



# A study of Village Milking Centre in China

by

**Maja-Lena Främling**



*A farmer in Hebei on his way to milk his cow.  
Photographer M-L Främling*



*Interview of a farmer in Hebei.*

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**Institutionen för husdjurens  
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**Swedish University of Agricultural Sciences  
Department of Animal Nutrition and Management**

**Examensarbete 220  
MSc Thesis**

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**Supervisors/Handledare: Kerstin Svennersten-Sjaunja, SLU  
Anders Fagerberg, DeLaval**

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## **Abbreviations**

VMC = Village Milking Centre

MCC = Milk Collecting Centre

TBC = Total Bacterial Count

SCC = Somatic Cell Count

## Sammanfattning

Målet med examensarbetet var att utvärdera konceptet Village Milking Centre (VMC) i Kina för DeLaval. Ett VMC är ett center med mjölknings maskiner och kyltank dit bönderna tar sina kor två eller tre gånger per dag för att få dem mjölkade. Tidigare fanns Milk Collecting Centres (MCC) dit bönderna kunde leverera mjölken efter att de mjölkat korna hemma. Det första VMC't startade för ca tio år sedan och det har varit en snabb utveckling för VMC i Kina. Idag finns det mer än 3 000 VMC'n i Kina.

De senaste 20 åren har mjölkproduktionen i Kina genomgått stora förändringar. Det har gått från stora statsägda mjölkbesättningar till småskaliga privatägda. År 2000 stod de småskaliga bönderna för nära 77 % av det totala antalet mjölkkor. För utvecklingen på den kinesiska landsbygden har mjölkproduktionen en stor roll bland annat för att det ger många arbetstillfällen. Fler och fler bönder satsar på mjölkkor i Kina.

Anledningen till att mjölkproduktionen tagit sådan fart i Kina beror på en medveten politisk satsning bland annat genom att man infört ett "skolmjölk program" där målet är att flera miljoner barn ska kunna dricka mjölk i skolan. Denna satsning beror på att många barn i Kina lider av näringsbrist och studier har visat att mjölk är en god näringskälla för skolbarnen.

Med hjälp av frågeformulär utfördes en intervjustudie. Tillsammans med en tolk och en serviceman från DeLaval besöktes 16 VMC och 16 föreståndare/ägare samt 67 lantbrukare intervjuades. Dessutom besöktes två mejerier och fem DeLaval servicemän intervjuades. Förutom frågeformulären fanns också en "checklista" över vad som skulle studeras på de olika ställena. Mjölksprov togs på alla besökta VMC för analys av antalet somatiska celler i tankmjölken. För dokumentation togs också foton på alla VMC.

VMCna som deltog i studien etablerades mellan 1999 och 2004. Antalet hushåll som hade anslutit sig till ett VMC varierade mellan 20 och 300 med ett medelvärde på 77. Positiva saker som VMC hade fört med sig var att lantbrukarna har fått mindre arbete med produktionen och mer betalt för mjölken. Det är många nya lantbrukare som gett sig in i branschen för att det ger en trygg inkomst samt att det är en investering att ha kor. Positivt för mjölk kvalitén är att mjölken blir kyld direkt.

Eftersom VMC och mjölkproduktionen i Kina fortfarande är i sin barndom finns det flera brister som behöver åtgärdas för att säkerställa mjölk kvalitén om mjölkkonsumtionen ska fortsätta att öka samt för att ge en säker produkt. Det fanns brister i hygien och service på de besökta ställena. Det genomsnittliga celltalet för tankmjölken var 1 455 000/ml vilket tyder på att juverhälsan var väldigt dålig hos de flesta kor.

Det finns stora brister i kunskapen hos alla de parter som hanterar mjölken vilket betyder att utbildningsbehovet är stort. Det var få av föreståndarna/ägarna till VMC'na som hade haft hand om kor själva och de såg det hela som en affärsrörelse där man gjorde allt för att minska på utgifterna såsom att låta bli att köpa diskmedel, reservdelar osv. Problemen med mjölk kvalitén skulle till stor del minskas om ett betalningssystem där man tjänade på att producera mjölk av god kvalitet infördes. När studien gjordes fick de allra flesta bönder och föreståndare/ägare betalt efter mängden mjölk som producerades.

## Summary

The aim of the study was to compile and evaluate Village Milking Centre (VMC) in China for DeLaval. VMC is a centre provided with milking machines and bulk milk coolers. Local farmers bring their cows to the VMC two to three times per day. Earlier there was Milk Collecting Centres (MCC) where the farmers delivered the milk. The first VMC was instituted about ten years ago, it has been a rapid development of VMC and today there are more than 3000.

The last 20 years the dairy production in China has experienced a large change. In the past it was dominated by state-owned dairy operations. Year 2000 smallholder dairy farms accounted for about 77% of the total number of dairy cows. Dairy production is a labour-consuming industry and it has an important role for the rural development and more and more farmers are interested in dairy cows.

The reason for the fast development of the dairy industry in China is that the government have put emphasises on the dairy production and they have implemented promotional programmes for milk consumption. One programme is the “School milk” programme which is targeted at more than 400 million children and teenagers. Many children and teenagers in China have deficiency of protein and calcium. The school milk programme have resulted in that the nutritional condition of the students and pupils have improved.

An interview study was made with the help of prepared questionnaires. Together with a translator and DeLaval servicemen 16 VMC were visited, 16 managers/owners and 67 farmers were interviewed. Two dairy processors were visited and five DeLaval servicemen interviewed. Except for the questionnaires a “check list” about things that should be studied was used. Milk samples for analyses of milk somatic cell count (SCC) were taken at every VMC. A camera for documentation was also brought to all VMCs.

All VMCs participating in this study was established between 1999 and 2004. The number of households for each VMC ranged between 20 and 300 with an average of 77. Positive things with the VMCs were that the farmers had got less work and better economy. There are many new farmers that want to test dairy production because of a more safe income and investment in dairy cattle seems to be a good business.

Because VMC and dairy industry in China still is in its beginning it is defective and there are several steps that need to be done to secure a safe milk quality, especially if the milk consumption will continue to increase. The hygiene and the service of the milking machines were deficient at all the places visited. The average SCC for the bulk tank milk for all VMCs was 1 455 000/ml and that indicates that the udder health was very poor for a major part of the cows.

For all of the parts that in one way or another are involved in the milk production there are insufficient knowledge about dairy production, which indicates that education about milk production is needed. Very few of the managers/owner to the VMC have had dairy cows themselves and they saw the VMC as a business where they have too keep all costs as low as possible, in many cases they didn't buy detergents, spare parts and so on. In the long run this will give problem with the milk quality. The dairy production needs a quality payment system where the farmers will earn more money if they manage to produce milk of good quality. When the study was made most of the managers/owners and the farmers were paid according to milk yield.



## **Introduction**

The last two decades the dairy production in China has experienced a large change. Before, nearly all dairy operations were state-owned, but today nearly 80% is private owned small scale dairy farms, and the numbers of dairy farmers are growing. The government in China has put a lot of emphasises on the dairy production during the last couple of years and the dairy industry has developed very fast. The government has introduced a lot of promotional campaigns and one good example is the “School Milk” programme, which is targeted at more than 400 million children. Milk production in China will rise greatly if this programme will be successful.

There are different systems to collect the milk from the farms. One system that has been practised in several countries is the so called milk collecting centre where the farmers bring the milk to a centre. The problem with this system is that milk can not be chilled directly after milking and the quality can be negatively influenced during storage and transportation. However a new system called Village Milking Centres (VMC) has been developed and this system does mainly exist in this particular way in China. Some similar systems can be found in India.

VMC is a centre in the village which is provided with milking machines, bulk milk coolers and other required technical equipment needed when machine milking cows. Local farmers bring their cows to the VMC two to three times per day. The first VMC was installed in China less than ten years ago and today there are more than 3000 VMCs. Hundreds of thousands cows are estimated to be milked in a VMC every day. The system has improved the milk quality but there are still more improvements needed.

One main problem is that there is no tradition in dairy production among the most farmers China and they don't use milk at home for consumption. All land is owned by the state in China and the state lends it to the farmers in long term leases. Therefore it can be difficult for the farmers to develop as they want and the opportunities for dairy production differs a lot from countries with long tradition in dairy production.

## **The aim of the study**

The aim of the study was to compile and evaluate Village Milking Centre (VMC) in China. By use of a questionnaire study, the evaluation included milk and milk quality, feed, feed system, feed quality, herd health and management.

Furthermore the project aimed to identify and propose improvements and product developments to be considered, and thereby contribute to the understanding of how to best operate and promote VMC in China.

## **Literature study**

The literature study was done to create an understanding how dairy cattle production in China works. The Chinese school milk program, milk production and milk quality were included in the literature review.

## **China and its new economical trend**

China is home to one of the world's longest continuous civilisations, with an impressive heritage of art, architecture, language and cuisine. It is a country of great contrasts: picturesque rural landscapes and crowded cityscapes and natural beauty that ranges from the untamed to the idyllic. However the past years have been a continual drama of energetic development, economic contortions, an invasion of Western culture and the resurgence of mass inequality (Harper *et al.*, 2002).

China is located in eastern Asia. China is one of the world's largest countries with a total area of 9 596 960 sq km. Of the land 15.4% is arable land, 1.3% is permanent crops. The climate in China is extremely diverse; tropical in south to sub arctic in north (CIA, 2005).

The last twenty years China has experienced a large change (Lu, 2002) and China's economic boom came at the expense of controls on air pollution, land clearing, deforestation, endangered species and rural and industrial waste. China's huge population combined with geographical factors make its environmental problems infinitely more massive than that for other nations. Nine out of ten of the world's most polluted cities are found in China and estimates are that China may become the world's largest source of air pollution (Harper *et al.*, 2002). There are more than 1 306 million people in China (CIA, 2005).

## **Dairy cattle production in China**

### ***Dairy Industry***

Within the primary production in China, dairy industry has the biggest potential for development (Lu, 2002). In the past, the dairy industry was dominated by state-owned dairy operations. Nowadays smallholder dairy farms play an increasingly important role in milk production and year 2000 smallholder dairy farms accounted for nearly 77% of total number of dairy cattle. For the rural development the dairy industry has an important role and dairy cattle husbandry is a labour-consuming industry. The development of the dairy industry may also lead to better use of natural resources and agro-industry by-products. A number of promotional programmes to improve the production of milk and milk-based products have been instituted by the Chinese central government (Jiaqi, 2002). Since China shifted to market economy a rapid economical growth and urbanization have started, the economy has grown in average 8.8% per year from 1987-1997 (Lu, 2002). Growing income levels and increasing health awareness have helped increase consumption of liquid milk (Moh & Tao, 2004).

In 1999, the official policy of the Ministry of Agriculture proclaimed that China is to “put more emphasis on the production of dairy products, stabilize the supply of pork and poultry, and raise the output of herbivorous animals”. For many years prior to this, the government had focused on providing consumers with large quantities of dairy products at low cost. The opening and reforming policy presently adopted by the government of China has changed the structure of demand and supply in the agro-products sector. Government is now placing increased emphasis on policy impacting on dairy producer’s income. Instead of direct subsidization to the industry, which has been used in the past, the government is promoting dairy products. The implementations of promotional campaigns and the new food guides from the Government of China are pushing China’s per capita consumption higher. One good example of the governments pushing to make it happen is “School Milk” programme, which is targeted at more than 400 million children and teenagers in China. If this programme will be successful milk production in China will rise greatly (Lu, 2002).

The performance of the processing sector determines the ability to pay the farmer, the price and terms of payment. Terms of payment are normally once a month, but this can vary from 20 days to two months. When the dairy company is not doing well, payment is prolonged 3-6 month following delivery. This occurs too often because there are many new companies and small-scale companies in the industry. Some of the established dairy companies are supplying breeding and veterinarian services, feeds and capital investment in milking centres. The price paid to the farmer is reflecting the costs and the market situation. Most payment programmes are based on the quantity of milk delivered but the industry is shifting rapidly to payment based on quality (Lu, 2002).

Economically active population in agriculture and subsidiary industries is 510 950 000 and its share of the total economically active population is 65.5 % (SJV, 2004).

### ***Three main systems of milk production***

Cow milk is produced in China in three main systems; household, state and collective system. Household production accounts for about 67 % of the production, production by state farms for 25 % and collective operations stands for approximately 8 %. At the same time there were roughly 2000 state dairy farms with an average herd size of 120 cows and average annual yield of around 6000 kg per cow and year. There were 340 000 households that owned and operated dairy farms with an average size of only 4.2 cows per household and most of these household had other income sources. Around 2500 kg milk per cow is the average annual yield on the household dairy farm. There were approximately 3600 collective farms with an average herd size of 24 cows per farm and an average annual yield of about 4500 kg per cow and year (Lu, 2002). Dairying is continuously transferring from the state sector to the private sector (O’Mullane, 1999).

### ***Village milking centre***

The Village Milking Centres (VMC) consists of milking machines, cleaning units, hygiene packages, bulk milk coolers and milk analysers. Local farmers bring their cows to the VMC where the cow is milked; milk is collected and efficiently cooled to ensure milk quality. VMCs are fast becoming important in China because of the increasing consumption of dairy products and growing demand for quality milk (DeLaval homepage, 2004).

The village is about 1-2 kilometres in diameter and there are 300-1000 cows raised by 100-300 households. The processing company or the individual investors have built the centre. The farmers will raise their cow individually on their own properties, and move the cows two

to three times a day to the milking centre for milking. The quality of milk is dramatically improved because the problem of adulteration is eliminated and the milking and handling of milk is controlled (Lu, 2002).

### *Farm Garden*

There is not a definite translation of Farm Garden yet, it is a purely Chinese thing. A good name for it is Cow hotel or “Cowtell”. It generally means to gather separate farms on one allocated area. Farmers can build their own barn or lease it; all barns in the farm garden must follow the same design. Farmers still keep their cows separately and they milk together in the milking parlour. The better ones have not only centralized milking, but also feed supply, veterinary and biological security etc. The size of the Cowtell is from 500 up to 2000-3000 cows (Mai, 2005).



