An Analysis of the Competitiveness of Chinese Malting Barley Production and Processing *

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ABSTRACT

China has experienced reforms, economic prosperity and enormous economic growth for several years. Today, China has the biggest beer market in the world and further development potential lays ahead. In many other areas of the world, which experienced a comparable development, intensive vertical coordination mechanisms have been established. In this context, the supply chain of Chinese malting barley production and processing is described, the design of its vertical coordination mechanisms is analysed and the competitiveness of the Chinese supply chain is examined.

The theoretical background for this analysis of vertical coordination is the New Institutional Economics, which approaches the problem at two levels. Both a political, economical, and juristic approach, as well as a cultural and social framework for each country, define the organisational structures of supply chains. This framework is analysed on the macro level. The analysis of individual exchange relationships between links in the supply chain takes place on the micro level. The vertical coordination intensity distinguishes different vertical coordination structures. Vertical coordination strategies are lined up along the vertical coordination continuum. These strategies range from the loose spot market strategy, the specification contract, the relation-based alliance and formal cooperation through to the most intensive exchange strategy, vertical integration. Some reasons given for different vertical exchange strategies are the trade off between transaction and organisation costs, different market influence situations of the actors, factor specificity, price and product risks as well as purchase and sales uncertainties.

The supply chain of Chinese malting barley production and processing, as well as its framework conditions, are described extensively. The analysis of the vertical coordination strategies yields that actors in the supply chain choose mostly loose coordination strategies. Merely between breeders and seed multiplicators, the exchange coordination takes the extreme intensive position on the vertical coordination continuum. Reasons for this intensive relationship lay in the historical and legal framework as well as in economic considerations of the actors.

The situation of competition between Chinese malting barley and imported malting barley becomes apparent. Referring to the value chain analysis by PORTER, the examination reveals that a reduction of Chinese production costs is necessary on the one hand, and qualitative improvements of the Chinese malting barley are needed on the other hand. Otherwise, the pure Chinese malting barley supply chain would run the danger of losing against its international competitors, as the quality malting barley demand will be growing respectively. Therefore, the supply chain needs innovations in breeding, which can be reached by refreshing the gene pool with international material. The improvement of the information flows between links in the supply chain of malting barley production and processing, as well as quality stimulating price mechanisms for barley farmers could help to improve the quality of Chinese malting barley output.
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ABBREVIATIONS

RMB - Renminbi (Chinese Currency)
USDA - US Department on Agriculture
1 INTRODUCTION
The supply chain of malting barley production and processing includes barley breeding, barley production, procurement as well as the malt and the beer industry. Beginning with the Chinese beer industry, the different supply chain links will be described.

Figure 1: Supply Chain of Malting Barley Production and Processing in China

Source: Own presentation.

Afterwards, the analysis focuses on the competitiveness of the pure Chinese malting barley production and processing system within the whole supply chain compared to import malting barley.

2 THE SUPPLY CHAIN OF MALTING BARLEY

2.1 The Chinese Beer Industry

2.1.1 Market Development

Beer Production
The history of the beer production in China is comparatively young. Russian settlers founded the first Brewery in northeast China in 1900. During the following five years, German colonialist opened up the Tsingtao Brewery and Czechs began to brew beer in China. At that time, all breweries were very small.

After World War II, the Chinese beer industry developed very slowly. At the end of the 1970s, the home production could not meet the increased demand for beer anymore and beer became scarce (ZHIGANG 2004: 1). During the following years, the Chinese central government had started to promote the beer production in China extensively. It implemented an opening policy of the economy that was the starting point for an extensive growth of the Chinese economy. Since the implementation of
this promotion, the beer production has been growing consistently. In 2002, China displaced the United States and became the largest beer-producing country by volume. YANG (2006) estimates the beer production could reach 320 mln hl in 2006.

**Beer Consumption**

Figure 2 shows the extreme increase of the per capita beer consumption in China. According to Figure 4, the per capita beer consumption increased from 2 litres per capita in 1984 to 22 litres in 2004. For the following years, the figure forecasts a further increase up to 28 litres per capita in 2010.

**Figure 2:** Per-capita Beer Consumption in China

Source: WANG (2005: 1).

### 2.1.2 Market Segmentation

**Regional Segmentation**

The Chinese beer market is strongly regionally segmented. On average three top suppliers of one region have a 68 percent market share of their region. Their market share in the total Chinese market is seldom higher than 20 percent. Good reasons for this phenomenon are the interests of provincial governments to maintain their regional breweries. Furthermore, high transport costs hinder the market development for local breweries. However, during the last few years, big breweries succeed largely in placing some of their beer brands nationwide. Today, the biggest beer markets of China are Northern and North Eastern as well as Eastern China which represent 57 percent of the total Chinese beer market (ZHIGANG 2004: 4).

**Qualitative Segmentation**

The Chinese beer market can be categorised into four quality segments. Figure 3 shows the segments “popular”, “near premium”, “premium” and “super premium”. In
contrast to European beer markets, the low quality segment (popular) dominates the Chinese beer market. This mass beer reaches the market for less than the average Chinese beer price of 0.82 US-Dollar per litre. People in rural areas upcountry have a relative low purchasing power. In these regions, the mass beer is even more popular than in prosperous urban regions in coastal China. The average sale price of beer in rural areas is 0.58 US-Dollar per litre. The mass beer covers 93.4 percent of nationwide beer sales. This equals 75 percent of the Chinese beer industry turnover on a value basis (ZHIGANG 2004: 4-5).

Figure 3: Segmentation of the Chinese Beer Market


The “Near Premium” and the “Premium” segments account for 6.3 percent of the market. The “Super premium” segment reaches only 0.3 percent market share. The products of the “Premium” and “Super premium” segments are mainly imported products or produced with brewing licences. Beer products of the lower quality segments are primarily produced by Chinese breweries.

Besides its big shares of the low quality segment, the Chinese Tsingtao Brewery Co. Ltd. claims 12.9 percent of the “Premium” segment. The “Premium” segment shows the biggest growth rates (Figure 3: 9.6 percent). The interest (of international companies as well as Chinese companies) in participating in this segment is based on the
finding that the increasing purchasing power of Chinese citizens does not only change the quantitative, but also changes the qualitative, demand for beer. Accompanied by the general increase in the purchasing power of Chinese citizens, an increase in the demand of middle and high quality beer can be expected (ZHIGANG 2004: 4).

### 2.1.3 Economic Actors in the Beer Market

Since 1988, the Chinese beer industry is in a consolidation process that has accelerated during the recent years. In 1988, China counted 813 regional breweries; in 2005, WANG (2005: 2) estimates that there were 400 breweries left. In 1996, the three biggest breweries controlled 22 percent of the total market; in 2003, the three top breweries already had a 53-percent market share (WANG 2005: 2). In spite of everything, the Chinese beer market is heavily fragmented and still differs from the far more consolidated beer industries of western countries.

ZHIGANG (2004: 5) describes four groups of economic actors in the Chinese beer industry:

1. **Beer Conglomerates**

This group contains brewery groups with an annual beer production of more than 10mln hl. Most prominent Representatives of this group are the Tsingtao Brewery Co. Ltd., Beijing Yanjing Brewery Co. Ltd., China Resources Enterprise Ltd. and the Harbin Brewery Group Ltd.

2. **Big Brewing Companies**

This group contains 14 breweries with an annual production of 2 to 10mln hl. Representatives are Zhujiang Beer, Chingqing, Goldstar as well as Huiquan.

3. **Small and medium sized Breweries**

Breweries with an annual beer production of less than 2mln hl belong to this category. This group represents 96 percent of all breweries in China. These producers are summarised under “others” in Figure 3.

