heavy metal pollution to cultivation soil; while, the other issues, such as the microbial exceeded in milk and over-polished rice, colored rice, can be conclude as the artificial reasons (Liang, 2010). These artificial problems were almost by the producers for more profits, non-compliance or illegal operation in food processing.

While, the artificial problems can be under control by the effort of government and the society; the natural or original problems should be regarded as more critical reasons to conduct a sustainable design for the food industry in China.

* 2. **The Breakthrough of Critical Points in Food Industry in Chongqing**

Chongqing, as a quite attractive and potential city in the western China, is rising to a development of an international level. Its food industries faced not only opportunities, but challenges, due to its self natural environment and climate. Changeable geography, hot and

humid temperature in summer, cold and humid temperature in winter, all of these special practical situations provide Chongqing both of advantages and disadvantages.

For food safety, the food industries in Chongqing should collaborate to develop for a real safe food industry system. While the food industries combine in a total food system chain, each component in the food industry system chain, can act as the important actor to supervise the producers to adopt the legal and health way to process food while increasing more profits at the same time.

Thus, a more reasonable and healthier industry system can benefit Chongqing with a sustainable development, so that Chongqing can become famous not only for its industry outstanding, but for living safe, green, sustainable to people, appropriate a sustainable city in China.

*** 3. Sustainable Food Eco-design Improvement and New Economy**

To the aspect of dairy safety and quality, as been discussed, the critical point is the dairy cow species and breeding. After the cow diet was redesigned, more protein and fat, less fiber in the forage can provide the guarantee of raw milk production in high quality and healthier quantity.

To the aspect of rice industry, the more rice processing approaches and products, such as rice bran, white bulk rice, tiny packaged royal rice and rice wine, all found their value in the food industry system. Thus, the different profit making ways, can benefit the rice producers with better marketing as well as the confidence of processing rice in the formal procedures.

By means of systemic design, the disadvantages in dairy and rice industries, such as poor dairy cow diet and raw rice grain cultivation, gray water and waste reuse, all turned into another type of materials from outputs to input, getting in or out of the food industry system. During this sustainable systemic design, not only the natural or original problems of food safety can be solved, but more profits are created so that the artificial problems by food producers can also decrease. Thus, the systemic design changed the initial food industries in Chongqing into a new food industry system, as well as a sustainable, safe and healthy living quality in China.

According to researching above, Systemic Design (Bistagnino Luigi, 2008) has developed the food industry system in Chongqing city, realized **ZERO emission, more profits, more products**. The more important is this new system indeed has the potential to solve the food safety problems in China, turning from a linear industry to an industry systemic, from chemical agriculture into a ecological agriculture,from a bust output into a ZERO emission, from harmful to friendly to environment and humans.

Consequently, after the systemic design for food safety in domestic China, a probable solution for dairy and rice food safety has been proposed. While, there still be **serious of problems** that should considered and discussed.

1. The more practical test for the nutrition content in the raw milk of dairy cows fed with new diets;
2. The discussion and communication among different industries to decide the cooperation plan;
3. The risk analysis in each production step is necessary to be considered in the quality control;
4. How the balance the quality test and the milk production, as in China the test and production generally proceed at the same time;
5. The packaging design and environmental impact should be discussed further more afterward;
6. In the systemic design, more details should be considered more deeply, such as the transportation, the waste shipping, the air emission, more suitable diet plan, and more possible systemic solution, all of which can give the breakthrough to China's food safety and sustainable development.

8.2 Discussion

Follow Up Research

1. China Food Packaging Safety Issues

Packaging and printing manufacturers usually were equipped with backward equipment and production technology, and quality management is not standardized. Nevertheless, the

relevant state packaging health and safety standards lags behind, and coupled with lax supervision, so that some unscrupulous food production and packaging manufacturers can take advantage of these disadvantages, resulting in the presence of food packaging safety hazards (You and Zhao, 2016).

* Monitoring Systems and Methods Are Backward

In China, plastic packaging businesses in the food industry are not included in the scope of food hygiene management, resulting in the plastic food packaging materials, equivalent to the production of industrial, agricultural and other uses of the products, during the production of these enterprises. In terms of health and safety regulations there is not any control and standard, such as the selection of the production environment, health of personnel, raw materials, manufacturing process control, product inspection and testing, all of which are without the special or specific requirements. Thus, the food packaging health and safety is out of control, and there is no monitoring system established by authority, no detect project, even no routine testing.

* Packaging Safety Standards Lag Behind The Development of Production

With the development of production and products, many of the standardized detection methods cannot match with the modern production, no refined, and lack of relevance. For example, the China's current standard of food packaging plastic materials requires the solvent residue of less than 10mg / m2, while there is no clear what kind of solvent; a recommended standard requires toluene residue of less than 3mg / m2, which is also far behind the requirements of the European and American countries (Lu and Wang, et. 2014)

At present, quality inspection agencies at all levels test projects periodic based on standards published in 1991, the "National Standard of Retort Packaging Films" (GB10004) and in 1993, the "Industry Standard of Two-way Stretch Nylon and Polyethylene Composite Film" (QB1871), both of which have been not suitable with the current actual production situation. Even so, the overall pass rate of checked projects is currently only 50% to 60% (Cao and Qian, 2012).