*A Farm Garden in Hohhot. Photographer M-L Främling*

### *Dairy cattle*

The dairy cattle population is spread throughout China with cattle concentrations dependant on both market and availability of resources. Table 1 shows the number of dairy cattle in the main dairy provinces China 2001 (Lu, 2002). The dairy cattle population is mainly located in northern parts of China where the resources as land and labour are abundant and the climate is favourable, but the major market for milk is in the higher income southern and coast region (Lu, 2002; Moh & Tao, 2004). In some areas buffaloes are a more important source of milk than cattle (O’Mullane, 1999).

Table 1. Number of dairy cattle in the main dairy provinces in China 2001 (Lu, 2002)

<b>Regions</b>	<b>Dairy cattle</b>
Inner Mongolia	873 700
Xinjiang	782 800
Heilongjiang	973 000
Hebei	452 800
Gansu	228 600
Shanxi	113 600
Jilin	102 300
Beijing	57 000
Shanghai	59 300
Tianjin	28 500

Year 2002 there were 5 143 000 dairy cows in China and the milk yield per cow was 2 597 kg. The total number of cattle (beef and dairy) was 106 151 000 (SJV, 2004).

The price for dairy cows varies depending on the age and breed. It can be economically impossible for many local farmers to be able to buy better breeds. Many milk processors would help by guaranteeing bank loans for the farmer to purchase cows to help improve milk output. In addition to imports of better breeds, companies are also working with research institutes to improve the yields of local cows (Moh & Tao, 2004).

The replacement rate was between 25-30 % 2003. A higher replacement rate causes higher total farm replacement cost and it will also lower the returns from selling surplus heifers. The price for a heifer in China is among the highest prices for heifers in the world (IFCN, 2004).

### ***Different breeds of dairy cattle in China***

About half of the national dairy herd is pure dairy breeds (for example Holstein) and the rest is local cross breeds (Moh & Tao, 2004).

#### ***Chinese Black and White***

Chinese Black and White is usually a crossbreed between local yellow cattle and Holstein. Milk production ranges from 4-7 000 kg/year and the average milk fat content is about 3.5-3.6 % (Moh & Tao, 2004). The body size of Chinese Black and White varies according to the origin of sires used in the crossbreeding. The highest individual yield has been 16 090 kg and it was in Beijing 1970 (Breeds of Livestock homepage, 1996).

#### ***Xinjiang Brown***

This breed is a result of crossbreeding the local breed Kazakh with Swiss Brown. Average milk production is 2 800 kg/year and the average milk fat content is over 4 %. The Brown Swiss are popular among cheese makers because of suitable milk composition. Xinjiang Brown is a dual-purpose cattle breed and has desirable milk/meat body conformation. It is usually smaller than the Sanhe (Moh & Tao, 2004; Breeds of Livestock homepage, 1996).

#### ***Kazakh***

This breed is mainly located in north Xinjiang and is a meat-draft-milk purpose breed. During a lactation of 5-6 months it produces about 880 kg milk with a fat content of 5%. They are well adapted to the local unfavourable climate, feeding and management conditions (Breeds of Livestock homepage, 1997).

#### ***Mongolian***

The Mongolian is one of the most popular indigenous cattle breed and it is mainly found in Inner Mongolia. The Mongolian is found in two varieties. It may produce 500-600 kg of milk in 5 month lactation. Body weights and conformation are influenced greatly by the type of natural grassland on which they are reared (Breeds of Livestock homepage, 1996).

#### ***Sanhe***

Sanhe is a product of Mongolian cattle crossbred with a few outside breeds mainly from Russia, but also breeds such as Simmental and Shorthorn. Milk production ranges from 2-4 000 kg/year and the average milk fat content is around 4 %. Sanhe is the first dual-purpose cattle breed in China and it has good carcass quality and lean meat (Moh & Tao, 2004; Breeds of Livestock homepage, 1996). The noticeably characteristic of Sanhe cattle is the adaptability to the adverse environment (Breeds of Livestock homepage, 1996).

### *Chinese Red Steppe*

This is a crossbreed between Mongolian cattle and Shorthorns. Milk production ranges from 1 500-2 000 kg/year. Milking Shorthorns are dual-purpose cows that are used for milk and beef. The milk from Milking Shorthorn breed is well suited for cheese production because of its high protein to fat ratio (Moh & Tao, 2004).

### **Milk production in China**

#### ***Increased milk consumption***

As a result of the increase in people's living standard, consumption patterns have changed towards diversification of quality, quantity and variety of food. Increase of living standard has increased the consumption of raw milk and dairy products. In numbers the consumption of dairy products has increased from 4.16 kg per capita year 1990 to 7.3 kg per capita year 2000 and the demand for raw milk, especially high quality milk, is continuously increasing. The predicted increases until year 2030 are over 40 kg per capita (Lu, 2002). The consumption patterns differ much between urban and rural areas, urban consumption was at the end of 2003 18 kg per capita and the rural consumption was 0.5 kg per capita in 2002 (Moh & Tao, 2004). 2001 was the average milk consumption in the world 100 kg per capita (Jiaqi, 2002). From 1981-2001 the milk consumption in China has increased by 355%, the growth per capita by 267% and the growth in population by 27%. Self-sufficiency for milk was 2001 84% (IFCN, 2004).

Milk from dairy cows contain high quality nutrients; milk fat, milk protein, lactose, minerals and vitamins. All nutrients in milk are highly digestible and especially protein is of excellent quality and minerals are of high availability. A large proportion of produced milk is further processed by the dairy industry into a wide variety of products and therefore there are advantages in manipulating the composition and other properties of milk. Possibilities to develop new products are in many ways dependent on the properties of the milk as it is produced from the dairy cow, even though there are a wide range of technological processing methods available to modify properties of milk after production (Tamminga, 2001).

#### ***Milk quality***

The quality of milk is becoming an increasingly important issue in the market place in China (Lu, 2002). The result of a test on the markets in the North reveals that the biggest problem is excessive content of antibiotic residues, followed by contents of mercury and lead. The excessive residues affecting the quality and safety of dairy products should still attract much attention otherwise consumers will lose trust in domestically made products and the healthy development of the dairy industry shall be effected (Dairy Consultants, 2005).

The challenge facing raw milk production in China is to be able to economically produce a high quality product that can compete on the world market. The principle of quality milk production is widely understood, but it is challenging to implement milk quality programs (Lu, 2002).

To improve efficiency and to produce milk with better quality, the farmers need financing and technology application. The farmers' income has to be secured and therefore a system needs to be built up. There is a large consumption potential and the development of Chinas dairy industry needs to accelerate (Lu, 2002; Jiaqi, 2002). The main limiting factors are low efficiency and lack of quality control system for milk production (HACCP). The co-operation on an international level on technology development for improving dairy production efficiency and milk quality control will speed up the milk development in China. Enhancing

the milk quality for human health and developing the technology for optimizing milk production efficiency will be the priorities for future years (Jiaqi, 2002).

The quality of the milk is considered according to the compositional and microbiological characteristics (Gandiya, 2001). Good dairy products can only be made from good quality raw milk therefore dairy product quality starts at the farm. It is important that the milk producers have a good understanding of how to produce such milk. Storage, transportation and processing have to be done in a way where the quality of the milk is maintained (Jonsson, 2001). Milk of poor quality may result in problems during processing, giving rise to products of poor quality (Gandiya, 2001).

Genetic factors, sanitary, physiological, climate, zootechnical and feeding factors are factors that interact in the quantitative-qualitative composition of milk; all these factors interact in determining milk quality. In order to meet the requirement of different users, genetic selection and management can result in changes in milk composition that will meet the requirement from different users. Unifeed breeding techniques (constant year-round feeding) has brought some changes. It has generally improved milk production as a result of optimal biochemical conditions of rumen, milk quality both for the fat and protein content and for the somatic cell content, better persistence of lactation curve as a result of little or no changes in the diet composition, lower incidence of mastitis, and lower demand for high energy feeds (Toppino & Degano, 2001).

The raw milk's quality will easily be influenced by the hygienic and compositional quality of the feed and the drinking water. Feed of lower hygienic quality may cause digestive disorders when animals are consuming it and further on result in unhygienic animal environment, with possibly bad hygiene during milking and poor animal health (Lind, 2003).

Cows should be kept clean and dry, under comfortable conditions and given feed and water of good quality to be able to produce milk of high quality standard. Poor quality forage may contain certain micro-organisms or spores that spread and possibly end up in the milk during milking. Raw milk produced under such conditions will badly affect the quality of the end product. For example the quality of cheese may be seriously affected. Important udder health risk factors include barn type and design (including equipments); frequency of manure removal, cleanness and hoof care. Hoof health is of particular importance (Lind, 2003).

#### *Somatic cell count (SCC)*

As a measure of udder health and thereby milk quality the somatic cell count (SCC) in the milk is a commonly used parameter. Somatic cells are simply animal body cells present at low levels in normal milk. Mastitis, inflammation in the udder, is usually caused by an intra-mammary bacterial infection. It is indicated by high levels of SCC in the milk. To help ensure quality products milk markets routinely rely on SCC. Many milk processors pay a premium for low milk SCC, good quality milk. Normal milk is generally below 200 000 SCC per ml, but may be below 100 000 in first lactation animal or in well managed herds (Sandholm *et al*, 1995). Milk with high SCC causes a rise in whey proteins, a decrease in casein and fat (Sandholm *et al*, 1995; Ma *et al*, 2000). The desirable components decrease and the undesirable components increase with high SCC. Except decreased quality, the quantity will also decline (Sandholm *et al*, 1995). Mastitis decreases also the shelf life and sensory quality of pasteurized milk, mostly by higher concentration of free fatty acids (Ma *et al*, 2000; Sandholm *et al*, 1995).

High SCC can be caused by a single factor or a combination of several factors. The major factor is an infection in the mammary gland caused by different organisms for example bacteria. The most common organisms are classified into two groups: 1. contagious pathogens and 2. environmental pathogens. Other factors causing high SCC are cow age and stage of lactation, stress and season, udder injury and indirect causes like poor milking procedures. Infections in other part of the animal do not increase the SCC (Sandholm *et al*, 1995).

### *Bacteria*

Low bacterial count is one of the best indicators of top quality milk; bacterial growth in milk may cause spoilage and possibly human illness. To maintain a low bacterial count it is very important to have a clean milking area (Wallen *et al*, 1983). It is also important that the udder is clean and dry because a small single drop of water from an udder can contain <30 billion bacteria. Healthy cows can only produce high quality milk, and once the milk leaves the cow, the retention or preservation of milk quality requires cleanliness, sanitation and careful handling. Cleanliness applies to the cow, cow environment, milking area, personnel involved in milking and the milk storage area. Sanitation applies to the milking system and bulk tank. Numerous details require continual attention to consistently produce high quality milk with low bacteria counts (Sandholm *et al*, 1995).

Pre-milking udder preparation including fore milking and teat cleaning reduces the number of pathogens and have therefore a direct mastitis controlling effect. Post milking teat dipping or spraying has proven to be particularly effective in preventing environmental mastitis types (Lind, 2003).

The milk should be cooled to refrigerated temperature within a few hours after milking and stored at 4 °C or below. Cooling of milk shortly after extraction is also important for minimising lipolytic activity (Lind, 2003). The growth of many bacteria can be reduced or stopped by refrigeration (Sandholm *et al*, 1995; Wallen *et al*, 1983). Milk will almost always be of top quality if properly harvested from healthy, clean cows with clean equipment, cooled quickly and kept cold (Wallen *et al*, 1983).

### ***Milk processing Industry***

Numerous small-scale producers and relatively unsophisticated processing techniques are characterising the industry. At the end of 2002 there were over 462 dairy processing enterprises and 118 of them were unprofitable with deficits according to the Ministry of Agriculture. Even though the larger industry leaders have gained share against smaller loss-making companies there should still be new entrants into this fast growing industry (Moh & Tao, 2004).

The lack of extensive cold-chain collection makes it difficult to transport fresh milk over long distances. Milk processors need therefore to be located within a certain distance to the raw milk source. As mentioned, most of the raw milk is produced in the northern part of China while the demand is in the south. The difficulties to transport fresh milk have resulted in the growth of milk powder and UHT (Ultra-High-Temperature treated) milk (Moh & Tao, 2004).

In recent years UHT milk has grown even faster and is now accounting for about half of the liquid market. The greater level of convenience given the advantage of room temperature storage and a longer shelf life has also contributed to the rapid growth of UHT milk. Nearly 90 % of the urban consumers owned a refrigerator but only about 16 % of rural consumer owned a refrigerator (at the end of 2003). The milk beverages are still a very small segment,



though new product developments are expecting to help drive the growth in this sector (Moh & Tao, 2004).

Liquid milk can be delivered to the consumer as raw milk or after various heat treatments. The milk can be pasteurised or sterilised in different ways. The properties of milk that requires most attention to the consumer is safety, shelf life and flavour. Consumption of raw, unpasteurised milk can never be considered as safe and that's why delivery of raw milk is not allowed in many countries. The importance of other quality parameters depends on how the milk is going to be used. Most people tend to dislike a cooked flavour for milk that is going to be used as beverage, and therefore (low-intense) pasteurisation is to be preferred. When milk is primarily going to be used in coffee or tea, in cooking or in baking the absence of cooked flavour is generally not essential and shelf life may therefore be the most important quality mark. When shelf life is most important sterilised milk is often preferred but milk preserved as evaporated milk, dried milk or sweetened condensed milk can also be used. The more intense heat treatment, the more flavour of the milk will differ from that of raw milk (Walstra *et al*, 1999).

There are several contaminants that can in principle be harmful to the consumer (Walstra *et al*, 1999):

Pathogenic micro-organisms can already be in the milk in the udder or they can be incorporated during or after milking.

Toxicants taken up by the cow from the feed can enter the milk during its synthesis. Other toxicants can enter the milk by contamination during and after milking.

Antibiotics used to treat the cow.

Disinfectants used on the farm or in the plant.

Bacterial toxins formed during storage of the milk.

Most of the pathogenic micro-organisms do not survive pasteurisation but they can also enter the product by recontamination. Other contaminants can mostly not be nullified by pasteurisation. To prevent health hazards proper management and an adequate way of collecting the milk is necessary. It is essential to regularly check for the absence of contaminants. Most countries have legal requirements for the maximum allowed count of micro-organisms, for the presence of coliforms and for the lack of the enzyme alkaline phosphatase, with references to the shelf life and safety of the milk (Walstra *et al*, 1999).