4. **International Brewery Groups**

The biggest international brewery groups active in the Chinese beer market are Anheuser-Busch Companies, Inc. (USA), SAB Miller PLC (South Africa), InBev (Belgium), Carlsberg A/S (Denmark) and Heineken International (Netherlands) as well as Asahi Breweries Ltd., Suntory Ltd. und Kirin Brewery Co. Ltd. (Japan).
In the 1980s, international brewery groups tried to conquer the Chinese market by implementing their beer brands on this market. Their strategy was crowned with only little success. Today, international brewery groups try to develop the market by purchasing company shares of Chinese brewing companies (WANG 2005: 2). For example, SAB Miller PLC owns 49 percent of China Resources Snow Breweries Ltd., the biggest beer brand by volume (17.3mln hl) in China (SAB MILLER PLC 2006: 133 and 30). Anheuser-Busch Companies, Inc. have made further inroads into the market: In 1995, they purchased today’s Budweiser Wuhan International Brewing Company and in 2004, they overtook the Harbin Brewery Group Ltd. In 2005, Anheuser-Busch Companies, Inc. own 27 of the Tsingtao Brewery Co. Ltd., the biggest brewery group of China (ANHEUSER-BUSCH COMPANIES, INC. 2005: 16).

However, the idea of selling own beer brands in China does not seem to be deemed out of the strategic planning of the international brewery groups. THE WALL STREET JOURNAL reported in November 2006 that SAB Miller PLC planed to introduce its brand “Miller” into the Chinese market (MEI FONG 2006: 6).

2.1.4 Use of Raw Materials

German beer brands are brewed in conformity with the “German purity law” out of hops, malt, yeast and water. Chinese breweries use other formulas. According to YANG (2006), most of the Chinese breweries use 60 percent barley malt. Raw materials like rice and corn substitute the remaining 40 percent. Only if consumers are to receive higher quality and an unchanging taste, do brewers use more malt. That is why the Beijing Yanjing Brewery Co. Ltd. uses 67 percent malt for its beer of higher quality (YANG 2006). However, malt is the decisive factor for the quality of the beer as well as for its production costs (MAJOR 2001: 5).

According to FUNG (2006), only some of the breweries use long-term contracts to ensure their raw material needs. All other breweries await the price development on the malting barley and malt markets. Furthermore, in recent years, the malt price was more important to the breweries buying decision than the malt quality. As beer is mainly sold on the mass market of the low quality segment (see figure …) where only low prices can be achieved and where beer quality is less important to consumers, the profit maximizing brewery needs to reduce costs to be competitive in the market. In the middle and high quality market segment, breweries ask for malt of higher quality.
The fast development of the premium segment will increase the demand for high quality malt.

The awareness of different malting barley varieties is not decisive amongst Chinese breweries. They do not have a distinct preference in malting barley varieties. Currently breweries do not dictate the malting barley varieties to the maltsters (FUNG 2006). Usually, Chinese breweries do not distinguish malting barley by variety but rather by origin. For this reason, Chinese maltsters are often the link between the Chinese breweries and the market of malting barley varieties (SHI 2006).

Historically, malt imports play a minor role. Before China’s WTO accession in 2001, import taxes on malt were prohibitively high (30 percent) and it was more profitable to import malting barley (3 percent import tax) than malt (MAJOR 2001: 3). Under this border protection regime, the Chinese malting industry developed very well and seems to be competitive on the world market today. Therefore, no great changes in malt imports need to be expected after the reduction of the border protection (currently 10 percent import tax) (NOVELLI 2001: 3).

2.2 The Chinese Malt Industry

2.2.1 Market Development

In the beginning of the 1980s, Chinese malting capacities did not keep up with the pace of the development of the beer production capacities. Many breweries faced raw material scarcities. Hence, many breweries built up own malting capacities not far away from their brewing facility (LI 2006). The growing brewing industry drove the demand for malt from 800,000 t in 1990 up to 2.7 mln t in 2000 (Major 2001: 3). Not until the mid 1990s, did the Chinese malt production capacities meet the malt demand of the breweries. Now their malt supply even overshoots the breweries’ demand. The aggregate Chinese malting capacities of 200 maltsters counted 4.3 mln t in 2004, which means an overcapacity of 30 percent in the same year (WANG 2005: 3). China’s recent malt industry is characterised by poor margins, permanent plant closures and acquisitions as well as expansion of capacities (ibid: 3).

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1 The dictation of malting barley varieties is common in other countries of the world. Breweries create a positive list of malting barley varieties which they are able to use for their brewing process. A variety that can make it to be on the list is called “homolog.” If a variety cannot make it onto the list of a brewery, it will usually be very difficult for the breeder to market such a variety as malting barley (HARTMANN 2006).
2.2.2 Economic Actors in the Malt Market

The structure of the Chinese malt production is very heterogeneous and permanently changing. Today’s economic actors can be categorized into four groups: brewery owned malting facilities, small maltsters, medium sized maltster companies and big malting conglomerates.

Brewery owned and small maltsters with less than 10,000 t annual production capacity are often located near the brewery they are supposed to serve. Sometimes this is far away from the important malting barley origins in China or from the import harbours. Medium sized maltster companies (30,000-80,000t) are mostly situated near the Chinese malting barley production sites. One outstanding maltster with an annual production capacity of 200,000 t in the production region of the Heilongjiang province should be especially mentioned. The two state owned big malting conglomerates (640,000 and 700,000t annual production capacity) run amongst others big malting facilities near the import harbours for malting barley.

The weighting of the economic actor categories has changed over the years of consolidation. The number of brewery owned and small maltsters has shrunk in recent years. The number of small maltsters decreased by 150 between the years 2000 and 2003. In 2003, China had 93 small malting facilities. By contrast, medium sized and big malsters have increased their production capacity during the last years. Recently, medium sized malsters increased their production capacity in the malting barley production regions. In 2003, 24 malting plants were under construction (WANG 2005: 3). The big malting conglomerates invest in their production capacities as well. In 2006, accumulated additional production capacity of 300,000t is under construction in coastal China (DONG 2006 and FUNG 2006).

The technical malting equipment differs greatly between the four categories. It is a long-range from technically obsolete facilities without cooling capacities (mostly of small malsters) up to the state-of-the-art tower malting facilities of the big malting conglomerates and the formerly mentioned maltster in the Heilongjiang province. Li (2006) estimates that Chinese commercial malsters produce about 80 percent of Chinese malt supply; brewery owned malsters still produce the remaining 20 percent. Whereas small and medium sized breweries have mostly closed down their malting facilities, big breweries still run their malting plants.
### 2.2.3 Malt Distribution

The major players in the malt production from Chinese malting barley are the malting plants in the malting barley production regions. In contrast, breweries are located near their beer consumers. On account of this, medium sized and big malsters distribute their products nationwide in China. For example, 90 percent of the malt produced in the Gansu province is transported to eastern China and it is used amongst others in the brewery plants of Yanjing Brewery Co. Ltd. in Beijing and of Tsingtao Brewery Co. Ltd. in Qingdao (WANG 2006a).

### 2.2.4 Use of Raw Materials

According to YANG (2006), Chinese breweries use about 10 kg malt per hl beer on average. At an annual beer production of 320mln hl, this sums up to an annual malt demand of 3.2mln t. For the production of this amount of malt, malsters need to use 4 mln t malting barley in their production process. Malting barley can either be originated from Chinese malting barley production regions or can be imported from other countries. Both possibilities have their individual advantages regarding price and quality (MAJOR 2001: 5):

*Chinese Malting Barley*

Compared to import barley, Chinese malting barley suffers quality disadvantages. These disadvantages are based on its biological properties, the agricultural production systems and structures as well as the procurement systems.

For local malsters in the Chinese malting barley production regions, domestically produced malting barley is the only raw material that is available on an economically reasonable basis because import harbours are far away and transportation costs are high. Most of the small and medium sized malsters in the malting barley production regions are more or less bound to the local malting barley production. Given a low supply of local malting barley, it may happen that low quality barley is used for the malting process. The generated low quality malt might still find good low price marketing opportunities at local breweries which use it for the production of low quality mass beer. (WANG 2005: 3).

Malsters who are located near the coast mostly use imported malting barley for their production process. Their interest in domestic malting barley depends on the price difference between domestic price and world market price. If the difference is big
enough, the demand for the domestic malting barley with a generally lower quality increases (Li 2006). In 2006, 1.9mln ts of domestic malting barley are expected to be processed in the Chinese malt production (Fung 2006).

Imported Malting Barley

Although Chinese malting barley production increased significantly during the 1980s, the domestic malting barley supply could not meet the domestic demand anymore. China began to import malting barley during the 1980s. Today, 2mln t of malting barley flow into China. This amount equals 40 percent of worldwide malting barley trade (without intra-EU-trade) China is the largest importer of malting barley in the world (Lütje 2004: 9).