* No Establishment of Mandatory Access and Elimination Mechanism

In recent years, food packaging industry of plastic materials has been developed rapidly, and the influx of a large number of small and medium enterprises has been in this industry

(Zhang, 2009). Due to there is no health and safety requirement when those enterprises access into market, in the face of fierce competition, only the costs become the unique index, without absolutely health indicators.

The fellow up of product packaging design should be consider seriously for the completely advancement of food safety in China.

The Role of Packaging

Packaging is an essential medium for preserving food quality, minimizing food wastage and reducing preservatives used in food. The packaging serves the important function of containing the food, protecting against chemical and physical damage whilst providing information essential to consumers and marketers.

Whether a can, bottle, jar, bag or carton, packaging helps to protect food from contamination such as micro-organisms, pests and other contaminants. Packaging also helps to protect the form, shape and texture of the food inside, preventing the loss of flavors and odors and will often extend the products shelf life. Packaging also assists in regulating the water or moisture content of the food to keep it as fresh as possible. The choice of packaging material should not affect the nutritional quality of a product.

Packaging also provides an important medium whereby manufacturers can provide information on product features, nutritional contents and ingredient information (Lu and Wang, et. 2014). Packaging is a system for preserving the safety and quality of food products throughout the whole distribution chain to consumer by:

• Maximizing shelf life.
• Carrying important information on the label relating to preparation, safety and nutrition.
• Providing evidence that the package is intact and the product has not been tampered with.
• Identifying the date and the location of manufacture for inventory control and identification of potential hazards.

Changing Market Demands

Today's lifestyles are vastly different from those of the past. The fast pace of modern lifestyles, the increase in single-person households and gender equal rights, have lead to changes in food preparation and consumption habits. A positive outcome of this has been

rapid advances in food technology, processing and packaging techniques to help ensure the safety of the food supply as well as making food more convenient to prepare and consume. In spite of these advances, contamination of the food supply by natural occurrence, accidental introduction of contaminants, or malpractice, does occur.

Ultimately, the quality and safety of food will be secured by the efforts of everyone involved in the complex chain of agriculture production, processing, packaging, transport, food production, and consumption.

Overall Sustainability

Consequently, all of these factors, relate to sustainability, addressing security, safety, and health, for the whole of the consumer market. By producing products that are packaged meeting legislative and consumer demands, society can expect packaging to be (WOP, 2009):

• Beneficial throughout its life cycle
• Designed to meet market criteria for performance and cost
• Manufactured using clean production technologies and best practices
• Made from materials suitable in all probable end-of-life scenarios
• Physically designed to optimize materials and energy usage
• Effectively recovered mechanically, biologically or as energy

Food Safety Packaging

Afterward, the part of product finishing, is proposed to consider overall and design to a safety and sustainable level. Due to the disadvantages of food packaging in China, such as low packaging materials, low processing technology, even illegally manufacture, all has affected the finished products in both of quality and appearance (Lu and Wang, et. 2014). Consumers are scared purchasing foods, no matter packaged with plastic or paper, all of which appear out of safety control.

To the Aspect of Dairy And Rice Packaging

For milk, the traditional packaging material is paper and plastic. Even though both of them are produced in good quality and safety, the design for dairy packaging is necessary, due the requirement of modern dairy market, where various consumers require the individual value can be realized during their living (Wang and Chen, 2011). Thus high living quality needs not

only good food, but good experience of purchasing and using.

For rice, traditional material is plastic, which is easy to broken while in vacuum, such as the tiny packaging rice; the bulk rice in market, is in a worse situation, less of quality and fresh protection, pollution from air solid, even consumers (Zhou, Lun et al. 2013)

Therefore, it is necessary to design a better quality and safety food packaging special for rice. Besides, the reuse and recycle of food packaging should also be considered, and the environmental impact should act as one of the valuation factor of food packaging.

In the end, what humans care about, should not be the present interests, instead, should the sustainable development, the real living quality of persons, the future of children, be the starting points while producing food.

2. A Solution of Food Coding: Product Labeling and Trace Ability

Prepackaged foodstuffs must comply with compulsory harmonized standards on labeling and advertising (Boyacia, Temiza, et al, 2014). The details that must appear on packaging include the name under which the product is sold, a list of ingredients and quantities, potential allergens (products which may cause allergies), the minimum durability date and conditions for storage. In many countries, nutritional information is also required. To ensure the safety of the domestic and global food supply, government regulations and brand protection demands from customers are on the rise. To address these growing requirements, food processors up and down the supply chain have introduced trace ability systems (Li and Jin, 2010).

For example, in Europe trace ability of food packaging is currently assured by the Materials and Articles in Contact with Food Regulation (EC 1935/2004) and imposed by the regulation of Good Manufacturing Practice (EC 2023/2006). This assures the packaging user that if a problem should occur they can trace it back to source and rectify the problem.