#### *Pasteurised milk*

Pasteurisation greatly enhances the shelf life of the product and it also ensures the safety. Pasteurisation is a mild heat treatment, e.g., 15 s at 72°C, kills all pathogens that may be present, to such an extent that no health hazard is left. This kind of pasteurisation also inactivates alkaline phosphatase to the extent that it is no longer detectable (but the enzyme may regenerate after keeping the product for some days). Most of the spoilage micro-organisms in raw milk are also killed by pasteurisation. Pasteurised beverage milk should keep for several days after purchase, provided it is kept refrigerated (below 7°C) (Walstra *et al*, 1999).

### *UHT-milk*

When raw milk is treated by a special sterilization technique and the milk is heated to 130°C for 4s, it is called UHT-milk. The aim with UHT-milk is to kill all micro-organisms present, including bacterial spores, so that the packed product can be stored for a long period at ambient temperature, without spoilage by micro-organisms (Walstra *et al*, 1999).

The undesirable secondary effects of in-bottle sterilization like browning, sterilization flavour and losses of vitamins can be diminished by UHT sterilization. Contamination by bacteria has to be rigorously prevented during packing of UHT-sterilized milk. Certain enzymatic reactions and physicochemical changes may still occur after UHT sterilization (Walstra *et al*, 1999).

### ***School Milk program***

Year 2000 the Chinese government launched a School milk program to improve the health and nutritional level of primary and middle school children (Moh & Tao, 2004; Inter-Ministerial Coordinating Office for School Milk Program in China, 2004). Dairy manufactures that meet certain criteria can apply to be a supplier to schools participating in the program. The government hopes to get 15 million children drinking milk by 2005 (Moh & Tao, 2004).

Since the School milk program was launched great achievements have been made in improving children's nutritional condition, boosting Chinese cow breeding and dairy processing industry, expanding employment and increasing farmers' income, etc (Inter-Ministerial Coordinating Office for School Milk Program in China, 2004).

It has been shown by recent research that high-quality protein and calcium are deficiently provided in daily meals of average Chinese people, especially for the kids and youngsters. A report on the effects of school milk shows that the nutritional condition of the students and pupils who take school milk improved clearly in several aspects: increase in intake of calcium, protein, vitamin A and vitamin B<sub>2</sub>, accelerating the skeleton growth and helping accumulation of bone calcium. For children from relatively poor families those effects are much more obvious (Inter-Ministerial Coordinating Office for School Milk Program in China, 2004).

## Material and method

To find out as much as possible about the Village Milking Centres (VMC) it was decided that the best way to do it was by interviews. Therefore four different questionnaires were made; one for VMC, one for manager/owner, one for farmer and one for dairy processor (Appendix 1-4). The questionnaires were formulated according to Trost (1994). In order to compare this study to a similar study made at the same time in India it was decided that the same questionnaires should be used in both countries. The study in India was made by Henriksson (2006).



*Interviews of farmers in Hebei. Photographer Liang Hui*

The questions in the questionnaires were made with alternative answers. As an addition to the alternative of answers there was space for own comments.

Headlines for the questionnaire for VMC;

- General information
- VMC membership information
- Milk information (capacity of tank, collecting system and seasonal variation)
- Services and facilities at VMC
- Technical equipment at VMC
- Cow health
- Investment, Financing and Operation costs

Headlines for the questionnaire for manager;

- Personal information
- VMC Information
- Economy
- Agreement
- Services at VMC
- Cow health
- Future

Headlines for the questionnaire for farmer;

- Personal and family information
- Farm composition
- Household income
- Relation to VMC
- Feed/feeding
- Breed/breeding
- Cow health
- Future

Headlines for the questionnaire for dairy processor;

- Personal information
- Dairy information
- Economy
- Agreement
- Dairy and VMC
- Cow health
- Future

To be able to do the interviews a translator was used during the whole study. In this study there were 16 VMCs visited and it was made in two different areas in China; 9 VMCs were visited in ShiJiaShuang in Hebei (the name Hebei is used for those VMCs) and 7 VMCs were visited in Hohhot in Inner Mongolia (the name Hohhot is used). Three different translators and four DeLaval servicemen participated in this study. The names of the VMCs are presented in Appendix 6.

The questionnaire for the VMC was made to be sent out in advance. In this study it didn't work to send out the questionnaire before the visit, it was only made for VMC 10-12. Those VMCs that answered the questionnaire in advance didn't understand the questions fully whereby the questions were asked again at the visit. Some of the questions for the VMC and the Manager were the same and it was made in that way to cross check the answers, but because it didn't work to get the answers in advance the questions were only asked once.

For the VMCs the delivery statistics, production statistics, economical balance sheet and operational results were asked for but, without any success.

Of all farmers interviewed the manager/owner of the VMC selected about half of them and the other half was randomly selected by me, the translator and the serviceman.

Some of the questions in the questionnaires had to be changed during the study to make it easier for the farmers to answer. Private questions as questions about the economy were very difficult to get trustful answers of even if the questions were asked in different ways. It was not possible to get the age structure of the farmers' family.

16 managers/owners and 67 farmers were interviewed. There were two to five farmers interviewed at each VMC. It was meant to be five farmers interviewed at each VMC, but it was not always possible. During the study there were also questions asked to five DeLaval servicemen about what they think about the VMCs.



There were two different dairy processors visited; one in Hebei (Sanlu) and one in Hohhot (Mengniu). One person at each Dairy processor was interviewed.

As many visits as possible at places that could help to give a picture of how dairy farming in China works were made, but not all visits were included in the result. All experience from the field study has contributed to the conclusions. Figure 1 shows where in China the study and visits were made.

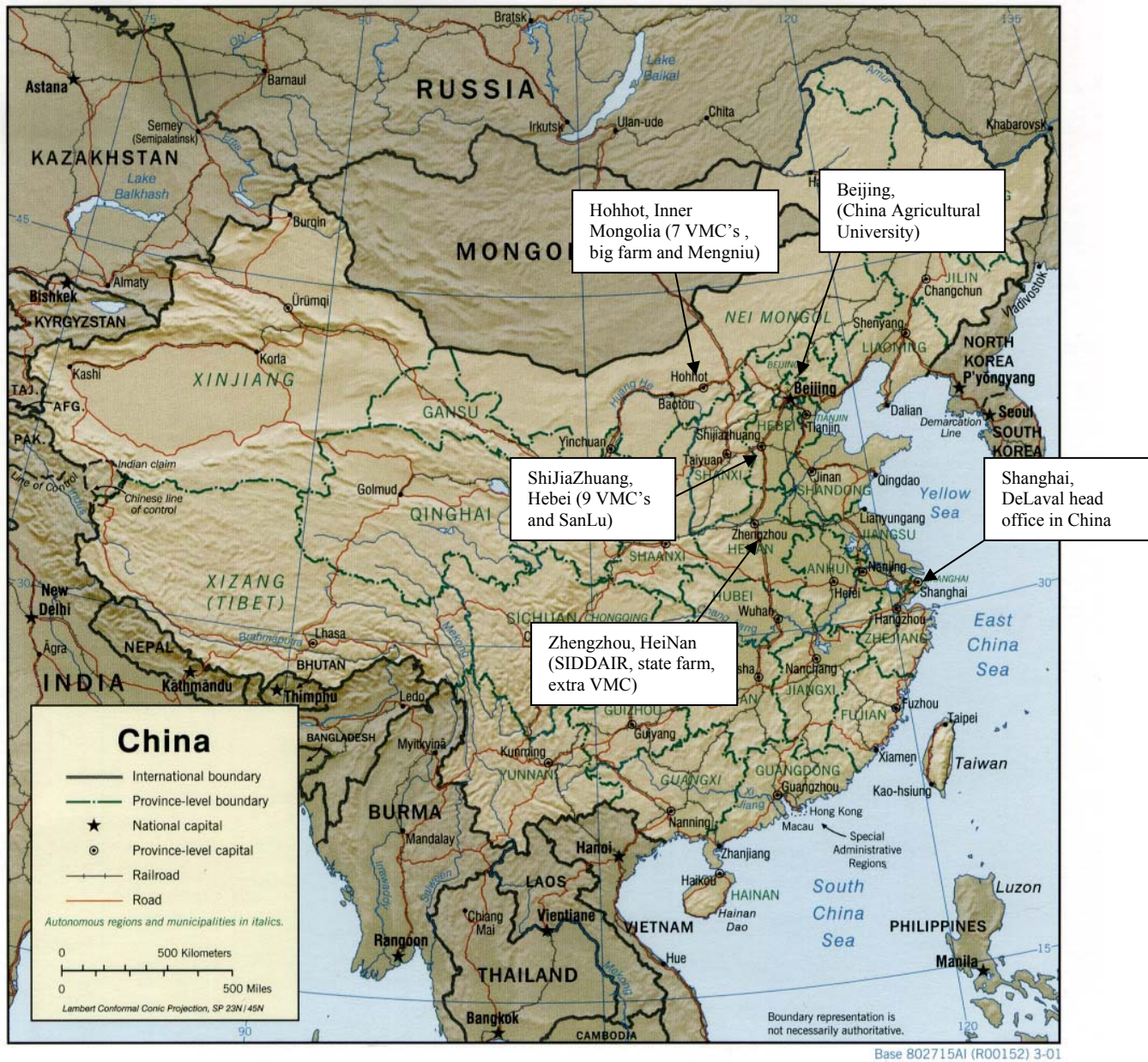


Figure 1. Map that shows where in China the study was made and which places that were visited. ([http://www.lib.utexas.edu/maps/middle\\_east\\_and\\_asia/china\\_rel01.jpg](http://www.lib.utexas.edu/maps/middle_east_and_asia/china_rel01.jpg), 2005-11-22)

Visits not included in the result;

- The first VMC that was made as a test VMC
- One extra VMC visit in HeiNan
- Two private farms in Hebei
- One big farm in Hohhot (Megniu Austasia Dairy farm)
- Seminar at China Agricultural University in Beijing
- Visit at a Dutch project (SIDDAIR) in HeiNan

In addition to the interview; milk samples were taken for analyses of SCC (DeLaval Cell Counter, DCC). The milk for the SCC test was taken from the milk tank during or after milking. There were always at least two tests taken at each VMC. The farmers who wanted to test their cows with the DCC were able to do that but their results were not noted. Memos and photos were taken of all places visited. A list with checkpoints for the VMCs was also made as a help for the study.

There were also two TBC (Total bacterial count) tests made on two different VMC, one in Hebei and one in Hohhot. The test in Hohhot was made after the study at one VMC not included in the study. The TBC test was made in two steps, before and after a total cleaning and some service of the equipment. There were four samples taken for each step;

1. Sample of milk taken in the beginning of the milking
2. Sample of milk taken after milking
3. Sample of milk taken at collecting
4. Sample of milk taken at delivery at dairy processor

The last four samples were taken after the servicemen had cleaned and looked after the milking equipment. The milk samples were then analysed by the dairy processor, in Hebei they used a bactoscan to get the TBC number and in Hohhot they used methylene blue tests to get the TBC number. When a methylene blue test is used the time it takes for the colour to disappear from the sample tells approximate how many bacteria's there were in the sample (Table 2).

Table 2. The number of bacteria in milk in relation to change in colour

Time of colour disappear	TBC
>4 hours	<500 000
2.5-4 hours	1000 000
1.5-2.5 hours	2000 000
1.5H-40 minutes	4000 000
<40 minutes	>4000 000

The answers from the interviews of VMC, managers and farmers were compared with each other and analyzed with help of Chi<sup>2</sup>-tests. The SCC results were compiled and answers from Dairy processors compiled.

## Results

The result starts with the VMC and the managers/owners interviews and is then followed by the farmers. Thereafter the result from the interview of the two Dairy processors is presented and the interviews of the DeLaval Servicemen.

In China primary school is for seven years, the secondary school is for three years, high school for three years and college for four years.

When the results include some kind of payment or money all numbers are in RMB. (One Yuan  $\approx$  one SEK).

## VMC

### *General information*

The 16 VMCs in the study were all established between 1999 until 2004. Figure 2 show the distribution of VMC establishment during 1999 to 2004 in this study. The VMCs had been in operation for one to six years, with an average of 2.81 years and the median of three years.

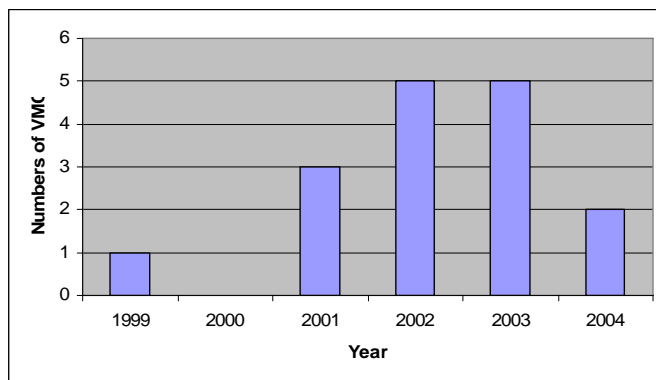


Figure 2. The distribution of VMC establishment during the years 1999-2004.

There were three different kinds of ownership for the VMCs. Eight (50%) of the VMCs were privately owned, three (19%) were owned by a cooperative, 2 (13%) were owned by the dairy processor and 3 (19%) were owned by the dairy processor and one other investor.



Two different VMC's in Hohhot. Photographer M-L Främpling

**VMC membership information**

The total number of households connected to the centre ranged from 20 to 300, with an average of 77 households and a median of 53.5 (Figure 3). The total number of dairy cows connected to one centre ranged from 175 to 2000 with an average of 686 cows and the median of 450. The average number of cows milked daily at the centre ranged from 125 to 1000, with an average of 333 cows and a median of 225 (Figure 4).

There were big differences in the number of members per VMC and number of cows per centre. The total number of animals connected to the centre was nearly twice as many as there were milked daily.