The import malting barley mainly comes from the two largest malting barley-exporting countries in the world, Australia and Canada. Relatively short seaways and professional marketing activities of the Canadian Wheat Board and the Australian Barley Board support the special position of these two countries (Hartmann 2006). The third largest exporter of malting barley to the Chinese market is Europe. European malting barley usually has a competitive disadvantage in price (high transportation costs and an unfavourable exchange rate). In the discussions it turned out that price differences between the Australian, Canadian or European origins dominate the Malters’ decision to buy or reject (Sun 2006, Dong 2006 and Fung 2006). European malting barley could gain in importance in relation to the Chinese market if there were production shortages in Canada or Australia.

2.3 Procurement and Commercialisation of Chinese Malting Barley

2.3.1 Procurement and Commercialisation Systems

The procurement and commercialisation systems are similar in different production regions of China. Figure 4 shows the system of the Gansu province to be exemplary.
The trading area of a local maltster is a radius of about 100 km. Farmers in the immediate vicinity of the maltster, deliver their malting barley directly.

For longer distances, local traders procure the farmers’ malting barley and transport it afterwards to the maltster. A trader usually acts very regionally. He procures the harvested barley of a village or a small region. After the harvest, the farmer stores the barley on his farm until the trader picks it up. Then, farmer and trader put the malting barley into 50 kg bags and the trader transports it via truck to the maltster, where it is stored in bags or in bulk. A large portion of the harvested barley is procured and sold to malsters directly after the harvest. The maltster is anxious to store most of his raw material himself (MaoGao 2006).

Some traders have a small storehouse. Farmers in the vicinity can deliver directly to these storehouses. These storehouses offer the opportunity to clean the barley before it is bagged. This step might offer price advantages and it provides the possibility to gear the market transactions to market developments.

The farmer, as well as the local maltster, can sell the barley to a supra-regional trader who sells and delivers it via train to the big malsters in eastern China.
Malting barley can be traded in China without any charges and restrictions (FUNG 2006). However, due to high transportation costs, the usual difference in quality between domestic and imported barley hinders the supra-regional barley trade in China. There were years when the low quality Chinese malting barley was more expensive in Chinese production regions than the higher quality international malting barley on the world market (GIRARD 2006). Higher domestic Chinese transportation costs could be the reason for this paradox phenomenon.

The described system is common for malting barley procurement in China. The procurement system of the already mentioned big maltster in the Heilongjiang province is slightly different. This maltster can be compared with the big modern malsters near the import harbours, but in contrast, it processes only domestic malting barley. According to own statements, this maltster procures his raw material with the help of eight agencies. These agencies buy barley from 108 farms. The assumption that these farms are mostly state farms makes sense. State farms (107) are relatively numerous in the Heilongjiang province (Table 1).

### 2.3.2 Cleaning and Storage

Farmers and traders seldom have mechanical equipment to clean the harvested barley. If they have such equipment, it has a low technical standard. In Gansu province, a mechanical cleaning process could be observed: An electrical sling threw the malting barley high up in the air on a pile. The wind separated the barley from the chaff. Workers swept the straw from the pile by hand. Such a cleaning system hardly achieves the result of advanced technical cleaning systems and contributes less to the improvement of the quality.

Storage facilities for malting barley differ strongly in China. They range from storage in silos to open air storage covered by plastic awning. In the north and the north west of China, this simple storage practice is unproblematic because it is cold and dry there during the winter. In the Jiangsu province, in contrast, storage presents difficulties from the outset. During the storage period, which begins at the end of May, the climate is hot and humid in this region (see figure…: climate diagram of Nanking). Storage facilities are often scarce, and cooling and air ventilation systems are seldom. These circumstances may lead to extensive quality losses after the harvest. Only maltsters and big (state) farms are currently able to store malting barley over a long-term period without a great danger of quality losses (Li 2006).
2.4 Agricultural Production of Chinese Malting Barley

2.4.1 Regions of Production

In the following, regions of production will be described. Therefore, the geography will be presented together with the climate conditions and the regions of production of different crops in China. Afterwards the malting barley production regions and amounts are explicitly shown.

Geography

The physical geography of China is manifold. Figure 5 shows a general-geographic map that indicates the relief structure of China. The terrain declines from the Himalaya in the southeast to the eastern part of the country, the Chinese lowlands.

China’s terrain is divided into 43 percent mountains, 26 percent highlands, 19 percent extensive hilly landscape and basins, as well as 12 percent planes and lowlands. Eleven percent of China’s terrain is agricultural land (HAUSER 2004: 14). The agricultural land comprises 122 mln ha – seven times as much as the German agricultural land or half of the Russian agricultural land.

Figure 5: General Geographic Map of China


Climate

Through its size and its geographical position, China has all climate zones. The northeast of China is a cold temperate zone, the north and northwest of China have
temperate climate conditions. Central China and the southwest are subtropical; tropical climate conditions characterize the southeast.

Figure 6 shows the different precipitation zones of China. The inner tropical convergence zone moves far north during the northern hemisphere summer. This leads to monsoon rain during the summer months in the southwest of China. Western regions have semi-arid or full-arid climates. In the north, expected precipitation declines from east to west as well (ZAHN ET AL. 1989: 220).

The red line in figure 6 divides China into climate categories. To the west of this line, agriculture is only possible if it is possible to irrigate the fields. The yellow areas show the deserts of Taklamakan and Gobi. To the east of the red line, precipitation conditions allow intensive agricultural production.

**Figure 6:** Areal distribution of precipitation in China

![Areal distribution of precipitation in China](image)

**Source:** CHINA9 (1983).

Compared to figure 6, the climatic advantageous regions comprise the geographically favourable regions for agricultural production. The centre of Chinese agricultural production lies in this area.

Temperature is another important factor for agricultural production. Figure 7 shows three of the temperature curves for three different regions in China according to WALTER.
Figure 7: Climate diagrams of chosen regions in China


The blue lines in these diagrams affirm the findings of figure 6. The red lines show the temperature pattern. The temperature curve of Harbin, capital of Hailongjiang province in the northeast of China, shows temperatures far below -10° Celsius during the winter period. In this region, summer crops dominate the agricultural production. Milder temperatures in Lanzhou, capital of the Gansu province and in Nanking, capital of Jiangsu provinces offer better conditions for the winter crops.

Production Regions of Agricultural Products in China

Figure 8 shows agricultural production regions in China. Green coloured areas mark the intensity of agricultural production. The sharp border between high and low intensity of agricultural land use is clearly identifiable. The paragraphs above explain this phenomenon.
Recently, the most important crops in China have been rice, wheat and corn (PARKHOMENKO 2004: 163), as well as soybeans and canola. In the north of China wheat, corn and soybeans are predominant. In the south, rice and tea are the most important crops.

From north to south, the intensity of land use declines. The intensity of land use is expressed by the multi cropping index, which is the seeded area divided by the total agricultural land. In the north, there is normally only one harvest per year; in central China, farmers might have three harvests in two years and in the south even more (PARKHOMENKO 2004: 163).

*Regional Distribution and Amount of Barley Production*

The existing statistical data for barley production in China differs strongly amongst different sources. In particular, the data of the Chinese department for agriculture are inconsistent and do not consider all regions (TIAN AND CHUDLEY 1999: 55).
Figure 9: Malting barley production in China


The USDA (2006) has also estimated Chinese barley production. Its scientists documented a downward drift for the barley production area and a barley output fluctuating around 3mln t for eight years. Figure 9 pictures these findings. The significant reduction of the barley production volume of the marketing year 1998/1999 is due, amongst other things, to a sharp increase of corn production and the accompanied reduction of the barley production area.

Market expert GIRARD (2006) characterizes China’s barley production as a fluctuating position in a range of 1.6 mln to 4.5 mln t. He expects the same annual fluctuation for the barley that meets the requirements of the processing channel. Because of these irregularities, Chinese malting barley production might range between 800,000 t and 1.9 to 2.0 mln t. Like many other market experts, Fung (2006) estimates Chinese malting barley production at 1.9 to 2.0 mln t.