These requirements must also be implemented into the packaging manufacturer's quality systems or certified separately by means of ISO 22000, EN 15593, the BRC/IOP Global Standard for Packaging and Packaging Materials or equivalent standards.

More Questions

1. How can China's food producers rebuild public trust?

Another case of Chinese Tea, puʾer Tea. (China Puʾer Market Report, 2014)

As the countryʾs food industry struggles with a trust deficit, researchers found the inspiration in the puʾer hills.

Chinaʾs food safety problems have triggered some inspiring attempts to innovate. Small and medium-sized enterprises accounted for 99.8% of all food-processing firms in 2010 (Zuo, 2011). In media accounts, these firms buy up whatever raw materials are available, and then process them under crude and unsafe conditions.

In 2008 , some researchers spent time investigating the structure of the tea industry in Puʾer, Yunnan. In fact, there were large tea processing plants with first rate equipment. But when it came to safety of the product, it wasnʾt the hardware that was the problem – it was a lack of procedures and poor management, and reliance on local farmers for the supply of tea leaves.

Finally, several small tea processors were working in the hills, and a tiny workshop was set up at the end of a small road. The stilted wooden buildings were hung with transparent

sheets of plastic to keep dust off the drying tea leaves.

The workshop was clean and orderly. Most impressive was the fact each worker had a small brick house in which to live with his or her family. Pigs were reared for meat, while chickens both provided eggs and ate pests in the plantation.

The 800 Mu (53 hectare) plantation sells its entire crop from an unassuming stall at Kunmingʾs tea market. It does no other marketing, and the prices are similar to ordinary tea leaves. They sell almost exclusively to regular customers, and through word of mouth.

The plantation was founded by a couple famous locally for their tea expertise, though the wife has now passed away and the husband is over 80-years-old. Their son told me that they had both worked with tea all their life and had a genuine love and understanding for it. They wanted to make Chinaʾs best Puʾer tea.

Food needs to be made with care, not on a mass production line. Many companies would agree with this as a slogan, but it was only in this tiny Puʾer tea plantation being put into practice.

2. Only Can Consumers Save

To the aspect of China Food System, in the modern food industry, the roles of producers, sellers and consumers fall out of sync, allowing bad practices to force out the goods, write zhou Li, the chief reporter of Chongqing Evening Newspaper. For most of human history, food has been scarce. In ages of scarcity, there are only two players in the food system – producers and sellers – and itʾs a **seller's market**.

When food becomes abundant, consumers appear as a new force, using the cash in their pockets to force **the sellers (now middlemen)** to focus on them, rather than the producers (Fan and Wang, 2014). At this point, the middlemen realize it isnʾt food thatʾs scarce, but consumption: the consumers, not the producers, convert their goods into riches.

But the three players are on a very uneven playing field. Producers and consumers are relatively weak, while the middlemen are powerful. The middlemen are able exploit the

producers and cheat the consumers in order to expand their own benefits. Consumers cannot fully understand the effect a foodstuff has on their health. They can only go by observation and experience when making decisions. And most consumers are only willing to pay for things that satisfy their senses – they tend not to want to pay for long-term health, or for anything that does not directly affect them: the ecological, cultural and social impacts of the food, or other benefits of agriculture.

Thus, if consumers attempt to buy **high-quality but cheap foods**, they often make bad decisions. When complete information is not available, there are moral risks associated with food production. Consumers make poor choices, while exploitative and mendacious middlemen motivate producers to flout quality and safety standards. The market fails, and food safety becomes a problem. One obvious sign of this is when prices are set neither by producers or consumers, but by the middlemen (Fan and Wang, 2014).

This kind of food market allows food standards to be controlled by the industry and for unwritten rules to operate. It inevitably leads to food-safety problems and market failure.

While the two ends of the food system are weak and the middlemen strong, a fourth player – **the government** – joins in. If a strong government sides with the producers and consumers, it can balance the strength of the middlemen. Unfortunately, it is hard to find an example of any government that has done this of its own accord. The nature of government and the private interests of officials are often the same as those of the middlemen. When profit comes first we always see the strong join forces with the strong – not the weak.

The government's intermediary role between the middlemen and either the producers or consumers often assists the middlemen, whether deliberately or otherwise. Food safety incidents are suppressed, creating a long-term food safety crisis. Government is often "close to capital", meaning its intervention only worsens the imbalance. With both the government and the market failing, bad practices drive out the good. This is a global problem.

In most need of attention is consumer responsibility. A healthy market needs consumers to realize there is a trade-off between quality and price (Fan and Wang, 2014). Consumer attitudes have been distorted by pervasive advertising and shifting social values. But only consumer responsibility can create the environment for government and business to fulfill

their duties, and unethical production to decline.

Therefore, we must recognize that staple foods are a necessity, not merely a commodity to be exchanged for cash. We must realize that **agriculture is a part of the public sector**, not industry, and not allow unfair competition between different agricultural systems or between agriculture and industry, if we are to stop bad practices taking over. This should be accepted by all, and be the starting point for all government agricultural policy.

3. We're All Farmers Now

For rising numbers of Chinese citizens, "organic" means trust and support between buyer and sellers. Fans of community supported agriculture don't care about certificate.