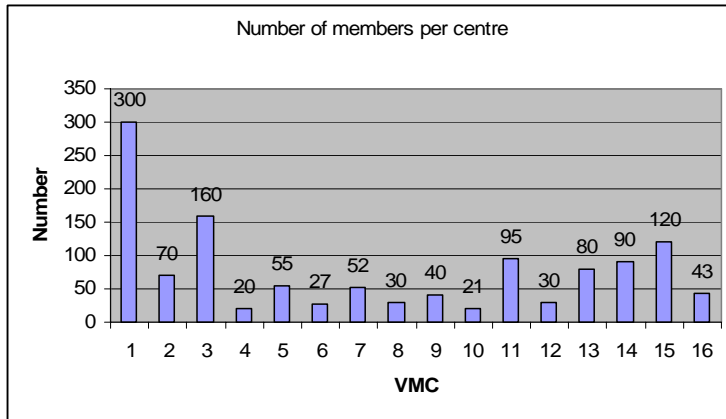


Figure 3. The number of households per VMC. VMC 1 to 9 are in Hebei and 10 to 16 are in Hohhot.

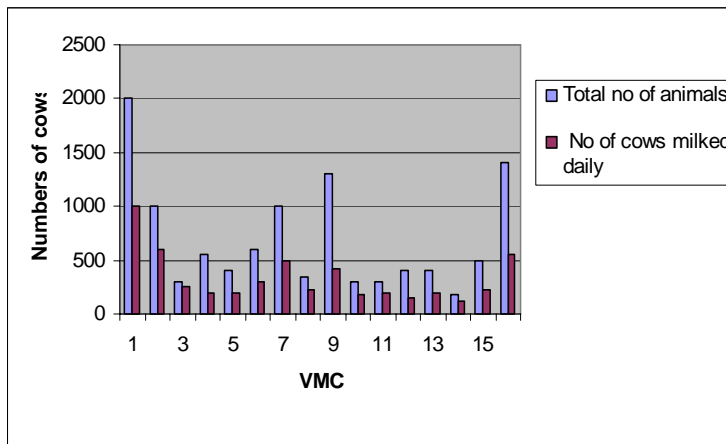


Figure 4. The total number of animals and number of cows milked daily per VMC

**Information about the milk production**

The minimum daily production per centre ranged from 1200 litres to 11000 and the maximum production per centre ranged from 2000 to 13000 litres. Minimum production per cow ranged from 5 to 24.5 litres and the maximum production per cow ranges from 8 to 28 litres (Table 3).



Table 3. Litres of milk produced per day per VMC and per cow.

	<b>Min production/VMC</b>	<b>Max production/VMC</b>	<b>Min* produced per cow</b>	<b>Max* produced per cow</b>
Min	1200	2000	5	8
Max	11000	13000	24.5	28
Average	4478	5744	13	17.5
Median	440	5800	13.3	16.7

\* Min and max production per cow is calculated from the total numbers of milked cows and litres produced. Assuming the same number of cows at both occasions.

Figure 5a shows how many litres milk each VMC produce per day and Figure 5b shows how many litres of milk the average cow produce at each centre. The production for VMC 8 is both from the cows milked at the centre and from milk collected in the village. The litres per cow for VMC 8 could not be calculated as they didn't know how many cows were milked in the village.

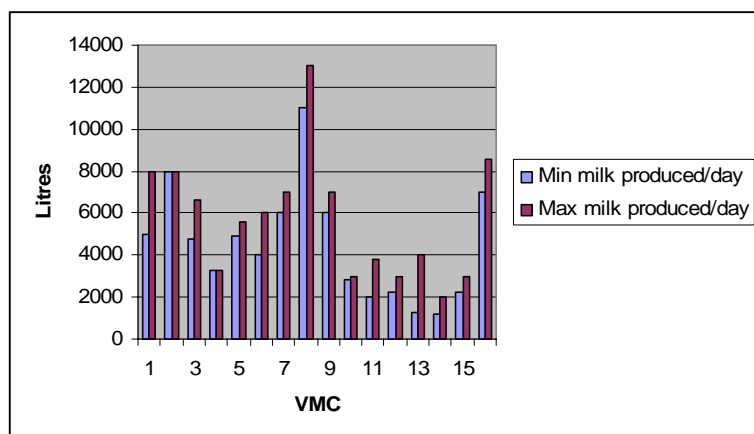


Figure 5a. Minimum and maximum production of milk (litres per day) at each VMC. VMC 1-9 is in Hebei and 10-16 in Hohhot.

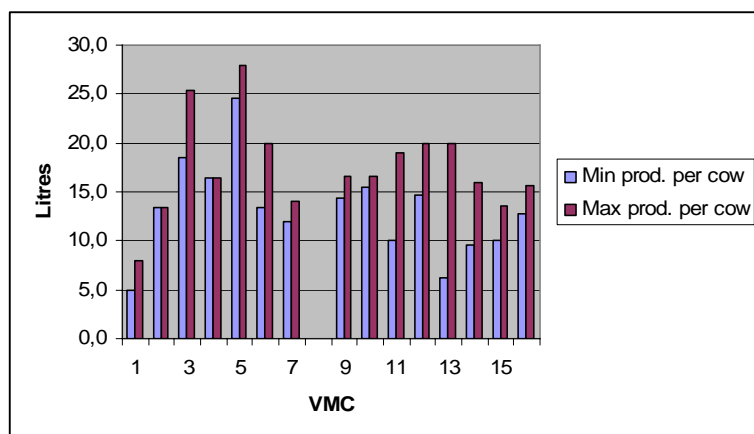


Figure 5b. Average milk yield/cow and day, minimum and maximum production for each VMC. VMC 1-9 is in Hebei and 10-16 in Hohhot. (These numbers are calculated from the total numbers of milked cows and litres produced per VMC)

There were some small differences between Hebei and Hohhot in the milk production (Figure 6 and 7).

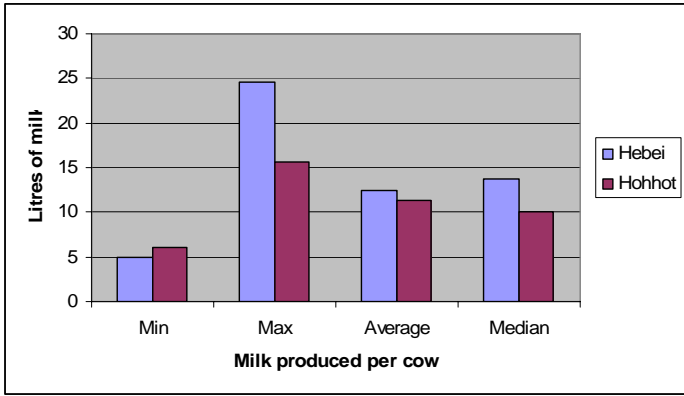


Figure 6. Minimum milk production per cow produced for the VMCs in Hohhot and Hebei.

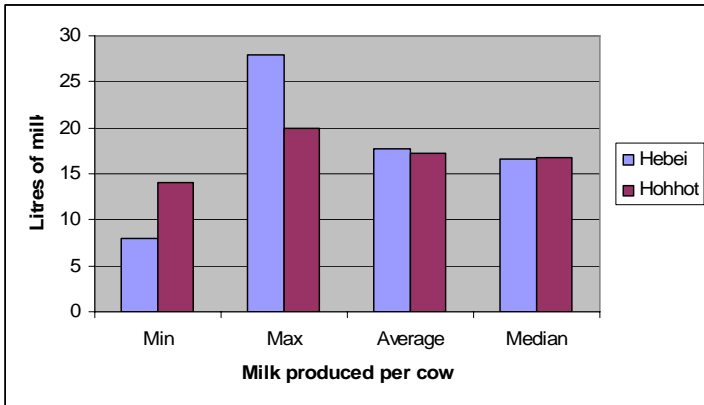


Figure 7. Maximum milk production per cow produced for the VMCs in Hohhot and Hebei.

In Hebei the nine visited VMCs delivered their milk to Sanlu dairy. On all VMCs in Hebei the cows were milked three times a day. In Hohhot five of the VMCs delivered their milk to Mengniu dairy and two to Yili dairy, all cows were milked two times a day in Hohhot.

The result of what the VMCs answered about seasonal difference in the milk production is shown in Figure 8. It was observed that in November to February less milk is produced while during July to October most milk is produced.

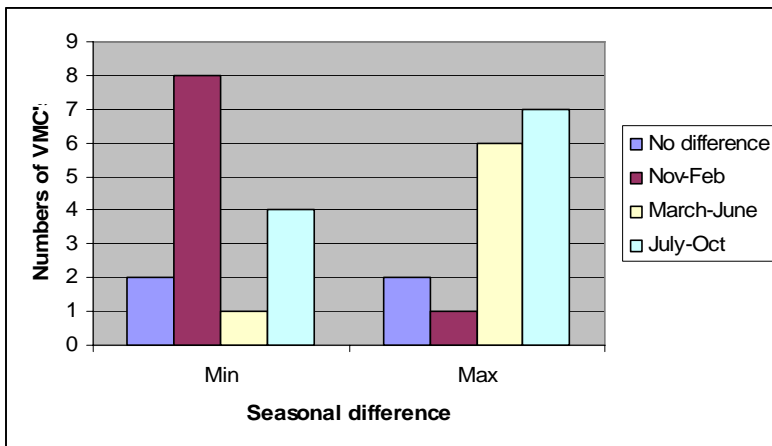


Figure 8. Seasonal difference in milk production for the VMCs.

### ***Services and facilities***

50% of the VMC provide the farmers with veterinary and breeding service and 25% had medical and feed supply (Table 4). However, only few of the remaining planned for services within the next year and services that the farmers had asked for. There were no VMC's with communication facilities, as telephone and internet, and none of them had planned to provide it and no farmers had asked for it.

Table 4. The number of VMCs with different kinds of services, services that were planned for to be provided within the next year and services asked for by the farmers

<b>Service</b>	<b>No. of VMCs with the service</b>	<b>No. of VMCs with plans for the service</b>	<b>Services asked for by the farmers</b>
Veterinary	8	1	1
Medical supply	4	2	1
Breeding (AI/training)	8	1	0
Feed (supply/training)	5	2	3
Herd management	3	0	0

Some of the VMCs had no plans for developing any services if the dairy processor didn't ask for it. When/if the dairy processor asks for it they will get this kind of service.

### ***Technical equipment***

In two of the VMCs visited there were bucket milking machines, in seven there were parlours with midiline, in three they had parlours with low lines and in four of the VMCs the equipment was not from DeLaval.



*Different kinds of milking parlours in four VMCs in Hebei and Hohhot. Photographer M-L Främling*

All VMCs got their electrical power from a network and most of them had a generator as well. Power cuts were very rare for all VMCs. All water used at the VMCs came from a well. The water heater was a water boiler heated by coal at all VMCs. Five of the VMCs had a computer.

### ***Cow health***

No one of the managers/owners thought that it was their business to deal with the cow health. One manager looked at the animals every day and told the farmer if he found a sick cow. For seven of the VMCs the veterinarians helped the farmers to take care of sick cows. Many of the managers/owners mention that they had some cows with mastitis, leg- and hoof problems and digestion problems. But none of them could say how many cases and how common the health problems were. All VMCs said that the farmers could treat with antibiotics without consulting a veterinarian first.

### ***Investment cost, financing and operation cost***

The investment cost for the different VMCs ranges between 150 000 and 4 000 000 Yuan for building and between 25 000 and 1 000 000 for the equipment (Table 5). For seven of the 16 VMCs a loan for some of the investments had been taken. 1 Yuan  $\approx$  0.955 SEK, 7.198 Yuan  $\approx$  1 Dollar and 9.023 Yuan  $\approx$  1 Euro (2006-03-20).

Table 5. Approximate cost (Yuan) for building and equipment. The table also shows who the financer was and if loan was taken

<b>VMC no</b>	<b>Approx. cost for building</b>	<b>Approx. cost for equipment</b>	<b>Financer</b>	<b>Loan</b>
1	600 000	165 000	Private	20 000
2	4 000 000	1 000 000	Dairy (51%) and town	-
3	5 000 000	300 000	Private	400 000
4	1 800 000	25 000	Cooperative	-
5	1 000 000	200 000	Private	100 000
6	6 000 000	800 000	Private	3 500 000
7	250 000	300 000	Private	500 000
8	2 000 000	**	Private	-
9	2 000 000	400 000	Private	-
10	*	*	Cooperative	-
11	150 000	170 000	Cooperative	300 000
12	250 000	230 000	Private and Dairy	-
13	300 000	155 000	Private and Dairy	155 000
14	150 000	150 000	Private	-
15	1 000 000	400 000	Dairy	-
16	2 000 000	160 000	Dairy	-

\*Number is missing

\*\*Cost for building includes the equipment

The annual operation cost for the VMCs varied between 57 800 (VMC 14) and 410 370 Yuan (VMC 2) with an average of 184 500 Yuan per year. The different costs are presented in Table 6.

Table 6. Shows the annual operation costs (Yuan) for the different VMCs

<b>VMC no</b>	<b>Salaries (month)</b>	<b>Power costs (month)</b>	<b>Cost for fuel (month)</b>	<b>Cost for detergent (year)</b>	<b>Other costs (year)</b>
1	11 000	2 400	19 950	5 400	1 500
2	15 000	8 335	9 000	15 000	7 350
3	6 700	2 600	4 200	5 000	0
4	6 000	3 000	3 000	*	0
5	6 000	2 000	*	5 760	8 000
6	6 000	6 000	10 000	5 760	12 500
7	7 000	4 000	1 050	8 400	1 000
8	15 000	7 000	2 600	5 000	30 000
9	10 000	4 000	6 000	4 800	18 000
10	5 000	2 000	840	4 530	6 500
11	2 100	1 100	340	4 200	15 000
12	3 000	2 000	1 000	2 000	4 200
13	920	2 750	1 500	3 400	5 000
14	1 700	1 000	1 200	5 500	5 500
15	2 000	1 500	1 250	6 000	2 000
16	16 000	4 000	2 400	1 440	0

\*Number is missing

The VMCs were paid differently depending on which dairy processor the milk was sent to and depending on milk quality and quantity (Table 7). The farmers always got the same price from the dairy processors except for VMC 16 where the farmers got paid depending on milk quality, 1.81 was the base price and they could get up to 0.06 Yuan more per litre depending on the milk quality. For the farmers at VMC 8 they got more money per litre milk from the VMC if they delivered much milk.