Due to its short growth period and high adaptability to different conditions for growth, barley can be easily integrated into the different crop rotations, which vary for climatic and economic reasons (TIAN AND CHUDLEIGH 1999: 54). Especially in crop rotations in which barley is the secondary crop, barley might have advantages over its „alternative wheat“ because it can be harvested earlier and thus prolong the growing period of the main crop by ten to twelve days. Hence, barley production has a high potential for a wide proliferation in China.
Unfortunately, official Chinese statistics on barley production distinguished by region do not exist. By means of expert interviews (LÜTJE (2006) and WREE (2006)), Chinese barley production could be narrowed down to main production regions that conform to the estimate of WANG (2006a).

Barley is farmed in nearly every province in China. It belongs to the crops of minor importance in the crop rotation in every region, but its relevance differs amongst regions. Nevertheless, some barley production regions stand out. These regions are shown in figure 10.

**Figure 10:** Malting barley production regions in China

![Malting barley production regions in China](source)

**Source:** Own preparation according to Wang (2006a).

1. Jiangsu and Zhejiang Province

This is the oldest production region for malting barley in China. Traditionally, animal production was part of the agricultural production system of this region. Barley production delivered an important feeding stuff. While other feedstuffs replaced barley, the brewing industry grew and increased its demand for malting barley. Jiangsu and Zhejiang were the two first provinces that switched to malting barley production and became an important production region (TIAN AND CHUDLEIGH 1999: 57). For the year 2006, DONG (2006) estimates malting barley production could reach 500,000 t in
this region. As there are many breweries and malsters in this region the region’s current account for malting barley is in deficit.

2. Gansu and Xinjiang Province

At the time the government recognized the increasing demand for malting barley, it implemented support programs for malting barley production in the northwest and the northeast of China. DONG (2006) estimates the production of this region might reach 1.05 mln t in 2006, whereas the Gansu province produces 700,000 t and Xinjiang province supplies 350,000 t.

3. Heilongjiang Province and Inner Mongolia

Similar to the Gansu province malting barley production experienced strong support by the government. To some extent, large agricultural business organizations provide structures, which assure sizable and uniform barley output. This kind of output facilitates processing for malsters and breweries. DONG (2006) puts the production in the Heilongjiang province to 200,000 t, the production of Inner Mongolia to 400,000 t in 2006. Barley production of Inner Mongolia delivers a higher output by volume, but its production is not as concentrated as in the Heilongjiang province, coloured red in the figure 10.

Furthermore, WANG (2005: 3) mentions two smaller production regions for malting barley in central China and in the southwest province Yunnan. Production output by volume in the Yunnan province might reach 150,000 t in 2006 (DONG 2006).

Barley Quality of different Production Regions

Barley quality forming depends strongly on the weather. In addition, the crop output is influenced by the weather. As long as there is sufficient water supply, crop output correlates positively with the length of the growth period and the duration of sunshine (TIAN AND CHUDLEIGH 1999: 55).

In order to identify the most favourable regions by climate for malting barley production, coastal and southern areas become less important. High temperatures and heavy monsoon precipitation characterize their climate during the harvesting season. This leads to quality deterioration through mildew, dark discolouration and lower germination capacities (ibid: 55). Thus, the natural growing conditions in the northern and western regions are more appropriate to producing malting barley of higher quality.
Today, Gansu province is the most important supplier for higher Chinese malting barley quality (Dong 2006).

### 2.4.2 Production Structures in Chinese Agriculture

With his proclamation of the People’s Republic of China, Mao Zedong terminated a long history of wars on Chinese terrain since 1851. A land reform followed which distributed the usable agricultural area to (former) military troops, and to the largest extent, to millions of fundless farmers (Hauser 2004: 54, Bayi State Farm 2006).

Several months later, the government combined the farmers into large agricultural cooperatives and centralised the agricultural commodity market. Mismanagement and famine characterized the following years. Mao Zedong initiated the campaign “Great Leap Forward” to overcome these big difficulties. He aimed to increase agricultural output by 45 percent over the following 15 years. In course of this aim, the government reorganised the agricultural cooperatives to people’s enterprises (Hauser 2004: 55-56).

However, not until Deng Xiaoping accomplished his reform agenda beginning in 1978 did the situation change significantly. His reform policies changed the agricultural production structures. Carefully, a system of private responsibility took the place of agricultural people’s enterprises. Farmers received agricultural land for private agricultural production from the government. Gradual privatisation increased agricultural output extensively (ibid: 55).

Tian and Chudleigh (1999: 57-58) showed that two agricultural production systems coexist in China today:

1. **Production in Family Farms**

This type of production system is dominant in China. According to estimates by the OECD (2005: 36-37) 200 mln agricultural family farms exist in China. On average, they farm 0.65 ha of agricultural land. The sizes of these farms vary heavily amongst regions. Generally households in sparsely populated areas in the north have more agricultural land per household (Heilongjiang Province: 2.5ha per household on average) than households in densely populated areas in eastern and central China (Zhejiang Province: 0.2 ha per household on average).

Members of the household execute the farm work. If at all, wageworkers are hired only for seasonal work. Farmers farm different crops to meet a subsistence level for
family use or to offer them for sale. Frequently some parts of the crop output serve in animal production. For these reasons, the amounts offered for sale are normally very small. Furthermore, malting barley quality is at risk because small-scale farmers seldom possess the technical equipment needed for a harvest at the proper time and for adequate storage.

Among other things, these factors present difficulties to malsters, as it is hard to find sufficiently large-sized batches of barley of uniform quality for processing.

2. Production in State owned Enterprises

State farms exist in China since 1967 and are distributed over the whole nation. Especially in northern China, this form of production is relatively frequent (Table 1). Former military troops founded the state farms and managed them in a military style. Chinese defence policy aimed to employ soldiers during peacetime but also to have a standby defence against feared Russian attacks at the northern Chinese border. When the fear of Russian attacks declined, the necessity of such military troops vanished. The reform agenda of Deng Xiaoping began to restructure the military farms into civil farms and was followed by gradual privatisation. The privatisation process proceeds slowly and, like in other sectors of the Chinese economy, it has still not been accomplished (PUHUA 2006a).

According to Li C.W. (2006), three privatization alternatives exist that have different impacts on today’s farm organization:

a. Divestiture of a State Farm

This alternative calls for the liquidation of the machines of a state farm to its workers. Moreover, land property is unhinged, given to the municipality and allocated to local farming household either for lease or unpaid.

b. Conservation of a State Farm without Machines

A state farm sells its machines to its workers but it keeps its land property. The management board of the state farm makes all subsequent agricultural decisions, but it commissions the new self-employed machinery owners to do the mechanical field-work for negotiated prices. Normally, the state farm still employs large amounts of workers who do the hand work in the fields.

Another variation of this alternative is the following: the state farm management leases its land property annually to local farmers and controls nothing but the crop
rotation. The leasing farmer decides on all other agricultural production issues like fertilisation, pest management, etc. The leasing farmers commission private contractors to do the mechanical fieldwork. These contractors mostly have relatively small machines.

c. Conservation of a State Farm with Mechanical Equipment

A state farm keeps its mechanical equipment and manages the crop rotation and the soil cultivation. The state farm leases its land property, fully prepared for seeding, to local farmers on an annual basis. For example, if the farm management plans to cultivate malting barley on a 100 ha sized field, a local farmer interested in farming malting barley can lease that field. Seldom can a single farmer afford to lease such a big field. Therefore, other farmers can lease the rest of the field. As the field is worked as a single unit, leasing farmers must agree upon the agricultural work that will be assigned to the state farm management and their machines afterwards. The economies of scale (effective mechanical equipment, large field size) can be maintained. The leasing farmers usually do the handwork by themselves or they hire seasonal workers.