At a monthly "friends of farming" dinner held by Green Heartland, an NGO based in Chengdu, west China, Chen Xia quietly reads an ode to the land against light background music. It's a simple thanksgiving ceremony the hosts conduct before leaving the diners to tuck into a feast of organic produce and listen to farmers talk about their lives and land.

Green Heartland was formed by a group of urban residents who buy their food directly from farmers, and their dinners give the two groups a chance to get together (Jiang, 2007). Chen, who is one of the founders, was prompted by health concerns into thinking more seriously

about the origins of her food. In 2007, together with two friends, she organized an organic market and heard about a village called Anlong, which was said to be working to protect its land and rivers through sustainable farming.

The people started to buy food from the village. One of her cofounders, Xia Lu, had been working for an NGO in Anlong, but stayed on after her project finished – as a friend, volunteer and consumer. She had plans for a website through which the farmers could reach out to urban consumers, and hoped to arrange customer visits, farmers' markets and dinners. Her overarching aim was to bring farmers and customers closer together and encourage a return to healthier farming methods. Xia's ideas got a warm response from people already buying food from Anlong town – and Green Heartland was born.

Gao Yicheng is in charge of deliveries and liaison: ''If you want to buy our crops, you need to come here first and have a look around. We won't give you anything until you've actually visited,'' he said.(Wu and Jiang, 2017)

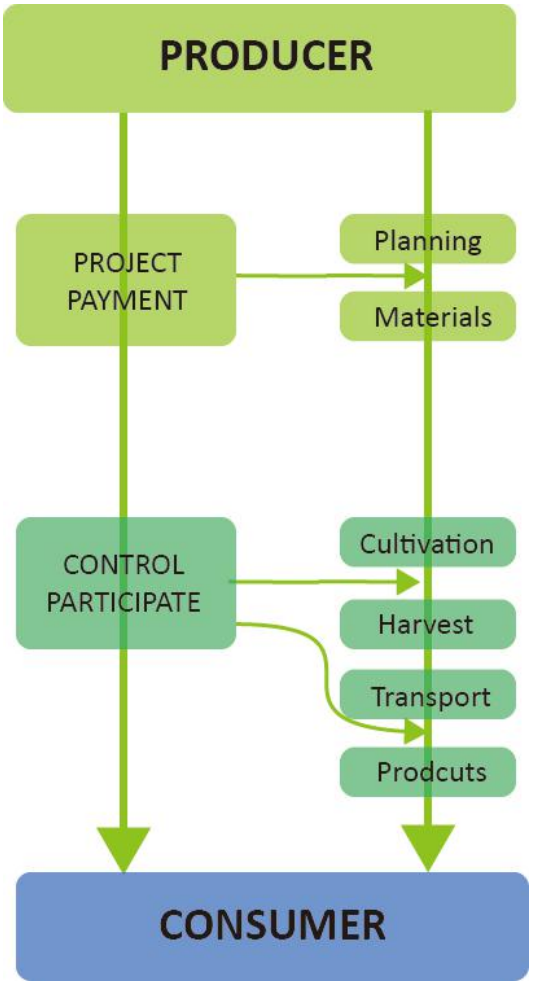
Gradually, the number of customers has grown. Against the backdrop of ever more frequent food safety scares, growing numbers of Chinese citizens are looking for safe and healthy alternatives. The popularity of the organic methods practiced at Anlong is soaring. Zhang Ming, a journalist at local paper Chengdu Daily, became both a customer and Green Heartland member after reporting on the village's activities.

Some customers have befriended the farmers and help to organize sales and distribute goods. Chen said that the organization hopes to improve understanding and trust between farmers and the people who eat their produce. Green Heartland also helps customers link up to make bulk orders and organizes markets to boost sales – as well as the farmers' confidence in the value of organic methods. The group now works with farmers in 10 places around Chengdu and has built up a core customer base of more than 100 people.

This kind of direct participation by consumers in the production of their food is commonly known as Community Supported Agriculture (CSA) (Qu and Jiao, 2013). It originated in Japan, Europe and the United States and, since 2003, has been actively promoted in China by Hong Kong-based NGO Partnership for Community Development (PCD) and global advocacy group Institute for Agriculture and Trade Policy (IATP). CSA provides a new way of thinking about

food safety, rural economies, environmental damage and urban alienation, as well as creating the possibility of a different way of life. Through local trials, overseas experience and the pressure of food safety scares, CSA has taken root in several Chinese cities as one option for shoppers on the hunt for safer food (Jia and Wang, 2015).

Map 66: The relation of CSA



The rise of CSA in China is helping farmers to understand the wider choice organic agriculture can give them, in terms of both technology and markets (Qu and Jiao, 2013).

It allows them to see that they have options beyond genetically modified crops and industrial farming, which will only relegate them to the bottom rung of a supply chain.

Map 67: The Processing of CSA

There are many examples. Even before 2003, a group of residents from the city of Liuzhou, in southern China, were moved to establish Farmers' Friends following a trip to the

countryside where they saw first-hand the threats to traditional agricultural methods and farmers' struggle for survival. Their social enterprise now takes city dwellers to the countryside to eat at village restaurants and purchase local products.