Table 7. Average price (Yuan) paid litre milk

<b>VMC no</b>	<b>Average price paid/litre milk to farmer</b>	<b>Average price paid/litre milk to VMC</b>
1	1.62	0.22
2	1.62	0.23
3	1.62	0.20
4	1.66	0.23
5	1.62	0.17
6	1.62	0.22
7	1.62	0.23
8	1.64	0.18
9	1.66	0.23
10	1.76	0.18
11	1.76	0.12
12	1.76	0.22
13	1.76	0.22
14	1.76	0.20
15	1.76	*
16	1.81	*

\*Dairy owns the VMC

### **Milk quality**

During the study SCC tests from all VMCs were taken. The SCC result is shown in Table 8. The SCC result shows that there were problems with udder health within the herds.



*Tests with the DCC during the visits. Many farmers were interested in the DCC and how it works.  
Photographer M-L Främling*

The best SCC result for the study was 211 000/ml and the worst was 4 971 000/ml. Average for the SCC were 1 455 000/ml and median 1 075 000/ml. (To read the SCC result for all places visited see Appendix 5.)

Table 8. The SCC result for the VMCs.

<b>VMC</b>	<b>SCC/ml Test 1</b>	<b>SCC/ml Test 2</b>
1a	3 399 000	3 401 000
1b*	1 874 000	1 755 000
2	1 700 000	1 725 000
3a	345 000	394 000
3b**	544 000	613 000
4	2 259 000	2 032 000
5a	963 000	950 000
5b**	307 000	451 000
6	211 000	267 000
7	711 000	646 000
8a	1 462 000	1 282 000
8b***	2 375 000	2 252 000
9	1 069 000	1 082 000
10	815 000	773 000
11	883 000	813 000
12	4 971 000	3 593 000
13	1 414 000	1 043 000
14	1 047 000	1 102 000
15	1 968 000	1 969 000
16	616 000	611 000

\*The test was done in two different parlours.

\*\*The result was from cows milked by hand and the farmers carry the milk to the centre.

\*\*\*The tests were done two days after each other.

In Figure 9 the numbers of lactating cows per VMC were compared to the SCC result and the figure shows that the more cows the lower the SCC result was except for the VMC with 1000 cows. The result for the big VMC (VMC 1) was not really true because there were five different VMCs in this VMC and there were about 200 lactating cows per VMC.

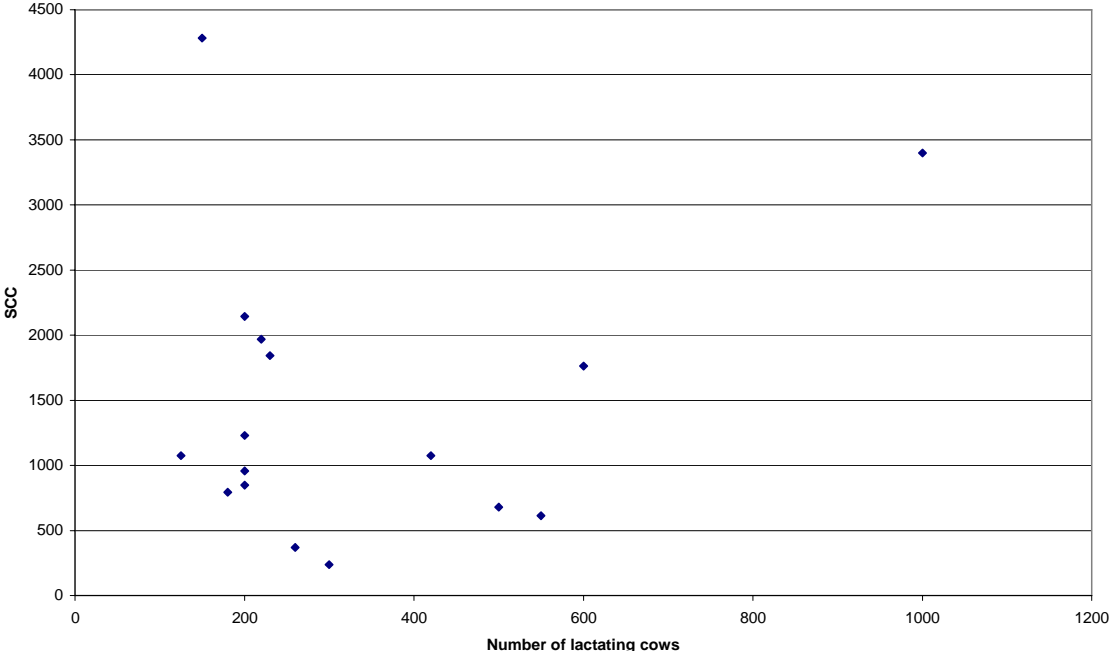


Figure 9. The milk SCC/ml milk x 1000 result for each VMC compared with the number of lactating cows at the VMC

There were no differences in SCC according to the number of times the cows were milked; the education of the manager/owner; the kind of ownership of the VMC; if the manager/owner had taken courses or not for managing the VMC; the age of the VMC; dairy processor or city.

There were two different TBC-tests made. One test was made in Hebei and one test was made in Hohhot. The result for the TBC test made in Hebei is presented in Table 9 and the result for the TBC test in Hohhot is presented in Table 10. The TBC test made in Hebei was made at VMC 8. The TBC test in Hohhot was made after the study and was done at a VMC not participating in the study.

Table 9. The result for TBC test made in Hebei 2005-06-21 & 22

	<b>Before Cleaning (no of bacteria)</b>	<b>After cleaning (no of bacteria)</b>
Beginning of milking	120 000/ml	78 000/ml
After milking	180 000/ml	78 000/ml
At delivery	215 000/ml	81 000/ml
At Dairy processor	230 000/ml	85 000/ml

During the cleaning of the parlour in Hebei the manager decided that the farmers were not allowed to do the second milking that day and the result of that can be seen in Table 8 (SCC result 8a compared to 8b).



Table 10. The result for TBC test made in TBC test Hohhot 2005-07-08, it shows how many hours before colour of test disappeared and approximate number of TBC.

	<b>Before Cleaning</b>	<b>After cleaning</b>
Beginning of milking	3,5 h $\approx$ 1 000 000/ml	5 h $<$ 500 000/ml
After milking	3,5 h $\approx$ 1 000 000/ml	5 h $<$ 500 000/ml
At delivery	3 h $\approx$ 1 000 000/ml	4 h $\approx$ 1 000 000/ml
At Dairy processor	1,5 h $\approx$ 4 000 000/ml	3 h $\approx$ 1 000 000/ml

### **Future**

All of the VMCs believed in a good future with rapid development for the VMCs. There were still farmers' hand milking and they will have to join a VMC in the future if they want to continue as dairy farmers. More farmers want to have dairy cows. The VMC concept was decided by the government and the government together with the dairy processors will decide what the future looks like for the VMCs.

Many of the managers/owners believed in more VMCs and bigger VMCs. Some of the managers/owners said that the land agreement were a problem for their VMC to develop.

Changes/improvements desirable for the future were; more and bigger VMCs, more cows per centre, more milk per cow and milk quality improvement.

The largest challenges for the future were the unfair competition and that the future depends on the dairy processors decisions, land agreement with the government and milk yield improvement, bad milk price and milk quality improvement.

### **Manager**

#### **Personal information**

The 16 interviewed managers/owners in this study were between 20 and 56 years of age, with an average of 39.4 years and a median of 41 years. 12 (75%) of the interviewed managers/owners were men and 4 (25%) were women. 15 (94%) of them were married and one was not married. 9 (56.3%) of the interviewed managers/owners live in Hebei and 7 (43.8%) in Hohhot.



*During milking. The managers write down how much milk each cow give and in the end of the month the farmers get their money for the milk. Photographer M-L Främling*



### ***Work experience***

One (6.3%) of the managers/owners had grown up on a dairy farm, two (12.5%) of them had owned and managed dairy cows and three (18.8%) of them still had own dairy cows. Four (25%) of them had managed the VMC less than one year and the other 12 (75%) had managed the VMC between one and five years.

10 (62.5%) of the managers/owners worked for a company before they started at the VMC, two (12.5%) have had other own business, two (12.5%) worked with dairy cows and two (12.5%) had no earlier work experience.

### ***Educational background***

In this study, four (25%) of the managers/owners had primary education, nine (56.3%) secondary education, one (6.3%) High school or College and two (12.5%) had University education.

Seven (43.8%) of the managers/owners had taken courses for managing the VMC. The courses were about technical equipment, management, feeding and diseases. Ten (62.5%) of the managers/owners organized courses at the VMC for the farmers. The courses were about herd management, health, breeding, feeding and diseases.

The manager/owners got paid under three different conditions. Eight (50%) of them got paid independent of milk yield and quality, five (31.3%) got paid depending on milk quality, two (12.5%) of them got paid depending on milk yield and one (6.3%) got paid depending on both yield and quality.

## **Farmer**

### ***Personal information***

Of the 67 interviewed farmers the age was between 23 and 62 years, with an average of 40.4 years and a median of 40 years. 64 (96%) of them were married, two not married and one widower. 35 (52%) of the interviewed farmers lived in Hebei and 32 (48%) in Hohhot and both in Hebei and Hohhot the majority of the farmers were men (Figure 10).

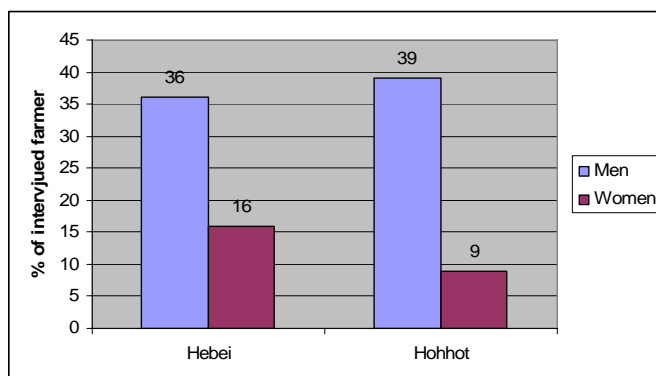


Figure 10. Percent men and women of the interviewed farmers in Hebei and Hohhot.

### ***Household composition***

The number of persons in each household for the interviewed farmers ranged from two to six persons with an average of 4.0. The number of generations living in the households ranged from one to three, with an average of 2.1.

### Work experience

The farmers work experience with dairy cows ranged from less than one year to more than 20 years (Figure 11).

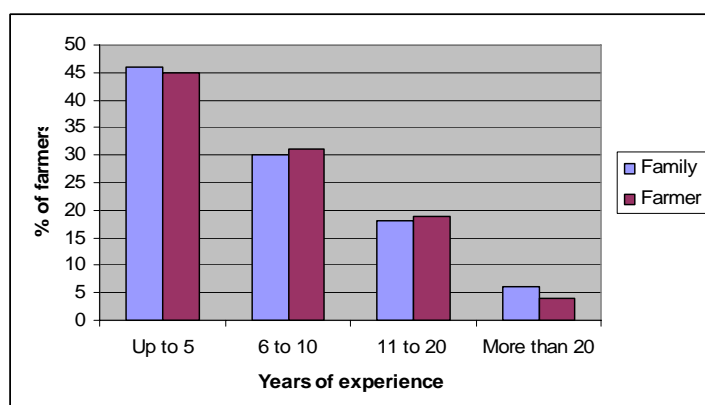


Figure 11. The families and the farmers work experience in years from dairy cows

There were no differences in the total number of cows depending on how long time the farmer and/or the family have had dairy cows. One tendency was that a larger share of the farmers that have had dairy cows for 6-10 years had more lactating cows than the farmers that have had dairy cows longer or shorter time. The tendency has the  $\chi^2$ -value of 7.4 and the probability 0.12. There were no similar tendencies for the heifers and dry cows.



One farmer in Hebei waiting for his turn to milk his cow. One farmer in Hohhot checking his cows during the day. Photographer M-L Främling

### Educational background

Four percent of the farmers had no education, while the rest of the farmers had education from primary education up to University education (Table 11).

Table 11. Number of farmer and percent of the farmers with different educational background.

Education	No. of farmers	% of farmers
No education	3	4
Primary school	22	33
Secondary school	36	54
High school/College	4	6
University	2	3

There was a tendency ( $p= 0.12$ ) that the farmers with higher education (high school or more) had a larger total number of animals. Farmers with primary or secondary school had a higher number of lactating cows, ( $p<0.05$ ). There were no relation between education and the number of heifers.

The connection between education and size of farm were significant ( $p<0.01$ ). Farmers with secondary school had more land than farmers with other education.

There were no differences between the education of the farmers and if they had a written agreement with the VMC or dairy processor.

The farmers with high education milked their cows at VMCs with more services than farmers with lower education. The connection was significant with a Chi<sup>2</sup>-value of 7.3 and  $p<0.05$ . There were no connection between the education of the farmer and if he/she wanted to develop the services.

### ***Farm composition***

In the study there were 22 farmers who didn't have any land or own feed production. The other 45 farmers had forage production, crop production or both (Table 12 and 13)

Table 12. Numbers of farmers with/without crop and/or forage production.

<b>Feed production</b>	<b>No. of farms</b>	<b>% of farms</b>
No own feed production	22	33
Crop production	32	48
Forage production	7	10
Both crop and forage	6	9

Table 13. The sizes and number of farms in hectares (ha).

<b>Size of the farm (ha)</b>	<b>No. of farms</b>	<b>% of farms</b>
No land	22	33
≤ 1	27	40
1.1-5	16	24
5.1<	2	3

There was a strong connection between the feed production and the number of cows. The more feed production the fewer cows the farmers had. The farmers with no own feed production had the biggest herds. The connection was significant and with a Chi<sup>2</sup>-value of 9.7 and  $p<0.01$ . The connection was seen for all different cow groups, heifers  $p<0.01$  and lactating cows  $p<0.05$ . The connection was seen for the size of the farm as well. The more land the farmer had the fewer cows. The farmers with the biggest herds had no land; the connection was significant,  $p<0.05$ .