Table 1: State farms of selected Provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Usable agricultural area farmed by state farms (1,000 ha)</th>
<th>State farms share in agricultural land use (Approximation, in percent)</th>
<th>Number of state farms</th>
<th>Average size of state farms in ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Total</td>
<td>4690.03</td>
<td>3.61</td>
<td>1967</td>
<td>2384</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>2025.95</td>
<td>17.21</td>
<td>107</td>
<td>18,934</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>1212.52</td>
<td>30.42</td>
<td>354</td>
<td>3,325</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>348.12</td>
<td>6.68</td>
<td>104</td>
<td>5,270</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>64.93</td>
<td>1.28</td>
<td>24</td>
<td>2,705</td>
</tr>
<tr>
<td>Gansu</td>
<td>44.28</td>
<td>0.88</td>
<td>17</td>
<td>2,605</td>
</tr>
<tr>
<td>Yunnan</td>
<td>17.33</td>
<td>0.19</td>
<td>47</td>
<td>262</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>4.97</td>
<td>0.23</td>
<td>62</td>
<td>80</td>
</tr>
</tbody>
</table>


Table 1 shows available data on Chinese state farms in selected regions. The data of usable agricultural area farmed by state farm and the numbers of state farms come from the STATE FARM STATISTICAL YEARBOOK 2004. The data on total usable agricultural land by region used for the calculation of the state farm share in total agricultural land use is taken from the NATIONAL STATISTICAL YEARBOOK 2005, which contains consistent data only up to the year 1996. According to the AGRICULTURAL STATISTICAL YEARBOOK 2005, the usable agricultural land of China declined by 8 mln ha
since 1996 (PUHUA 2006b). Hence, percentual shares in agricultural land use are only approximate. The real percentual shares of state farms in the agricultural land use of a province might be slightly underestimated.

Table 1 shows the concentration of state farms in the northernmost provinces Heilongjiang, Inner Mongolia and Xinjiang and the relatively high share of state farms in the use of agricultural land. GIRARD (2006) estimates that state farms produce a large part of the Chinese malting barley supply. This is especially conjecturable in those regions where the state farms’ share in agricultural land use is high, i.e., Xinjiang and Heilongjiang province.

State farms are subordinated either centrally to the state government or decentrally to the local administrations. AGRICHLINA (2006: 10) points out that state farms subordinated to the state government receive remarkable technical and financial support and consequently, their equipment is often very modern. Nevertheless, according to TIAN AND CHUDLEIGH (1999: 58), these farms sometimes suffer from mismanagement and inadequate state support. However, they might have some advantages over the small-scale family farms because they

- often have their own research department for testing new crop varieties and for multiplying their own seeds,
- are able to produce and to supply their crops in bulk and in uniform quality due to their field sizes,
- are effective due to their advanced technical equipment and consequently they can reduce the risk of bad weather,
- sometimes have their own marketing department or integrated processing companies securing the overturn of their crops.

2.4.3 Production Cost Analysis on the Basis of exemplary Farms

This part analyses the competitiveness of Chinese malting barley production in comparison with alternatives crops and with imported malting barley.

Therefore, the AGRI BENCHMARK approach has been chosen. This approach is used to analyse and to compare sales revenues with production costs of farms all over the world. Furthermore, it can be used to compare alternative crops at one single location. The analysis of the AGRI BENCHMARK approach is based on typical example farms in the focused production region. The production regions and their typical farms need to
be identified in the run-up, visited and interviewed. Afterwards the received data will be analysed (AGRI BENCHMARK 2006: 8).

During the visit to China in September 2006, the Gansu and the Heilongjiang province have been visited. From these production regions, exemplary farms have been developed by interviewing several farmers. In the run-up, research showed that state farms are involved into the malting barley production in China. Hence, state farms were integrated into the analysis. Figures 11 to 14 show the results of the analysis. The appendix contains the tables on which the figures are based (Appendix 2 to 5).

Abbreviations name the selected farms. They contain the location and size of the farms. For example, CNGan0.67Wu describes a 0.67 ha sized farm in Wuwei County of the Gansu province. CNHeil30Youyi denotes a 30 ha sized farm in Youyi County of the Heilongjiang province, etc.

The exemplified farms of the Gansu Province are household farms. CNGan0.67Wu represents small-scale and CNGan13.33Jin large-scale farms. In contrast to CNGan0.67Wu, which produces only malting barley in a monocropping system, CNGan13.33Jin runs a crop rotation, which contains malting barley (8 ha), corn (1.3 ha), wheat (2.7 ha) and sunflowers (1.3 ha).

Except for CNHeil35Xixian, the exemplified farms of the Heilongjiang province are farms that completely lease their land from state farms on an annual basis. CNHeil30Youyi accords to the third privatisation alternative described above. On behalf of the leasing farmer, the state farm management executes all machinery work with its modern equipment. CNHeil60Youyi and CNHeil20Youyi have rented their land from a state farm that does not have its own machinery. Hence, leasing farmers commission the mechanical fieldwork to private contractors. CNHeil35Xixian is a private farm, which has both from the municipality allocated land and leased land from a state farm. For the most part this farmer runs his own machines and occupies seasonal workers.

CNHeil30Youyi plants malting barley (5 ha), corn (10 ha), and soybeans (15 ha). CNHeil60Youyi plants malting barley (40 ha) and soybeans (20 ha), CNHeil20Youyi grows soybeans (20 ha). CNHeil35Xixian cultivates corn (33 ha) and soybeans (2 ha).

To analyse the relative competitiveness of different crops, data is shown on a per-ha-basis. Figure 11 shows the direct costs occurring in the exemplified farms for different crops.
Direct costs are expenses for seeds, plant protection and fertilization. Figure 11 reveals that malting barley is not a low input crop in China like it is in European countries. In the Heilongjiang province, intra-farm cost comparison of CNHeil60Youyi and CNHeil30Youyi yields that especially soybeans can be produced with much lower variable input than malting barley. In the Gansu province, direct costs roughly equal among the crops. Only corn generates slightly lower costs at CNGan13.33Jin farm.

The inter-regional comparison of malting barley production between the Gansu and the Heilongjiang province shows eye-catching differences. Factor price and application rate determine the level of the direct costs. Both vary strongly amongst the exemplified farms.

The difference between regions in the use of seeds and fertilizer by volume is especially noticeable. The sowing densities ranges from 200kg/ha (CNHeil30Youyi) to 375 kg/ha (CNGan13.33Jin) and exceed by far the common seed densities of Germany for example (LWK HANNOVER 2001: 30). Expenses for seeds range from 2.2 RMB/t (CNGan13.33Jin) to 3.6 RMB/t (CNHeil30Youyi). Regarding fertilizer expenses, the level of fertilizer use cause big differences between farms. Fertilizer use
ranges from 68.5 kgN/ha (CNHeil30Youyi) to 138.75 kgN/ha (CNGan13.33Jin). Thus fertilizer use is in the range of fertilizer use recommended by German plant management consultants for the German production regions (LWK HANNOVER 2001: 38a-d). Different crop outputs legitimate differences in the level of fertilizer use. On the farms of the Heilongjiang province however, fertilizer use does not correspond to the low crop output. Prices for the mostly used nitrogen fertilizer “Urean” vary only slightly between 3.69RMB/kg N (CNHeil30Youyi) and 3.91RMB/kg N (CNHeil60Youyi). All analysed farms use additional multicomponent fertilizer.

**Figure 12:** Operating Costs for alternative Crops

![Operating Costs for alternative Crops](image)

Source: Own presentation.

Figure 12 shows the operating costs\(^2\) for malting barley and their alternative crops on a per ha basis. The intra-farm (CNGan13.33Jin, CNHeil30 and CNHeil60Youyi) comparison of total operating costs for alternative crops shows that there are only small differences in operating costs. However, the internal structures of the operating costs differ. For example, CNGan13.33Jin commissions malting barley and wheat harvest to contractors, which increases his variable machinery costs for these crops.

\(^2\) According to the AGRI BENCHMARK approach, operating costs include variable machinery costs (including contractor costs), energy and irrigation costs, depreciations for machinery and buildings, expenses for hired labor and opportunity costs for family labour as well as insurances (AGRI BENCHMARK 2006: 18).
The same farm harvests its corn and sunflowers, which lowers its variable machinery costs for these crops and increases hired labour and family work opportunity costs.

Economies of scale lower the operating costs of CNGan13.33Jin in comparison with CNGan0.67Wu. In total, machinery and building depreciations of CNGan13.33Jin are twice as high as of CNGan0.67Wu. By dividing these higher depreciation costs by a larger area, these costs become less important on a basis per ha. The same is true for farms which commission the fieldwork to contractors. Large fields of state farms allow big machines to come into operation. Therewith the operation costs per ha decline.