The meals are delicious and made with produce fresh from the fields. The farmers that the group works with grow rice in their backyards, in the same ponds they use to raise ducks – a traditional organic method. And the seeds they plant are traditional crops handed down from generations past. These ways of working allow the farmers to escape the constraints of commercial agriculture and boost their appeal to customers.

As the number of customers has increased, Farmers' Friends has opened a museum of traditional farming techniques and a restaurant serving healthy and organic farmhouse fare. The restaurant, which brings together rural producers and urban consumers, is more about spreading the news and spirit of CSA than serving top cuisine. It works to nurture the traditional crops that are disappearing, provide diversity of income for small-scale farmers, protect farming culture and promote links between city and countryside. The association pays stable prices for produce and has established a fund to help farmers continue to plant traditional crops, organize themselves and promote rural cooperation.

The past three years have seen a surge in cooperation between consumers and farmers outside of commercial markets. All around China, consumers are opening organic shops, holding regular organic markets, setting up collection or sales points and organizing bulk purchasing – all activities that bring together consumers and farmers. And, unlike normal markets, consumer advocacy is a big part of what they do. They even arrange for farmers and consumers to negotiate prices together in order to build understanding and trust.

Beijing Farmers' Market was founded by a small group of consumers in 2010, since when it has expanded to serve an average showing of 2,000 shoppers. Some 20 farmers and farms and more than 10 NGOs and craft workshops attend every event. Natural and handmade everyday goods and processed foods are on sale alongside agricultural produce (Wang and Li, 2014).

The majority of the products on sale are not actually certified as organic, but consumers can talk to the producers about their goods and how they grew them and build up trust in that

way. A core group of volunteers pays regular visits to producers to look at their land and talk to them and ensure their products are qualified for the market. The markets started out as a monthly event, but are now held once a week.

Similar activities are flourishing in many other places across China, including Shanghai, Guangdong, Guangxi and Sichuan. For participants in CSA, ‘‘organic’’ isn’t about certification, but the trust, support and sharing involved in simple business transactions.

And farmers, as well as consumers, are working to build that trust. In Anlong, the organic farmers are even picky about whom they sell their produce to. Gao Yicheng is in charge of deliveries and liaison: ‘‘If you want to buy our crops, you need to come here first and have a look around. We won’t give you anything until you’ve actually visited,’’ he said. (Wu and Jiang et al, 2017) The farmers here think it’s crucial that buyers meet producers.

Since 2008, the Shanxi Yongji Farmers’ Association has been working to develop organic agriculture through farmers’ cooperatives (Ma, 2008). It has attracted plenty of buyers from many places, but is most preoccupied with finding local customers. Zheng Bing, an association official, said that selling locally helps boost trust among consumers.

Supermarkets and big food companies are now pushing ‘‘**Green” and “Organic”** products (China Market Report, 2017). But CSA advocates say that they are in search of something different: nature and health.

At a recent forum on rural development, as experts and NGO representatives were fretting over how organic agriculture could be scaled up, Hebei farmer An Jinlei spoke out: ‘‘As a farmer, I don’t like the term ‘organic’. It has become a buzzword and lost its meaning. The rich folk in the city drive their cars to the supermarket and buy organic food – they’re just worried about their own health. But what are their lifestyles and values, their excessive consumption of resources, doing to the health of the planet?’’ (China Market Report, 2017)

An prefers to call his farming methods **“Natural Agriculture**’’, which he describes as looking after the land in accordance with natural principles. ‘‘The land can’t take any more,’’ he said. ‘‘We need to look after it, to help it recuperate. You need the land to be healthy if you are going to get food for a healthy life.’’

An believes many modern agricultural ideas go against the laws of nature. That's what prompted him to quit his job at a state-owned farm 10 years ago and return to his home village. Together with his wife, he sought out natural farming methods that would restore the land. He believes that even pests have a place. "If humanity doesn't stop its exploitation of the land, there will be no way back," he said. His determination has seen once lost birds and insects return. A pharmaceutical firm pays a premium for his cotton and corn, while a number of CSA consumer groups in Beijing buy his crops.

A laments that more farmers in his village aren't following his example. They generally recognize the harm done by fertilizers and weed-killers, he said, but believe they have no choice because they can't afford the initial costs of going organic. Without external support, it is almost impossible for farmers suddenly to switch to sustainable farming.

While many farmers cannot afford to go organic, some urban residents have taken matters into their own hands.

Green Mothers Alliance was founded by a group of housewives concerned about their children's' health and future (Yogeev Report, 2012). In 2006, food safety scares prompted these women to experiment with growing their own food, but they soon found they lacked the necessary knowledge to make it work. Inspired by CSA outfits like Little Donkey Farm and Taiwan's Housewives Alliance, they started making bulk purchases from like minded farmers. Today, their organization has more than 200 members.

De Run Wu Organic and Natural Store (www.bjchano.com) is one of Beijing's oldest instances of urban residents taking control of their food supply. The owners have a small organic farm outside Beijing, where they grow and sell their products. The shop only sells organic goods, both its own products and those it imports from Taiwan and elsewhere.