For the farms that participated in the study the only animals they earn money from were the dairy cows. Some of the farmers also had a few chicken or a pig but only for household. 100% of the cows in the study were owned by the farmers. Some farmers had taken loans to be able to buy dairy cows.

The total number of dairy cows per farmer varied between 3 and 55 with an average of 18.1 cows and the median of 16 cows. The number of lactating cows varied between one and 27 with an average of 8.6 and the median of seven cows per farmer (Table 14). The trend was

similar in both Hebei and Hohhot (Figure 12). The number of born calves per herd and year ranges between one and 30. The average for born calves per herd was 9.4 and the median 8.

Table 14. The number of cows in different stages, maximum, minimum, average and median are presented.

	Min	Max	Average	Median
Total no. Animals	3	55	18.1	16
Dry cows	0	24	2.9	2
Lactating cows	1	27	8.6	7
Young (heifers)	0	22	6.6	6

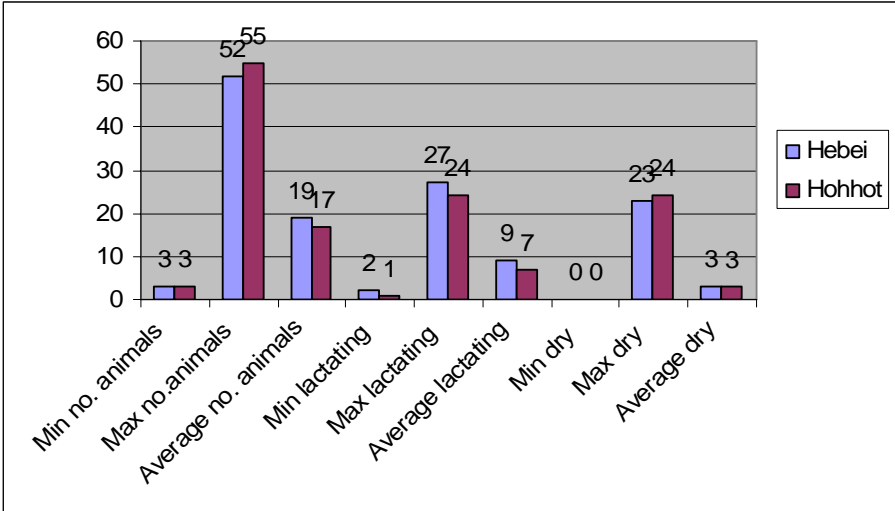


Figure 12. The number of cows in different lactation stages, maximum, minimum and average in the two areas Hebei and Hohhot.

The time the farmers spend on their cows differed depending on how many cows they had. Two (3%) of the farmers spend less than four hours per day on their cows, 17 (25%) farmers spend 5-8 hours per day on their cows and 48 (72%) farmers spend more than eight hours per day on their cows.

**Household income**

For 57 (85%) of the 67 interviewed farmers the milk production was the major source of income. Eight (12%) of the farmers had their major income from off farm employment, one (1.5%) farmer had cattle sale as the major source of income and one (1.5%) had the major income from cash crops. The farmers were paid between 1.62 and 1.87 Yuan per litre milk. In Hebei the farmers were less paid than in Hohhot (Table 15).

Table 15. Number of farmers with different payment per litre milk

Yuan per litre milk	No of farmers in Hebei (% of farmers)	No of farmers in Hohhot (% of farmers)
1.62	23 (34)	-
1.64	1 (1.5)	-
1.66	8 (12)	-
1.68	3 (4.5)	-
1.76	-	30 (45)
1.81	-	1 (1.5)
1.87	-	1 (1.5)

There was no seasonal difference in how much the farmers were paid per litre milk. Four farmers were paid according to the quality of the milk, two of them were paid depending on the fat and protein content and the last two depending on the SCC. The other 53 farmers were not paid depending on the quality. Five farmers (from the same VMC) were paid different prices per litre milk depending on how much they produced.

The cow with the lowest milk production in this study produced 6 litres per day; the cow with the highest milk production produced 50 litres per day. Average for all cows was 18.4 litres and the median of 18 litres. The trend was similar in Hebei and Hohhot (Figure 13). Average milk production per lactation was 4989 litres and the median 5000. The minimum milk production per lactation was 3000 and maximum 7500 (Figure 14). 46 (69%) of the farmers knew what their cows produced per lactation (21 missing answers in Hebei and 2 Hohhot).

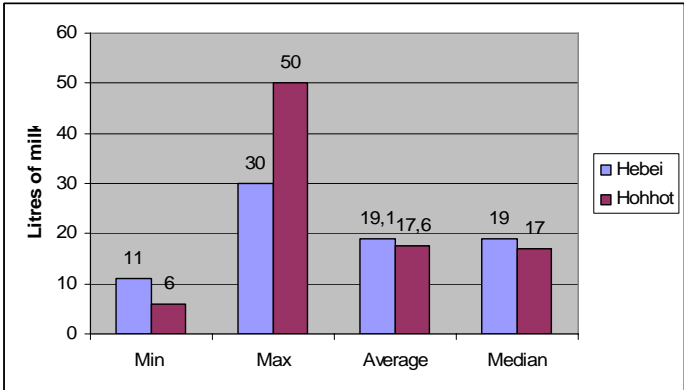


Figure 13. Milk production per cow and day in Hebei and Hohhot.

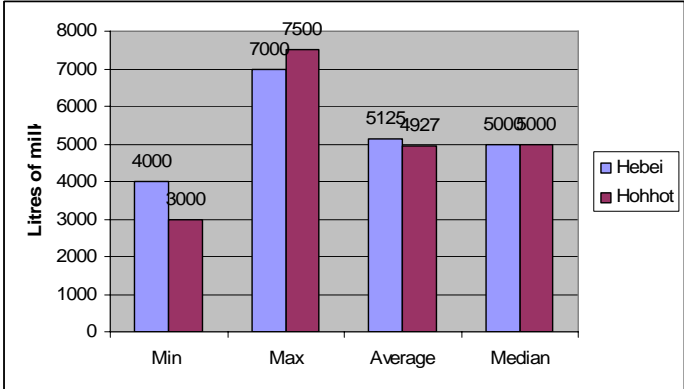


Figure 14. Milk production per lactation in Hebei and Hohhot.

All farmers were paid once a month by the dairy processor. 38 (57%) of the farmers were paid cash and the other 29 (43%) got the money transferred to a bank account.

49 (73%) of the farmers thought that the VMC had changed their economical situation, 13 (19%) thought that they have had no changes and five (8%) couldn't answer (Table 16).

Table 16. Different economical changes for the farmers since joining the VMC.

	<b>No. of farmers</b>	<b>% of farmers</b>
Higher income	23	34
A more safe income	16	24
More regular income	10	15
No change	13	19
Can not answer	5	8

### **Relation to VMC**

44 (66%) of the farmers joined the VMC from the beginning when it first started, 23 (34%) joined the VMC after it had started. All farmers in the study joined the VMC between 2001 and 2004 (Figure 15). Notably was that year 2003 36% joined the VMC but only 21% year 2004.

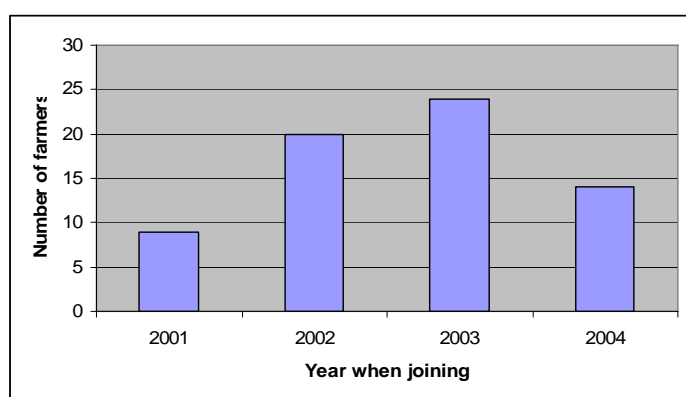


Figure 15. Year when the farmers joined their VMC

The farmers found out about the prospect of joining the VMC in four different ways. Most of them heard about the prospect from another farmer or from the village, but rather few heard about it from the dairy or the VMC (Table 17).

Table 17. Number and share of how the farmers heard about the VMC prospect.

	<b>No. of farmers</b>	<b>% of farmers</b>
From another farmer	40	60
From the dairy	6	9
From the village	15	22
From the VMC	5	7.5
Didn't know	1	1.5

The different reasons for the farmers to sign up at the VMC were; first dairy processor decision and second economical reason (Table 18).

Table 18. The main reason for the farmer to sign up at the VMC.

	<b>No. of farmers</b>	<b>% of farmers</b>
Dairy processor decision	23	34
Economical	20	30
Less work	10	15
Safe and regular income	8	12
Didn't answer	6	9

### ***Services at the VMC***

The answers about the different services were very different depending on whether it was the farmer or manager/owner who answered. The result from what the farmers answered is shown in Table 19.

Table 19. Numbers of VMC with the service and numbers of farmers that could use the service and numbers of farmers that used the service.

<b>Service</b>	<b>No. of VMC's with the service*</b>	<b>No of farmers that can use the service</b>	<b>No of farmers using the service*</b>
Training/education	4	14	9
Feed	6	21	11
Breeding (AI)	7	28	17
Seed	2	7	0
Veterinary	6	23	18

\* Some of the farmers didn't agree with the manager that there was a service, this farmers have answered that they didn't use the service.

The number of farmers who wanted the services to be developed further is shown in Table 20.

Table 20. Farmers that wanted to develop the different services further.

<b>Service</b>	<b>No. of farmers</b>	<b>% of farmers</b>
Training/education	15	22.4
Feed	17	25.4
Breeding (AI)	20	29.9
Seed	6	9
Veterinary	16	23.9

### ***Changes since joining VMC***

More than 50% of farmers had achieved changes in their milk production since they joined the VMC. The greatest changes were less work and safer and more regular income (Table 21). There were 55 of the 67 farmers who answered this question.

Table 21. Number of farmers who said that they have had the different changes listed in the questionnaire

<b>Change</b>	<b>No of farmers</b>	<b>% of farmers</b>
Less work	49	73.1
Safer more regular income	36	53.7
More money per litre milk	27	40.3
Improved knowledge about dairy	19	28.4
Improved standard of living	15	22.4
More milk produced	14	20.9
Healthier cows	14	20.9

### ***Courses at the VMC***

45 (67.2%) of the farmers had participated in courses at the VMC and 50 (74.6%) of the farmers wanted to participate in courses. Courses that the farmers wanted to participate in were about feed/feeding, breed/breeding, milk quality, herd management, cow health and medication for cows. Diseases and illness were of big interest to the farmers and they wanted to learn more about these items. There were no relations between the levels of education of the farmer and if they have taken courses or if they wanted to take courses for the VMC.

### **Agreement**

50% of the farmers had no agreement with the VMC (Table 22). The farmers with an agreement with the Dairy processor had taken a loan from the processor when they bought their cow/cows. When the farmer had paid back the loan he/she is free to deliver the milk to any Dairy processor.

Table 22. Number of farmers with and without agreement with the VMC

	<b>No. of farmers</b>	<b>% of farmers</b>
No agreement	34	50.7
Written agreement	14	20.9
Agreement with dairy processor*	19	28.4

\* The farmers who had taken loan from the dairy processor had an agreement with it

### **Feed/Feeding**

More than 80% of the interviewed farmers gave their cows silage as roughage (Table 23). Other kinds of roughage that the farmers gave to their cows were green chop, hay and straw.



The photo to the left show how the farmers normally kept their silage and the photo to the right show how corn straw could look like before it were shopped. Photographer M-L Främling

Table 23. Different kind of roughage used for the dairy cows

<b>Roughage</b>	<b>No. of farmers</b>	<b>% of farmers</b>
Straw	14	20.9
Hay	32	47.8
Silage	55	82.1
Green chop	34	50.7

There were some differences in what kind of roughage the farmers in Hebei and Hohhot fed their cows with (Figure 16). There were many more farmers in Hohhot that gave their cows hay compared to farmers in Hebei.



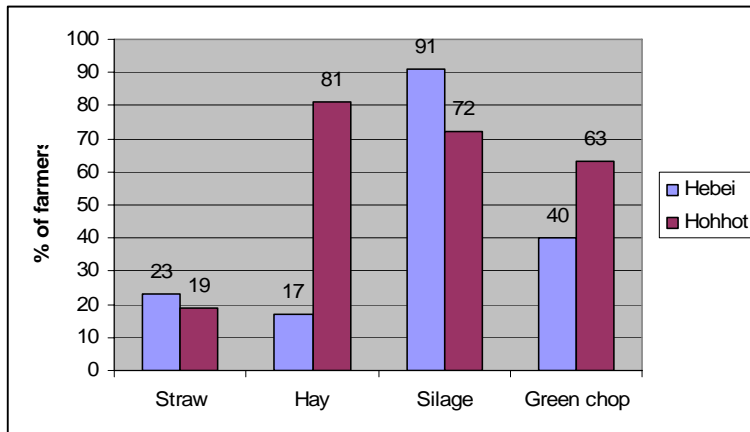


Figure 16. Show in % how many of the farmers in Hebei and Hohhot who give their cows' straw, hay, silage and green chop.

75% of the farmers gave the cows “ready mix” as concentrate (Table 24). Most of the farmers that gave their cows' ready mix gave their cows other kinds of concentrates as well mixed in the ready mix. They didn't trust the ready mix to be complete for the cows. The farmers that didn't buy ready mix mixed the concentrates themselves.

Table 24. Different kind of concentrates given to the dairy cows

Concentrate	No. of farmers	% of farmers
Grain corn	48	71.6
Soybean	19	28.4
Cereal	20	29.9
Peanut meal	26	38.8
Cotton seed	7	10.4
Ready mix	50	74.6
Minerals	20	29.9

63 (94%) of the farmers fed their cows three times a day and two (3%) of the farmers gave their cows free access of forage and two farmers fed their cows twice a day. There seemed to be very little seasonal difference in what the farmers fed their cows with except for the green chop (alfalfa). 46 (68.7%) of the farmers gave their cows free access of water and the rest of the farmers gave their cows water three times a day, before or after the feed.