In a comparison of production regions, relatively high energy and irrigation costs of the Gansu province attract attention. Lower precipitation rates in Gansu province (Figures ...5 und ...6) explain these phenomena. Furthermore, these energy and irrigation costs include fuel costs. As fieldwork at the leasing farms (CNHeil30Youyi, CNHeil60Youyi and CNHeil20Youyi) is totally commissioned to contractors, these farms neither show energy nor depreciation costs. On these farms, energy and depreciation costs are included into the variable machinery costs, which are the contractor costs. Whether the paid contractor cost represent the real operating costs, cannot be stated with ultimate certainty. Especially state farms with modern technology acting as contractors might be showcases of the Chinese government and therewith due to financial support be able to work at lower than the real operating costs.

Figure 13 clarifies the total costs and market revenues of alternative crops on a per ha basis. Total costs include: direct costs, machinery and building costs (depreciation and maintenance), labour costs (paid wages and opportunity costs for family labour), interest cost (paid interest and opportunity cost for invested own capital), land costs (paid land rent and contingent opportunity costs for land allocated by the municipality if a legal possibility exists to rent the land to other farmers) and overheads (IFCN 2005: 26). Market revenues are derived from the crop output per ha multiplied by the sale price. Total revenue is the sum of market revenue and governmental financial subvention. The difference between total revenue and total costs is the farm profit (see Appendix 3).
Figure 13: Total Costs and Market Revenues for Alternative Crops

Source: Own presentation.

Total costs presented in figure 13 do not afford surprises. They are derived from direct costs and operating costs shown before extended by land costs and opportunity costs for invested own capital.

The revenues of these exemplified farms are in surprising contrast. They differ strongly, as, consequently, do the profits per ha. Farmers of the Gansu province put their malting barley output per ha very high to 7.5 t/ha (CNGan0.67Wu) or 7.95 t/ha (CNGan13.33Jin). Their crop outputs exceed Gansu average malting barley output (6.75 t/ha) by approximately 0.75-1.2 t/ha (WANG 2006a) as well as malting barley output of the investigated farms in the Heilongjiang province by 3-3.5 t/ha. Furthermore, CNGan13.33Jin declared having a very high market revenue per ton (1 660RMB/t). This farmer also indicated relatively high prices and outputs for other crops. Although the level of output of the Gansu province might be higher than in the Heilongjiang province, the indicated outputs of the Gansu province farmers seem to be slightly too high and should be reduced for the inter-farm comparison.

As CNGan13.33Jin sets all outputs and prices at a high level, these breaks lose in importance for the intra-farm analysis of relative advantages of certain crops. All investigated farms have in common that profits from malting barley production are
marginally lower than profits from alternative crops. Intra-farm analysis shows that especially corn and soybean production seem to be competitive.

**Figure 14:** Total Costs and Revenues in comparison with the World Market Price

![Figure 14: Total Costs and Revenues in comparison with the World Market Price](image)

**Source:** Own presentation.

Figure 14 shows total production costs per t malting barley, the received market price per t and the estimated world market price (CIF Guangzhou, China) in September 2006. Aiming to analyse the per t competitiveness of Chinese malting barley production against the world market supply the diagram concentrates on investigated farms, which crop malting barley.

Displayed total costs include the same figures like figure 13 They are composed of opportunity costs, depreciation costs and cash costs (*AGRI BENCHMARK* 2006: 24).

Compared to figure 13 production costs per t have adjusted in figure 14 between regions. Analysing on a per t basis, high yields relativise high total production costs in the Gansu province. If production costs of the Gansu farms were calculated with the average Gansu province malting barley output total production costs increase to 1.413 RMB/t (CNGan0.67Wu) and 1.104 RMB/t (CNGan13.33Jin) respectively.

The denoted world market malting barley price (CIF Guangzhou, China) is derived from the estimated world market malting barley price in Australia in September 2006 (approx. 1,300 RMB/t) plus freight costs (approx. 300 RMB/t) from Australia to Guangzhou in China. It should be mentioned that the world market price for malting
barley fluctuated strongly during the last years (Lütje 2006). Thus, this estimated snapshot of the world market price serves as a rough guess.

The production costs of the exemplified farms lie below the world market price for imported barley at the Chinese coast. Chinese production seems to be competitive. Costs are added for the transportation of malting barley from the Chinese production regions to coastal malsters (200-300 RMB/t and 400-600 RMB/t if there is no back freight) who have direct connection to import harbours, the Chinese malting barley competitiveness decreases on the one hand. On the other hand, high transportation costs improve the competitiveness of Chinese malting barley in the Chinese production regions.

Although Chinese malting barley production might be competitive regarding the production costs when world market prices are high, the reader should bear in mind that the Chinese malting barley suffers from quality disadvantages, among other things due to production management. For instance, intensive nitrogen fertilisation causes high protein contents being undesired by the processors. Chinese malting barley’s protein contents often reach up to 13 percent and therewith surpass common protein contents of malting barley on international markets (up to 12.5 percent, especially Europe: 10.5 to 11.5 percent). Thus, coastal malsters tend to prefer international malting barley to a certain extent even though the Chinese malting barley price was lower.

### 2.4.4 Perspectives of Malting Barley Production in China

From a technical point of view, Chinese malting barley production could be expanded easily. Chinese malting barley production seems to be price elastic; hence, rising prices would induce an increase in malting barley supply (Tian and Chudleigh 1999: 59). The Chinese government established additional programs during the 1990s in order to increase malting barley production and processing in the northernmost provinces and to decrease malting barley import dependence on other countries.

These programs had great influence on the development of today’s important malting barley production regions in China. However, certain difficulties hindered and hinder the effective implementation of these programs and the expansion of malting barley production in China.

During the first years after the establishment of these programs, price relations between barley and alternative crops fluctuated strongly because of market liberalisa-
tions and further state subsidies. Malting barley tended to decline in its relative value. For this reason, producers prefer main crops (corn, soybeans, wheat and rice) and malting barley is left for less fertile soil and to colder mountain regions (Slafer et al. 2002: 10, Tian and Chudleigh 1999: 67-68).

Furthermore, malting barley is a relatively new crop to many farmers in China. This makes it difficult for farmers to achieve a competitive output because they do not have as much experience with the production of malting barley as they have for alternative crops. Over-fertilisation and inappropriate seed densities often result in a low quality performance (Wang 2006b).

Additionally, in a more global perspective, China will be much more dependent on agricultural imports in the medium run. In the meantime, the Chinese government puts its agricultural priorities on the assurance of food supply. Corn and soybean production are in the centre of political interest (Girard 2006).

Bottlenecks in the Chinese energy supply lead to political interference on agricultural production. With a strong rising tendency, 3.5mln t of corn annually flow into the production of bio ethanol (Girard 2006).

2.5 Chinese Malting Barley Breeding and Seed Multiplication

2.5.1 Actors of the Breeding Industry

Chinese malting barley breeding was established in the beginning of the 1980s during the reforms of Deng Xiaoping. From the outset until today, the Chinese state subordinates malting barley breeding to its administration, not by law but by its practical execution.

Integrated in state-owned seed enterprises, research institutes breed malting barley (Figure 15). At present, four Chinese research institutes do research on malting barley breeding. One research institute has facilities in every described malting barley production region in order to breed locally adapted varieties. In 2005, a fourth institute commenced operations in the southwest Yunnan province to promote malting barley production in this region (Wang 2006b).

Although private breeding is legal and desired in China (People's Republic of China 2001: Article 11), it would face hard economic times if it were to exist. Under the former legal situation, breeders could not achieve enough of the important revenue from barley breeding in China. The recent legal situation covers plant breeder’s rights
but it still is very young and an effective system that rewards plant breeders for their efforts waits to be established and to be executed. At present, the Chinese state’s budget bears the costs when research institutes’ expenses exceed their revenues and when other branches of the seed enterprise cannot meet those research institutes’ budget gaps (WANG 2006b).

2.5.2 Chinese Malting Barley Varieties and their Characteristics

Gansu Province

Summer malting barley varieties (Ganpi 3 and Ganpi 4) dominate the malting barley production in the Gansu province. In absolute altitudes around 2000 m, the relative Ganpi 5 comes into operation. This is a young summer malting barley variety, which is characterised by a relatively short growth period (WANG 2006a). The breeding of these two-row malting barley varieties is based on the Hungarian malting barley variety “Favorit” and Mexican varieties from the 1980s. According to their breeder (WANG 2006b), these varieties have certain agronomical advantages: They were extremely steadfast, resistant to diseases and they delivered a high yield. Furthermore, they produced the highest quality of Chinese malting barley.