Wang Tianxiang of organics products business E-colourful told China Dialogue that similar operations existed in China as long as 20 or 30 years ago, but were very rare and generally supplied only senior officials and foreigners. Operations with a wider market have only become more common in the past few years. The market is still small, but demand outstrips supply. And prices aren't high when compared with the costs: half a kilogram of organic vegetables at De Run Wu costs 10 yuan (US$1.60).

Outside of China, CSA got going thanks to concerns over food and land quality. But here, the rise of new approaches to farming has been catalyzed by food safety problems. Although most people rely on "organic" labels to make their choices, due to the influence of marketing and the lack of alternatives, more and more shoppers want to know – to really know – where their food is coming from.

4. Can consumers change markets online?

Both small food companies and the farmers, as well as agricultural cooperatives producing local products using natural methods, tend to be in remote locations. This allows them to keep apart from the pollution and production-line farming of modern agriculture. But it makes getting their products to market costly.

Ninety-five percent of China's villages are now covered by internet, collected by various delivery companies that can even reach the smallest county towns. This means small-scale producers can get involved in E-commerce – reaching consumers online and having delivery firms handle the logistics (Zhang and Geng, 2014).

Now 2,500 types of food are directly sold by producers on **Taobao,** www.taobao.com / www.tmall.com, **China's equivalent of Ebay**, while 3,800 food firms sell via Taobao's business-toconsumer site Tmall.com.

Online merchants win consumer trust through transparency and interaction – the entire production process is visible and immediate feedback is provided to any questions. The merchants also need to engender a sense of familiarity, to sustain the trust which substitutes for the quality certification used by industrial producers.

It is hard for consumers to pick a trustworthy supplier from all the listings (Tan, 2014). Customers are mostly young, female white-collar workers, or young mothers shopping for their children. Once they have settled on a supplier, either by trial and error, or by word of mouth, they spread the word. Customer numbers can rocket.

Companies and farmers willing to make changes and the customers willing to take a chance and seek out safe food deserve our respect. They are scattered throughout China's cities and villages, but are rebuilding public trust. And only in a trusting society can we get safe food. It is believed the internet is breaking down people's blind faith in authority and rebuilding social trust (Liu, 2010).

In the end, food safety is just a starting point. Consumers are not just seeking safe food for themselves and their children, but to build a basic understanding of rights and create opportunities to unite – they are creating the conditions for a trusting society.

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Tables

Table 1: 10 Years of Food Safety Issues in China (Cases From 2005 to 2017)	
General Information of food safety problems	Meat and meat products; Vegetable; Wine; Fruits and Fruit products; Drinks - 40.54%; Food processing - 60.16%; Artificial additives - 75.5%; Illegal Food Additives - 31.24%
Top 10 incidents	1, 2006, Sudan dye IV used in eggs 2, 2008, Sanlu Melamine milk powder 3, 2009, pickled vegetables 4, 2010, sewage cooking oil recollection 5, 2010, fake milk powder 6,2011, "Clenduterol" used in pig meat production 7, 2013, pesticide used in vegetable processing 8, 2013, fake chicken eggs; 9, 2015, colored unripe strawberries 10, 2007/2017, Cd rice appeared in large number in China
TOTAL CASES	227386
*Food-poisoning cases that involved 100 or more victims	

Table 2: The World Dairy Cows Distribution		
Total amount	2017（million head）	YoY
Europe	23.545	-0.2%
New Zealand	4.958	-0.8%
America	9.349	0.42%
China	14	-11.4%

Table 3: Comparison of National Dairy Standard, International and China			
Object	Developed Countries	China (1986)	China (2010)
Bacterium Content in raw milk	≦200 thousand/ml	Level 1: ≦500 thousand/ml Level 2: ≦1 million/ml Level 3: ≦2 million/ml Level 4: ≦4 million/ml	≦2 million/ml
Protein Content in raw milk	≧3.0 g/100g	≧2.95 g/100g	≧2.8g/100g

Table 4: Comparison of Dairy Breeding and Production			
Object	**Europe**	**China**	**Chongqing**
Ordinary Dairy Cow Forage	Alfalfa 1.5 ton; Grass silage 6 tons; wheat straw 1 ton; Root block 0.5 ton; Concentrated feed 3 tons	Grass silage 6 tons; Corn straw 1 ton; Root block 0.5 ton; Rice bran 1 ton; Concentrated feed 2 tons	Grass silage 6 tons; Rice straw 1 ton; Hay 1 ton; Rice bran 1 ton; Root block 1 ton; Concentrated feed 2 tons
Content of Forage	NEL 7.2MJ/KG CP 18% Fat 7% Fibre 50%	NEL 6.6MJ/KG CP 15% Fat 5% Fibre 60%	NEL 6MJ/KG CP 12% Fat 5% Fibre 60%
Yield of milk	9-10 tons raw milk/head	6-8 tons raw milk/head	6-7 tons raw milk/head