Farmers with larger herds (more than ten cows) had free access of water to their cows to a greater extent than farmers with smaller herds. Farmers with smaller herds gave their cows' water three times a day to a greater extent than farmers with bigger herds. This connection was significant ( $p < 0.005$ ). There were no differences in milk production whether they had free access of water or were given water three times a day.

Farmers with more than 22 cows gave their cows more often straw ( $p < 0.01$ ) than farmers with fewer cows. Farmers with fewer cows gave their cows more often hay ( $p < 0.01$ ) than farmers with more cows. Farmers with more cows gave their cows more often silage ( $p < 0.01$ ). There was no difference in how the farmers feed green chop.

The more heifers the farmers had the more often they fed with straw ( $p < 0.001$ ). However if the farmers had fewer heifers they fed them with hay ( $p < 0.01$ ).

Farmers with few cows seemed to feed more often with corn grain than farmers with more cows ( $p=0.058$ ). Farmers with bigger herds seemed to give their cows minerals to a bigger extent. There was no other difference concerning the concentrates. There were no differences in milk production according to what kind of feed the cows were fed.

### ***Breed/Breeding***

All farmers in the interview had Holstein cows or crosses between Holstein and other breeds. In this study there were 100% Artificial insemination (AI) used, no one of the farmers used own bull. The semen was from imported bulls. The bulls were imported from US, Canada, Australia and New Zealand. All bull calves were sold directly after birth; the price they got for the bull calf ranged from 30 to 400 Yuan, with around 300 as most common. (One farmer had bought one young bull to use as a heat detector).



*The photo to the left show some cows tied up outside the village and the photo to the right show some farmers waiting for their turn outside the VMC. Photographer M-L Främling*

The cow ages were between two and seven years, with an average of 4.4 and median of four. Most of the farmers replaced the cow when she was old but if she didn't milk anymore or didn't get pregnant they replaced the cow earlier. Most of the farmers wanted to replace bad cows but not all of them could do that due to economical reason. The number of calves per cow ranged between one and four with an average of 2.5 and a median of 2.

There were five different causes of calf death in the herds. Five farmers have had one calf each that died from diarrhoea. One farmer has had one calf with pneumonia and 10 farmers have had problem with abortions/died during calving, two farmers have had calves with foot and mouth disease. One farmer has had one calf that got too much medication and died therefore.

There were two out of the 67 farmers who let the calf suckle the mother; the other 65 farmers gave their calves' milk for two to four month, usually two months during summer and four during winter. The heifer was usually  $\leq 2.5$  year at calving but for nine (13.4%) farmers their heifers were 2.5-4 years at calving. Eleven (16.4%) of the farmers milked their cows for 6-8 months, 32 (47.8%) milked their cows for 8-10 months and 24 (35.8%) of the farmers milked their cows  $\geq 10$  months. For 64 (95.5%) of the 67 different herds the cow usually became pregnant again within three months after calving. For three (4.5%) of the herds the cow became pregnant again within 3-6 months after calving. 26 (38.8%) of the herds had calving problems, Table 25 show the different kind of calving problems the farmers claimed their cows to have. Normally there were one to seven people to help the cow/heifer with her calving, most common seem to be two to three people. The different fertility problem some

farmers claimed they had was problem to get the cow pregnant again, abortion virus and uterus problems.

Table 25. Different kind of calving problem

<b>Calving problem</b>	<b>No. of farmers with problem</b>	<b>% of farmers</b>
To big calf	9	13.5
Wrong position	6	9
Retention of placenta	5	7.5
Paresis/milk fever	5	7.5
Fertility problem	4	6
Born too early	1	1.5
Stillbirth	1	1.5

### ***Cow health***

In the interview one question about different kinds of health problems was asked. 60 of the 67 farmers thought mastitis was a problem for them. One farmer had not had any kind of health problem that was asked for in his herd. All farmers who said they have had problems with Worms/Lice/Flea treated the cows for it. The numbers of farmers with different kind of health problem in their herds are shown in Table 26.

Table 26. Different kind of health problem reported by the farmer

<b>Health problem</b>	<b>No. of farmers with problem</b>	<b>% of farmers with problem</b>
Mastitis	60	89.6
Worms/Lice/Flea (treat)	41	61.2
Stomach disturbances	28	41.8
Leg/h hoof problem	9	13
Decreased fertility	9	13.4
Injured udder	7	10
Underfed/Starving	5	7.5
Milk fever	5	7.5
Retention of placenta	3	4.5
Other*	4	6

\* Three foot and mouth disease and one hardware disease.

For the group of cows with stomach disturbances almost all of them were fed with silage (only two not fed with silage). The tendency that the cows with stomach problems were fed with silage had the probability 0.052. There seem to be no other connections depending on which type of feed the cows were given.

The farmer was also asked if the cow health had changed since they joined the VMC. 39 of the 67 farmers had not noticed any change. 14 thought the cow health had been worse; they had got more diseases especially mastitis since joining the VMC. Four thought the cow health had been better since they joined the VMC and ten couldn't answer because they didn't had cows before joining the VMC (Table 27).

Table 27. The farmers opinion how the cow health had changed since he/she joined the VMC.

<b>Change</b>	<b>No. of farmers</b>	<b>% of farmers</b>
No change	39	58
Worse	14	21
Better	4	6
Can not answer	10	15

### ***Future***

42 (62.7%) of the farmers wanted to increase the number of cows in the future if it was possible. 57 (85.1%) thought that it was possible to increase the amount of milk per cow. Some of the other ten who didn't think it was possible to increase the amount of milk per cow had tried with medication that didn't work. 52 of the farmers thought that they could increase the amount of milk with better breeds and/or better feed and some of them also mentioned better herd management. One farmer thought he could increase the amount of milk if he gives the cows some medicine and eleven of the farmers think that it is possible to increase the amount of milk but they didn't know how.

59 (88.1%) of the farmers were sure that they will continue to deliver milk to the VMC in 2-5 years, three (4.5%) don't think they will continue to deliver milk and 5 (7.5%) say that it depends on milk and feed price if they will continue to deliver milk.

Most farmers wanted to have healthier and more cows in the future. Many farmers wanted to sell bad cows and buy better ones. One farmer wants to build his own VMC.



*Maybe these kids will be the futures dairy farmers in China. Photographer M-L Främling*

## Dairy processor

### *Dairy Processor Information – Sanlu in Hebei and Mengniu in Hohhot*

The numbers of VMCs, MCCs (milk collecting centres) and farms that were connected to the two dairy processors are shown in Table 28. The average milk collected for the dairy processors are shown in Table 29. Table 30 show when the dairy processors collected most and least amount of milk and Table 31 show how much they paid for the milk.

Table 28. Number of VMCs, MCCs and farms connected to the dairy processor

Dairy Processor	No of VMCs	No of MCCs	No of private farms/state farms	Year when first VMC joined dairy
Sanlu	170	30	8/2	1998
Mengniu	<600*	0	**	**

\* >3000 in whole China

\*\* Number is missing

Table 29. Milk collected from VMCs, MCCs and farms

Dairy Processor	Average milk collected from VMC (ton/day)	Average milk collected from MCC (ton/day)	Average milk collected from farms (ton/day)
Sanlu	375	60	27.5
Mengniu	165	0	835

Table 30. Months when the dairy processor collects most and least amount of milk per day

Dairy Processor	Month when collects most	Month when collects least
Sanlu	September	January
Mengniu	February-July	July-August

Table 31. Price paid for the milk

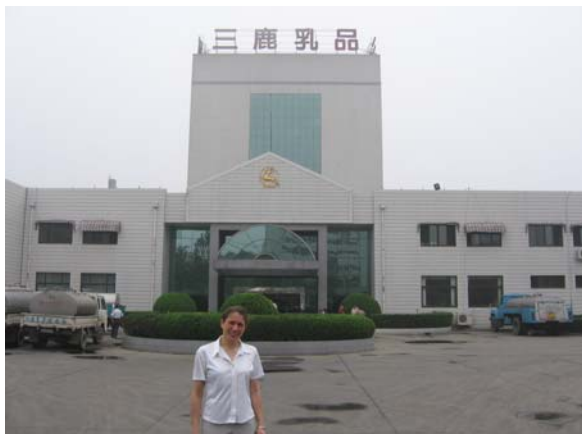
Dairy Processor	Max price paid to farmer	Price paid to VMC	Quality payment system
Sanlu	1.62	0.23	Yes*
Mengniu	1.76	0.22	Yes*

\*The quality payment system is explained later in the result

### *Sanlu Dairy*

Sanlu was privately owned, joint stock Company. Sanlu didn't own any VMCs themselves. The dairy claimed to have a quality payment system to the VMC and they check fat, protein, total solids, bacteria and acidity. All milk delivered to the dairy was cooled down before delivery.

Sanlu had a written agreement with the VMCs it included the price, milk quality, transport of the milk from farmer to dairy processor, how Sanlu paid the farmer, tests of the milk, Sanlu's duty to farmer, farmers duty to Sanlu and what happens if the agreement breaks. Everything worked well with the agreement. The agreement was changed every year, depending on what happened. There were possibilities for the VMC to sign off their membership. Some parts of the agreement were translated and are shown in Appendix 7.



*SanLu. Photographer Anders Fagerberg and M-L Främling*

When it was bad milk quality or epidemic diseases Sanlu could exclude the VMC from delivering their milk. If they noticed different medical residues in the milk they didn't take the milk. They examine the milk before they received it. They check Sodium bicarbonate ( $\text{Na}_2\text{CO}_3$ ). The government had rules for the VMCs about hygiene, food safety and cow health. The buildings had to follow sanitary rules and the VMC will get a certificate from the government. The rules will be checked every year and if the VMC didn't follow the rules it had to close.

In the beginning of every year Sanlu decided how much milk the VMC could deliver to them and if the VMC grows the dairy send some people out to decide if they should take the milk. Sanlu organized courses for the VMC's managers and farmers about herd management, technical facilities, milk quality, microbiology, feeding and breeding.

The changes that had been the results since the VMC started were more milk collected; better milk quality; change in cost and work for collection; safer and more regular deliveries; safer dairy products and improved knowledge about relation with milk producers.

There were no balance between supply and demand for milk; the demand was bigger so they want more milk.

The estimation of the future development by Sanlu was slow, but it was hard to tell. The VMC development and long-term prospect follow Sanlu's development. Bigger farms instead of VMCs were the changes/improvements that Sanlu regard as desirable for a successful future. MCC will disappear in the future.

The largest challenge facing the future for Sanlu was the unfair competition between different dairy processors. The largest challenge for the future for the VMCs was the same as for Sanlu. Sanlu will process more than 50% more milk in five years and 80% of that will probably come from VMCs. To speed up the milk production from the VMCs Sanlu helped them to buy cheaper milking equipment.



### ***Mengniu Dairy***

The dairy didn't own any VMCs itself. The dairy claimed to have a quality payment system to the VMC and they checked fat, protein, dry matter, bacteria and acidity. All milk delivered to the dairy was cooled down before delivery.



*Mengniu in Hohhot. Photographer M-L Främling*

For VMCs who wanted to sign up to deliver milk to Mengniu today the VMCs had to contact Mengniu and then before they signed any contract they had a negotiation. If people at Mengniu found an old VMC delivering to a competitor they asked them to deliver milk to them. Farmers could borrow money from Mengniu to buy cows and then they will have an agreement with Mengniu. When the farmers had paid all money back they didn't have an agreement anymore. The agreements were from one to ten years. There were no problems associated with the current agreement. They had just changed the agreement so it will take a while before they change it again. Some parts of the agreement with the VMC were translated and are shown in Appendix 8.

There were many points in the agreement. If the VMC wanted to deliver the milk to another dairy they had to meet that situation when it's happened. There were no possibilities for the dairy to exclude VMCs. They helped them to solve their problems. They involved experts on the particular areas to help the VMCs. At least once a month Mengniu arranged courses for the VMCs. The courses were about milk quality, microbiology, and feeding and udder health.

The changes that had been the result since VMC started were more milk collected; better milk quality; safer and more regular deliveries; safer dairy products; improved knowledge about and relations with milk producers and better economy for farmers.

There was no balance between supply and demand for milk. The demand was bigger. They wanted to try to introduce different payment system to be able to produce the same amount of milk all year around.

If they notice any medical residues in the milk they throw the milk away and they investigate what the problem was at the VMC.

The estimation of the development and long-term prospect of this dairy will be rapid and positive. The estimation of the development and long-term prospect of VMC will be slower and more stagnant. The VMC must be replaced by bigger farms.

For the dairy following changes/improvements in the VMC system would be desirable; more cows per farmer, milk quality improvement and “Farm gardens” instead of VMCs (same feed and controlled breeding).

The largest challenge for Mengniu was the competition with other dairy processors; more and more foreign products and more people knew more about food quality. The dairy processor will produce about 50% more liquid milk in five years and of that increase less and less will come from VMCs.

### **Thoughts from the servicemen**

During the study the servicemen were asked what they think about VMC as a concept and what they think is desirable for the future. Five servicemen were asked what they think about the concept of VMC and they are listed in the order they were asked about the VMCs.

#### ***Serviceman 1 and 2***

VMCs are no good for the farmers. They should have it better by themselves. The VMCs have big problems with hygiene and the managers don't often own any cows themselves and because of that they don't care so much about the cows as they should. The owners don't care much about quality; they just want to keep their costs as low as possible to get higher income. They don't change rubber etc until it is broken and they don't listen to what we tell them and as long as the dairy processors don't pay them after quality they don't need to change. The dairy processor should have a quality payment system for the VMC and they will have to change their mind and understand how important it is to take care of the milking machines. They should care more about the cow health as well if they noticed that they will earn money on that. The knowledge the managers have about dairy farming is too little. It doesn't help if we explain to the farmers how to do it if the managers don't want to change. For the future there should be bigger farms instead of VMCs.