Heilongjiang Province

The dominant variety in this region is the six-row summer malting barley Kenpi 2. It represents 75 to 80 percent of the annual malting barley production. The two-row summer malting barley varieties Kenpi 3, Kenpi 7 and Kenpi 8 share 20 to 25 percent of the malting barley production in the Heilongjiang province (Li C.W. 2006).

Jiangsu Province

Malting barley varieties of the Jiangsu province could not be investigated during the research trip in September 2006. According to DONG (2006), former Japanese winter malting barley varieties Gang 1 and Gang 2 dominate the malting barley production.

From a quality perspective, all Chinese varieties have weaknesses compared to international varieties. According to WANG (2006b), the thousand-kernel weight is low and the glumes are too thick. HARTMANN (2006) and LI (2006) found these weaknesses on the comparatively small and old gene pool. The breeders breeding material is often older than 25 years of age; the breeding programs themselves are never older than 25 years. Consequently, new varieties are created from a few basic varieties and the potential of innovation is small. WANG (2006b) emphasizes that for many years
agricultural interests were in the centre of the breeders’ interests. Not until recent years did breeders pay more attention to quality aspects of barley breeding.

2.5.3 Seed Multiplication and Seed Marketing

The organisation of the seed multiplication and seed marketing is comparable amongst provinces, although there are differences in their historical structure development.

Figure 15 shows the organisation of seed multiplication and seed marketing of the Gansu province breeder. In the following the organisation will be explained before turning towards the differences against another marketing organisation.

**Figure 15:** Organisation of Seed production in the Gansu province

Source: Own presentation.

The state owned seed enterprise of the Gansu province is an integrated company for seed production. It includes a research institute, a marketing body and a multiplicity of farms reaching a size of approximately 600 ha.
Besides the development of special fertilisers for malting barley production, the research institute breeds new malting barley varieties, the maintenance breeding and the production of foundation seed. The multiplication farms, which rent their land to private farmers, use the foundation seed, produce register seed and deliver it back to the marketing body. Approximately 86 percent of the register seed leaves the seed enterprise after suitable preparation; the seed enterprise uses only 14 percent for its own certified seed production. The seed enterprise realizes a higher price when it sells registered seed compared to selling certified seed. However, the price difference is only approximately 100 to 200 RMB/t (10 to 20Euro/t). The marketing of malting barley seeds is limited in volume. Excess supply is sold as certified seed to small-scale farmers (CHEN 2006).

The sale of legally unprotected register seed and the sale of certified seed are the only possibilities for the seed enterprise to gain revenues from the seed sector. After selling such seeds, the seed enterprise loses its intellectual property rights regarding these varieties.

Relatively large farmers, state owned farms as well as local malting barley processors buy the registered seeds. They produce certified seed and sell it independently to malting barley farmers. Estimated market shares (CHEN 2006) of these actors in the barley seeds market are denoted in figure 15.

In Gansu province, malting barley farmers produce 60 percent of their needed seeds themselves. These seeds are often used in the fifth or sixth generation. These reproduction seeds are produced on the own farms or farmers exchange them among themselves, believing that physical output improves. According to WANG (2006b), the exchange of seeds is comparable to gambling. It may have a positive result if the exchanging farmer receives material that is younger than the material he gave away.

In general, the organisation of the seed enterprise in the Heilongjiang province is similar but the historical background is slightly different. This seed enterprise developed in a state farm where agricultural land was abundant. This seed enterprise has 20,000 ha at its disposal for seed production. The outcome of this is the possibility of integrating the production of certified seed completely into the seed enterprise. The production of certified seed takes place at company owned fields that are rented to farmers who agreed to produce the seeds. In contrast to the seed enterprise of the

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3 Besides malting barley, this enterprise produces soybean, corn, summer wheat, sugar beet and watermelon seeds (Li C.W. 2006).
Gansu province, malting barley seed only leaves the enterprise of the Heilongjiang province as certified seeds (Li C.W. 2006).

3 COMPETITIVENESS OF CHINESE MALTING BARLEY PRODUCTS

The preceding chapters broached the issue of competition between Chinese malting barley and imported malting barley. While the Chinese beer industry purchases its raw material “malt” nearly exclusively from Chinese malsters, Chinese malting barley is directly exposed to competition from import barley at the coastal malsters. At inner country malting sites, a situation of competition arises indirectly from the comparison of the Chinese malting barley malt with the import malting barley malt at the breweries. In the inner Chinese production regions, an isolated intrasystem value chain of breeders, agricultural producers and local processors emerges from the poor availability of import malting barley. In the long run, especially, this pure Chinese supply chain should find competitive strategies to persist against international malting barley imports.

Characteristic of the Branch

In general, malting barley and malt are mass products. Different varieties can be distinguished, but in processing varieties are exchangeable within certain parameters. Recently, the adherence to parameters seems to be of secondary importance to many Chinese breweries. With development of the quality beer market segment in the long run, the malt demand might move significantly to high quality malt. Then, the sale of low quality malt derived from low quality malting barley would be increasingly difficult.

Branch Position and Competitive Strategy

From a quality perspective, Chinese malting barley and therewith the pure Chinese malting barley supply chain ranks behind the international malting barley supply. Distinguished by their quality characteristics, the sale of Chinese malting barley and its products cannot be pushed successfully. Therefore, the price is the crucial factor for its demand. It should be the strategic aim to produce Chinese malting barley and its malt products as cheaply as possible and to contemporaneously improve its quality characteristics to catch up with international quality standards.

Measures to Secure or to Improve the Branch Position
Reducing the farm-level production costs per t can generally be achieved by reducing factor input at same level of output or by increasing the output with constant factor input. Factor input can be reduced by reducing direct costs or by reducing operating costs. To reduce direct costs farmers should reconsider seed densities and the intensity of fertiliser input. The operating costs are amongst others closely linked to the size of the farm production structures. At present, the on average small production structures of Chinese agriculture are not changeable for political reasons. Exemplary farms, renting the land from state farms, achieve relatively low output. If these farms could increase their crop output, production costs per t malting barley could, especially on these farms, decline and their economies of scale would be more obvious.

To catch up with international quality a multi-plane approach should be chosen. The malting barley breeders should breed varieties that can keep up with international barley varieties in all parameters. Therefore, the Chinese malting barley gene pool is too old. For significant improvements, Chinese breeders depend on international gene pool resources. As breeding is a long process, the international exchange is pressed for time. International conglomerates like Anheuser-Busch Companies, Inc., and Carlsberg A/S are vertically diversified companies, which to some extent use their own malting barley varieties for their beer brands. From their activities on the Chinese market, Chinese malting barley breeders and the whole supply chain could obtain new impulses.

According to Wang (2006b), quality problems do not only rest in genetic weaknesses of Chinese malting barley. They also lay in the production and the processing of malting barley in China. Small farm structures and different procedures of malting barley farmers yield heterogeneous malting barley quality output. This heterogeneity of barley quality not only presents obstacles to processors but also has a negative influence on the malt quality later on (MaoGao 2006). In the forefront of the processing, inappropriate storage entails quality deterioration.

The citation “The supply chain is not a chain at the moment” (Li 2006) describes the recent situation of the pure Chinese value chain. The present organisation of the supply chain transactions has economic grounds. However, quality problems, which have their causes in the production and processing management, could eventually be diminished by an intensified link-up of single entities of the pure Chinese supply chain. The master thesis, on which this excerpt is based, describes these reasons in detail.
chain system. The intensified link-up should include an improvement of the information exchange between the single chain links.

While an information exchange seems to exist between breeders and processors (WANG 2006b), the integration of farmers should be tightened by implementing courses and seminars in malting barley production, by providing information on quality requirements as well as consultation and control of the malting barley production.