Table 5: Grey Water Emission in The Dairy Processing		
Pollutants	Unite	Standard
pH	pH	6-9
BOD5	mg/L	50
COD	Mg/L	250
TN	Mg/L	10
TP	Mg/L	2
Grease	Mg/L	10
Total suspended solids	Mg/L	50
Temperature rise		3
E. coli	MPN/100ml	400
Active ingredients/ antibiotic	depend	
RESOURCE: Scientific test method, in consideration of surrounding environment, MPN is the maximum		

Table 6: Waste During The Dairy Processing	
Dairy products	Total solid waste (kg/1000 L)
Fresh milk and products	1.7-14
Cheese, yogurt and powder milk	0.5-10
Ice cream	35-58
RESOURCE: on the base of more than 10 dairy industries, Nordic Council of Ministers (2001)	

Table 7: Resource and Energy Waste During The Dairy Processing							
Consumption of production	Unite	EU dairy industry	Sweden dairy industry	Denmark dairy industry	Finland dairy industry	Norway dairy industry	Industry benchmarks
Water							
Fresh milk and products	l/l raw milk		0.96-2.8	0.60-0.97	1.2-2.9	4.1	1.0-1.5
Cheese and yogurt	l/l raw milk		2.0-2.5	1.2-1.7	2.0-3.1	2.5-3.8	1.4-2.0
Milk powder	l/l raw milk		1.7-4.0	0.69-1.9	1.4-4.6	4.6-6.3	0.8-1.7
Ice cream	l/kg						4.0-5.0
Energy							
Fresh milk and products	kWh/l	0.09-1.11	0.11-0.34	0.07-0.09	0.16-0.28	0.45	0.1-0.2
Cheese and yogurt	kWh/l	0.06-2.08	0.15-0.34	0.12-0.18	0.27-0.82	0.21	0.2-0.3
Milk powder	kWh/l	0.85-6.47	0.18-0.65	0.30-0.71	0.28-0.92	0.29-0.34	0.3-0.4
Ice cream	kWh/kg			0.75-1.6		0.8-1.2	
Grey water emission							
Fresh milk and products	l/l		0.8-2.5	0.83-0.94	1.2-2.4	2.6	0.9-1.4
Cheese and yogurt	l/l		1.4-2.0	0.77-1.4	1.5-3.2	3.2	1.2-1.8
Milk powder	l/l		1.2-4.3	0.75-1.5	1.9-3.9	2.0-3.3	0.8-1.5
Ice cream	l/kg		2.7-4.4		5.6	3.0-7.8	2.7-4.0
RESOURCE: EU dairy association (2002), Nordic Council of Ministers (2001)							

Table 8: Input and Output of Dairy Cow Farming and Production System			
Subsystem	Input	Output	Functions
Cultivation	Seeds Diesel Fertilizers Pesticides Manure	Forages Waste	Cow forage production

Cows farming -breeding -milking	Forage Complementary fodders Disease control equipment Electricity Water	Manure Gray water waste	Raw milk production Raw milk quality control
Production -collection -processing -packaging -storage	Testing equipment Processing equipment Storage equipment Packaging (tetra pak) Shipment Storage Electricity Water	Gray water Waste Organics BOD COD Solid waste Greenhouse Gas	Milk processing Quality and safety control Product packaging
Distribution	Transportation	GHG	Finished product distribution
Use and Elimination	Energy	Packaging waste	Consumption Recycle

Table 9: Tianyou Dairy Database						
Input	Cow Amount	Raw Milk	Energy in Breeding	Energy in Production		
	21.000 heads In milking	147.000 ton/y 4 yuan/kg	Water: 4.200.000 ton/y Electricity:4.200.000 kWh/y	Water:735.000 L/L Electricity:132.300 kWh/L		
Output	Manure	Waste in breeding	Waste in processing	Products		
	63.000 ton/y	Solid Waste: 2.000 ton/y Liquid waste: 210.000 ton/y	Liquid Waste: 690.900 ton/L SolidWaste:11.613 ton/y	Fresh Milk: 99.072 ton/y Milk Powder: 1.852 ton/y Yogurt: 28.576 ton/y		
New Diet Designed for Dairy Cows in Chongqing(Head/year)						
Classic Diet	Grass silage	Straw	Rice Bran	Concentrated feed	Root block	Hay
Amount	6 ton	1 ton	1 ton	2 ton	1 ton	None
New Diet (total 10%)	Algae	Mushroom chaff	Rice wine grains	Rice husk		
Amount	0.05 ton	0.5 ton	0.5 ton	0.15 ton		

Table 10: The Ranking of World Rice production in 2017			
Ranking	Country	Production (kiloton)	Proportion (%)
Total	Globe	481540	100%
1	China	144850	30.08%
2	India	106500	22.12%
3	Indonesia	37150	7.71%
4	Bangladesh	34578	7.18%
5	Vietnam	27861	5.79%
6	Thailand	18600	3.86%
7	Myanmar	12400	2.58%
8	Philippines	11500	2.39%
9	Brazil	8160	1.69%
10	Japan	7780	1.62%