WANG (2006b) recognizes an enormous need for action in these fields. At the same time, WANG (2006b) and LI (2006) point out the difficulties in successfully teaching Chinese farmers in barley production and to win them over for an improved quality production. This becomes a particular challenge, when the quality efforts of individual farmers are not remunerated appropriately. Processors might refuse a mark-up for individual farmers because one farmer can seldom improve the quality of a whole batch. Then, a high crop output (intensive nitrogen fertiliser utilisation) maximises his overall farm profit and improved quality (lower protein contents by sweeping nitrogen fertilisation and consequently a lower crop output) is not of his ultimate goal (adverse selection). Hence, LI (2006) recommends the implementation of a quality stimulating bonus-malus-system that pays farmers a notable mark-up for a delivery of high quality malting barley or an individual markdown for a delivery of low quality malting barley, respectively. If such a system was enforced, consequently it could be an adequate instrument to improve the quality awareness of malting barley farmers. However, the enforcement would be expensive and prefinancing would be necessary until such a system would be established, and until processors receive remarkable improvements in malting barley quality and uniformity of batches.
LIST OF LITERATURE

(For the Master Thesis)


Im Internet: http://deposit.ddb.de/cgi-bin/dokservlet?idn=97163887x&dok_var=d1&dok_ext=pdf&filename=97163887x.pdf (15.08.2006).


Im Internet: www.usc.cuhk.edu.hk/webmanager/wkfiles/1284_1_paper.doc (10.08.2006).


Im Internet: http://www.ifcnnetwork.org/03_PL/Inhalt_c product01b.html (20.08.2006).


Im Internet: http://www.ifpri.org/divs/mtid/dp/papers/mssdp41.pdf (03.08.2006).


Im Internet:


Im Internet: http://www.feer.com (25.10.2006).


Im Internet: http://213.253.134.29/oecd/pdfs/browseit/5105101E.PDF (15.08.2006).


Im Internet: www.dbresearch.de (20.11.2006).


Im Internet: http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=1138&ftype=.pdf (02.08.2006).


Im Internet: http://www.dbresearch.de (20.11.2006).


Im Internet: http://www.top-wetter.de/klimadiagramme/asien.htm (10.08.2006).


Im Internet: www.agr.gc.ca/mad-dam/ (20.07.2006).

Im Internet: http://www.kas.de/db_files/dokumente/7_dokument_dok_pdf_8340_1.pdf (12.11.2006).

WIKIMEDIA COMMONS (2005): Topography China.


Im Internet: http://www.who.int/topics/alcohol_drinking/en/ (10.08.2006).


Im Internet: http://www.zmp.de/shop/inhaltsverzeichnis/bigfexChina.pdf (02.11.2006).
APPENDIX

Appendix 1: China and its Provinces

Quelle: www.sacu.org (15.01.2007).
### Appendix 2: Direct Costs for alternative Crops on the exemplified Farms (Data table for Figure 11)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Direct Costs</th>
<th>Wheat</th>
<th>Sunflowers</th>
<th>Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat (RMB/ha)</td>
<td>Sunflowers (RMB/ha)</td>
<td>Soybeans (RMB/ha)</td>
<td></td>
</tr>
<tr>
<td>CN (kg)</td>
<td>CNGan 0.67</td>
<td>CNGan 13.33</td>
<td>CNHeil 30</td>
<td>CNGan 13.33</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>1500.0</td>
<td>1104.0</td>
<td>561.6</td>
<td>591.0</td>
</tr>
<tr>
<td>Seeds</td>
<td>577.5</td>
<td>825.0</td>
<td>828.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Plant Protection</td>
<td>52.5</td>
<td>15.0</td>
<td>630.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Sum Direct Costs (RMB/ha)</td>
<td>2130.0</td>
<td>1944.0</td>
<td>1452.6</td>
<td>1271.0</td>
</tr>
</tbody>
</table>

**Quelle: Own Calculation.**

### Appendix 3: Operating Costs for alternative Crops (Data table for Figure 12)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Operating Costs</th>
<th>Wheat</th>
<th>Sunflowers</th>
<th>Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Costs</td>
<td>Wheat (RMB/ha)</td>
<td>Sunflowers (RMB/ha)</td>
<td>Soybeans (RMB/ha)</td>
</tr>
<tr>
<td>CN (kg)</td>
<td>Variable machinery costs</td>
<td>675.0</td>
<td>902.0</td>
<td>910.0</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>Energy and irrigation costs</td>
<td>1450.0</td>
<td>0.0</td>
<td>1030.7</td>
</tr>
<tr>
<td>Seeds</td>
<td>Depreciation machinery and buildings</td>
<td>1200.0</td>
<td>0.0</td>
<td>1142.0</td>
</tr>
<tr>
<td>Plant Protection</td>
<td>Hired labour</td>
<td>0.0</td>
<td>478.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Sum Operating Costs (RMB/ha)</td>
<td>4494.0</td>
<td>2607.6</td>
<td>1032.5</td>
<td>1031.0</td>
</tr>
</tbody>
</table>

**Variable machinery costs:** all allocated and direct variable machinery costs including custom labour

**Energie- und Bewässerungskosten:** all allocated costs for energy and irrigation

**Depreciation machinery and buildings:** all allocated depreciation for machinery and buildings

**Hired labour:** hired labour that is allocated to the crop

**Family labour:** opportunity costs for family labour that is allocated to the crop

**Insurance:** all insurances bought by the farm.

**Source:** Own Calculation.

### Appendix 4: Total Costs and Market Revenues for alternative Crops (Data table for Figure 13)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Revenue</th>
<th>Wheat (RMB/ha)</th>
<th>Sunflowers (RMB/ha)</th>
<th>Soybeans (RMB/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Revenue</td>
<td>Wheat (RMB/ha)</td>
<td>Sunflowers (RMB/ha)</td>
<td>Soybeans (RMB/ha)</td>
</tr>
<tr>
<td>CN (kg)</td>
<td>Output (t/ha)</td>
<td>7.5</td>
<td>8.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>Price (RMB/t)</td>
<td>1260.0</td>
<td>1660.0</td>
<td>1420.0</td>
</tr>
<tr>
<td>Seeds</td>
<td>Subsidies</td>
<td>228.0</td>
<td>12.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>Total Revenue</td>
<td>9450.0</td>
<td>13197.0</td>
<td>6390.0</td>
</tr>
</tbody>
</table>

**Total Costs**:

- **Direct costs:** all direct costs of the specified crop excluding direct machinery and irrigation costs
- **Machinery and building costs:** Costs of depreciation and maintenance of machinery and buildings including irrigation that are allocated to the specified crop
- **Labour costs:** Wages paid and opportunity costs of family labour
- **Interest costs:** Interest costs of loans taken from the bank and opportunity costs for equity
- **Land costs:** Land rents and opportunity costs for "owned" land, if a land market exists
- **Fixed costs:** the sum of all fixed costs, which are allocated to the production of the crop specified.

**Source:** Own Calculation.

### Appendix 5: Total Costs and Revenues in comparison with the World Market Price (Data table for Figure 16)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Revenue</th>
<th>Wheat (RMB/ha)</th>
<th>Sunflowers (RMB/ha)</th>
<th>Soybeans (RMB/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Revenue</td>
<td>Wheat (RMB/ha)</td>
<td>Sunflowers (RMB/ha)</td>
<td>Soybeans (RMB/ha)</td>
</tr>
<tr>
<td>CN (kg)</td>
<td>Output (t/ha)</td>
<td>7.5</td>
<td>8.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>Price (RMB/t)</td>
<td>1260.0</td>
<td>1660.0</td>
<td>1420.0</td>
</tr>
<tr>
<td>Seeds</td>
<td>Subsidies</td>
<td>228.0</td>
<td>12.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>Total Revenue</td>
<td>9678.0</td>
<td>13209.2</td>
<td>6390.0</td>
</tr>
</tbody>
</table>

**Profit**:

- **Total revenue:** 9678.0
- **Total costs:** 9537.0
- **Profit (RMB/ha):** 141.0

**Direct costs:** All direct costs of the specified crop excluding direct machinery and irrigation costs

**Machinery and building costs:** Costs of depreciation and maintenance of machinery and buildings including irrigation that are allocated to the specified crop

**Labour costs:** Wages paid and opportunity costs of family labour

**Interest costs:** Interest costs of loans taken from the bank and opportunity costs for equity

**Land costs:** Land rents and opportunity costs for "owned" land, if a land market exists

**Fixed costs:** the sum of all fixed costs, which are allocated to the production of the crop specified.

**Source:** Own Calculation.