Table 11: Indica Rice Processing National Standard GB1354-2009					
Level standard		Level 1	Level 2	Level 3	Level 4
Rice fragment	Amount	7.5%	10.0%	12.5%	15.0%
Impurities	Amount	0.25%		0.3%	0.4%
	Bran powder	0.15%		0.20%	
	Minerals	0.02%			
	Rice grain	3 t/kg	5 t/kg		7 t/kg
	Rice husk	4 t/kg	6 t/kg		8 t/kg
Moisture		15.5%			
Yellow rice		1.0%			
Intermixing		5.0%			
Color and odor		No extraordinary color or odor			

Table 12: Fine Indica Rice Processing National Standard GB 1354-2009				
Level standard		Level 1	Level 2	Level 3
Rice fragment	Amount	2.5%	5.0%	7.5%
Chalky rice		10%	20%	30%
Taste value		90	80	70
Amylase content		14%-20%		
Impurities	Amount	0.25%	0.3%	
	Bran powder	0.15%	0.20%	

	Minerals	0.02%	
	Rice grain	3 t/kg	5 t/kg
	Rice husk	4 t/kg	6 t/kg
Moisture		15.5%	
Yellow rice		1.0%	
Intermixing		5.0%	
Color and odor		No extraordinary color or odor	

Table 13: Japonica Rice Processing National Standard GB1354-2009

Level standard		Level 1	Level 2	Level 3	Level 4
Rice fragment	Amount	15%	20.0%	25%	30%
Impurities	Amount	0.25%		0.3%	0.4%
	Bran powder	0.15%		0.20%	
	Minerals	0.02%			
	Rice grain	3 t/kg	5 t/kg		7 t/kg
	Rice husk	4 t/kg	6 t/kg		8 t/kg
Moisture		14.5%			
Yellow rice		1.0%			
Intermixing		5.0%			
Color and odor		No extraordinary color or odor			

Table 14: Fine Japonica Rice Processing National Standard GB 1354-2009

Level standard		Level 1	Level 2	Level 3
Rice fragment	Amount	10%	20%	30%
Chalky rice		10%	20%	30%
Taste value		90	80	70
Amylase content		15%-24%		
Impurities	Amount	0.25%	0.3%	
	Bran powder	0.15%	0.20%	
	Minerals	0.02%		
	Rice grain	3 t/kg	5 t/kg	
	Rice husk	4 t/kg	6 t/kg	
Moisture		15.5%		
Yellow rice		1.0%		
Intermixing		5.0%		

Color and odor	No extraordinary color or odor

Table 15: The Data during Rice Production (based on 100 tons of Fine Rice)			
Object	**Amount**	**Percentage**	**Price**
Fine Rice	100 tons	65%	7820 yuan/ton
Rice Fragments	14 tons	9%	2250 yuan/ton
Rice Bran	10.8 tons	7%	1050 yuan/ton
Rice Husk	27.8 tons	18%	75 yuan/ton
Water	0.77 ton/day + 5 ton/day	0.5% (153.85 tons)	5 yuan/ton
Electricity	603.35x24x300, 434.4120 kkvr.h		0.5 yuan

Table 16: Input and Output of Rice Cultivation and Production System			
Subsystem	**Input**	**Output**	**Functions**
Cultivation	Seeds Diesel Fertilizers Pesticides Manure	Forages Waste	Cow forage production
Rice processing	Forage Complementary fodders Disease control equipment Electricity Water	Manure Gray water waste	Raw milk production Raw milk quality control
Production -collection -processing -packaging -storage	Testing equipment Processing equipment Storage equipment Packaging (tetra pak) Shipment Storage Electricity Water	Gray water Waste Organics BOD COD Solid waste Greenhouse Gas	Milk processing Quality and safety control Product packaging
Distribution	Transportation	GHG	Finished product distribution
Use and	Energy	Packaging waste	Consumption

Elimination			Recycle

Table 17: Qiaoping Rice Database			
Input	Raw Rice grain	Energy	Packaging
	56.155 ton/y	Processing water: 730 ton/y Electricity: 28.220 kWh/y	
Output	Solid Waste	Liquid Waste	Products(white rice)
	Rice Fragment: 1.845 ton/y Rice Husk: 10.107 ton/y Rice Bran: 5.055 ton/y	511 ton/y	36.500 ton/y

Table 18: The Nutrient Content of Local Materials				
Objects	Rice Wine Grains	Mushroom Chaff	Algae	Rice Husk
DM	93	40	56	50
EE (fat)	5.4	1.5	0.1	0.5
CP (protein)	24	25	8.2	2.7
Fibre	75	5	9.8	41

Table 19: Systemic Design Map - Profit Comparison			
Products	Actual (Ton)	Systemic (Ton)	Price (Euro/ton)
Forage	252	312.5	37.5
Raw Rice Grain	56.155	116.155	312
White Rice	36.5	75.5	500
Raw Milk	147	208.25	500
Liquid Milk	99.072	140.352	2500
Yogurt	28.576	40.483	3750
Milk Powder	1.852	2.624	12500
Mushroom	0	43	1875
Algae	0	1	750
Rice Wine	0	39	7500
Fish	0	420	1000