#### ***Serviceman 3***

The farmers don't know how to feed their cows but the dairy want them to produce quality milk. It is not possible when the quality of the feed is not good. There are no cobs left in the silage in this area. Feed prices are higher and higher and the farmers have problem to afford it. The farmers and the VMCs have it difficult to get good profit from the cows, much depending on bad feed, and they will have a hard time to survive. It is also hard for the VMC to manage the cows when they belong to the farmers. He knows that it is common in this area that the managers add water and milk powder to the milk. Sometimes the dairy processor tests the milk but it is not always they will notice. He thinks the VMCs will decrease in number but there will be bigger ones instead and it will be more farms.

#### ***Serviceman 4***

He thinks the VMC system should be replaced in a few years. The VMCs provide too little service to the farmers and in the present situation the farmers will not change their mind about farming as they should. The health problem is going to be bigger and bigger until the dairy processors decide to do anything about it. If the dairy processors started to test for example SCC nearly no VMCs should be able to deliver any milk. The VMCs should develop to bigger farms instead. Big farms in Beijing are a good example.



### ***Servicemen 5***

VMC is just a step to big farms. VMCs are not good for the future and they have to develop to big farms because it is no good when the owner/manager earn the money. The farmers want to earn the money themselves. Farm garden is good when the dairy processor is the owner, but in future it is not possible for them to invest in a lot of Farm gardens. The only way is bigger farms.

### **Discussion**

It was difficult to make an interview study in China depending on the cultural differences and through that communication problem. Before the visit in China there were some problems. The questionnaires were sent to the contacts in China in advance and they wrote back that everything was very good but at the first day in China it was clear that no one had really understood what this study was about and why it was to be done.

Given the cultural difference and the short time period and number of interviews, it is very difficult to build the necessary confidence required to get the true answers in all situations. This was the first time ever a field study and farmer interviews were made and thus it will give a unique result even if the uncertainty may be considerable in many areas. The concept of loss of face is practically unknown in Europe but is a cultural reality in China and will always require considerations to obtain good results.

The language barrier was another complication. Someone good in both languages usually lack experience and understanding in dairy farming, while someone knowing the farm side like the DeLaval servicemen lack the deeper knowledge in English required to avoid misunderstandings or mistakes. The preparations with DeLaval's local organisation could have been better. Translations and tests of the interview forms should have been done in advance. The field work could also have been prepared more thoroughly in advance.

People were very nice and friendly but they didn't always answer the questions truly. If the manager was with us during the interview they seemed to answer what they thought he wanted and sometimes they let him answer the question; the answers that I got differ a lot depending on who was asked and who was participating during the interview. In the questions about services the different answers express this problem very clear. If the manager was with us during the interview the farmers answered one thing and if the farmer was alone he answered another thing. I often got the feeling that the person interviewed often answered depending on what he thought the manager, I or someone else wanted to hear. For this reason I don't trust my result totally. The rural population is not exposed to so many contacts with Europeans so it is understandable that they tend to answer what they believe you want to hear or know is a good answer.

When we asked question about the economy it was really hard to get an answer at all. They didn't want anyone to know about their economy.

Some questions was not asked if I didn't remind the translator, the same for all three translators and I think these kind of questions was not of the kind you ask another person in China but no one wanted to tell me that.

If I compare what I saw and what the managers answered it could differ very much. All manager/owners answered that they used detergent but very often I couldn't find the detergent

anywhere. And if they knew that I was looking while they were milking, they for example cleaned the udder very well, but when they thought I looked in another direction they didn't do a good job at all. It was the same with the service of the milking equipment. All VMC's told me that they did the service as they had been told, but the servicemen told me that they didn't, they do it when something is broken. The servicemen that I talked to also said that they thought it was a big problem for them when they tell the managers how they should take care of the equipment. Of course this will be a problem when nobody wants to or don't understand why they should do as the people educating them says. And the educators will feel that it is no idea that they even try. This indicates that a quality payment system has to be developed, the sooner the better.

It has been a very fast and recent development of dairy production. Knowledge, tradition and supporting infrastructure is also under fast development. There has not been any tradition among most farmers and managers in dairy production. They don't take milk home to the family for home consumption. They see milk as a trade able commodity and cows as production means. They sell what is bought at best price and lowest cost.

Consumer and consumption are also under rapid development and the consumers will increase their demands on better milk quality. The rapid development is very likely to continue due to the large population. So solutions have to be found.

Farmers that have had dairy cows for six to ten years seem to be the most successful ones. Maybe because they have learnt to take care of their cows, find when the cow is on heat and so on. The farmers that have had dairy cows shorter time still have to learn how to take care of cows in best way and that this is important if they want to earn more money. They can't just see it as a business if they want the cow to get pregnant and give a large amount of milk with good quality.

In this study most of the farmers said that their cows got pregnant again within three months after birth but when I was at the Dutch project they told me that they though one pregnant cow in average have had seven inseminations. But it could be so that I only talked to the best farmers or maybe they didn't know or wanted me to know.

If I looked at the cows health and their feed I though that an average production about 5000 kg per lactation is very high. Maybe I only interviewed the best farmers or maybe they said what they thought I wanted to hear or maybe they guessed. As many as 1/3 of the farmers told me that they didn't know how much their cow produced per lactation, the only thing that interested them was per day.

According to the level of milk SCC the udder health was really bad. They produce bad quality milk at the same time as they get a big production loss. Cows with good udder health produce more milk. The legal level of cell counts in EU is 400 000 SCC/ml if it is for human use (Ole Lind, 2006), this means that it was only three VMCs that could manage that. One of these three tests from VMC that was under 400 000 SCC/ml was from hand milked milk (MCC at the VMC). If a dairy farmer in Sweden want to get full price for his milk the SCC have to be less than 200 000/ml otherwise he gets less paid.

The SCC result for the MCCs had two of the best result of all tests made and this suggests that the udder health was better for hand milked cows. There were too few MCCs visited to compare them with the VMCs. But the cow's mastitis problem at the VMC could be caused

by bad service and cleaning of the equipment and because it is many different herds milking in the VMC and diseases are spread more easily.

Even though the cold chain of the milk have been better since VMC started and the milk should be cooled down directly after milking in a cooling tank the system is still not good enough. Many of the VMCs visited didn't cool the milk enough (it was higher than 4°C); maybe because it was too hot outside (around 40°C) and the cooler couldn't manage it. I observed that the thermometer on the outside of the cooling tank didn't always show a low enough number and sometimes the thermometer didn't work at all so no one knew the right temperature of the milk. This together with no use or very little use of detergent while cleaning the cooling tank after emptying it could be a very effective way of growing lots of bacteria. I also saw one milk truck that was standing fully loaded with milk and waited for long time and it had no cooler; no truck I saw in China had a cooler. The milk in that truck was probably of very bad quality after that with too many bacteria spoiling it.

The climate in China is extremely diverse. In the areas where the study was made they have very cold winter and very hot summer. Shifting weather conditions increase the demands for the equipment to work properly in different conditions.

Something really good though is that since the VMC started it have been a positive change for most of the farmers. They have got better economy and the machines have given them less work.

Something really noticeable is that many of the farmer thought that the health of their cows had been worse since they joined the VMC. Many of them also ask for better possibilities to veterinary help.

There were fewer farmers joining VMCs 2004 – this might depend on that dairy farming is not as attractive anymore maybe because of higher feed prices and that it is more expensive to buy cows/heifers now.

The feed was not always of good quality and this will also be a problem if you want to produce good quality milk. I didn't see any silage with the corn cobs left in it. It is very hard to make good quality corn silage without the cobs; it is too late harvested if the cobs should be harvested first and it will be too little energy left to make a good quality feed.

Dairy farming is a relatively new agricultural activity in China compared too many other countries for example Sweden and India where farmers have had dairy cows for many generations. This is one explanation of some of the problems the Chinese dairy farmers have had and an explanation of the bad milk quality and udder health. In China there is very little tradition in milk production and the dairy processors still haven't built up a working quality payment system yet.

As mentioned in the literature study milk production in China has experienced a large change during the last couple of years. The dairy industry is an important and labour consuming industry. There will also be a large challenge for the dairy industry to develop as fast as needed if the milk consumption continues to increases in the same speed as the last couple of years. And the challenge includes the production of safe milk of high quality from healthy cows.

## **Conclusions**

- The Chinese Dairy processors (together with the government) need to build up a milk quality payment system for the farmers and the VMCs otherwise there will never be any milk quality improvements.
- All involved in dairy farming need education about;
  - Herd management
  - Milk quality
  - Feed/Feed production
  - Diseases
  - Breed/Breeding
- The farmers need help to understand how to keep records and how to use the valuable information of their cows that they already have.

## **Suggestions for future**

- Show the results for all involved to let them what the situation is like.
- It is important to communicate with the Dairy processors.
- Use the servicemen's knowledge and experience about the VMC's and listen to their ideas.
- Include education and service when something is sold.
- Share knowledge with the Agricultural University in Beijing and cooperate with them.

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### Figure

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## **Appendixes**



**VMC INFORMATION TO BE SENT OUT AND TO BE FILLED IN ADVANCE****Survey**

- Question 1: General information  
 Question 2: VMC membership information  
 Question 3: Milk information  
 Question 4: Services and facilities at VMC  
 Question 5: Technical equipment at VMC  
 Question 6: Building  
 Question 7: Cow health  
 Question 8: Investment, Financing and Operation costs

**1. GENERAL INFORMATION**

- 1.1 Name of VMC \_\_\_\_\_  
 1.2 Address \_\_\_\_\_  
 1.3 Telephone no. \_\_\_\_\_  
 1.4 Name of manager \_\_\_\_\_  
 Address and phone no. to manager \_\_\_\_\_  
 1.5 Year of VMC establishment \_\_\_\_\_  
 1.6 Form of VMC ownership:  
 1) Private investor  
 2) Cooperative  
 3) Dairy processor  
 4) Other: \_\_\_\_\_

**2. VMC MEMBERSHIP INFORMATION**

- 2.1 Total no. of active members/producers/households \_\_\_\_\_  
 2.2 Total no. of milking dairy cows connected to the VMC \_\_\_\_\_  
 2.3 Average no. of dairy cows milked daily at VMC \_\_\_\_\_  
 2.4 No. of farmers with:  
 1-3 cows \_\_\_\_\_  
 4-6 cows \_\_\_\_\_  
 7-10 cows \_\_\_\_\_  
 ≥10 cows \_\_\_\_\_  
 2.5 Average herd size \_\_\_\_\_

**3. MILK INFORMATION**

- 3.1 Max capacity of milk tank: \_\_\_\_\_ Litres  
 3.2 Collecting system:  
 Name of dairy who collects the milk \_\_\_\_\_  
 How often is the milk collected?  
 1) Twice daily  
 2) Once a day  
 3) Every second day  
 4) Other: \_\_\_\_\_  
 At what time is the milk collected at VMC \_\_\_\_\_  
 3.3 State seasonal variation:  
 How much is the maximum daily production of milk: \_\_\_\_\_  
 How much is the minimum daily production of milk: \_\_\_\_\_  
 Which month/months do the cows milk most: \_\_\_\_\_  
 Which month/months do the cows milk least: \_\_\_\_\_  
 Other seasonal differences?  
 \_\_\_\_\_

**4. SERVICES AND FACILITIES AT VMC**

## 4.1 Services provided at VMC:

- Veterinary Services \_\_\_\_\_
- Animal medical supply \_\_\_\_\_
- Breed (AI/ training) \_\_\_\_\_
- Feed (supply/ training) \_\_\_\_\_
- Herd Management \_\_\_\_\_
- Communication facilities (telephone/internet) \_\_\_\_\_
- Other \_\_\_\_\_

## 4.2 Services planned to be provided within the next year:

- Veterinary Services \_\_\_\_\_
- Animal medical supply \_\_\_\_\_
- Breed (AI/ training) \_\_\_\_\_
- Feed (supply/ training) \_\_\_\_\_
- Herd Management \_\_\_\_\_
- Communication facilities (telephone/internet) \_\_\_\_\_
- Other \_\_\_\_\_

## 4.3 Services not currently provided but asked for by farmers:

- Veterinary Services \_\_\_\_\_
- Animal medical supply \_\_\_\_\_
- Breed (AI/ training) \_\_\_\_\_
- Feed (supply/ training) \_\_\_\_\_
- Herd Management \_\_\_\_\_
- Communication facilities (telephone/internet) \_\_\_\_\_
- Other \_\_\_\_\_

**5. TECHNICAL EQUIPMENT AT VMC**

5.1 Type of milking machines \_\_\_\_\_

5.2 No. of clusters \_\_\_\_\_

5.3 Type of washing facilities \_\_\_\_\_

5.4 No. of washing units \_\_\_\_\_

5.5 Description of cooling system  
\_\_\_\_\_**Description of power supply**

5.6 What kind of power supply is used at the VMC?

- Power network
- Generator
- Both power network and generator

5.7 If using power network, how often does a power cut occur?

- Several times every week
- Once a week
- Every second week
- Once a month
- Other

5.8 When power cuts occur – how long is the power usually away for?  
\_\_\_\_\_**Description of water supply**

5.9 Water used for VMC activities comes from:

- Well
- Fresh water from surface
- Both well and fresh water from surface

5.10 Description of water heater and capacity  
\_\_\_\_\_

5.7 Computer available:

- 1) No
- 2) Yes

**6. BUILDING**

- 6.1 Size of building (m<sup>2</sup>) \_\_\_\_\_  
(Please attach building plan)
- 6.2 Any addition or/and change of original building? \_\_\_\_\_  
\_\_\_\_\_

**7. COW HEALTH**

- 7.1 Please fill in treated and untreated number of cases of health problems  
(average during the last year)

Health problem:	No. of cases:	Proportion treated at VMC:
Mastitis		
Injured udder		
Digestion problems		
Leg/h hoof problem		
Worms		
Lice, fleas		
Ticks		

- 7.2 Possibility to treat with antibiotics without consulting a veterinary if needed?  
 1) No  
 2) Yes

**8. INVESTMENT COSTS, FINANCING AND OPERATION COSTS (RMB)**

- 8.1 Approximate investment cost for VMC building \_\_\_\_\_
- 8.2 Approximate investment cost for equipment \_\_\_\_\_
- 8.3 Who has financed the building and equipment \_\_\_\_\_
- 8.4 Have any loans been taken for financing VMC  
 1) Yes  
 2) No
- 8.5 If a loan have been taken:  
 – By whom \_\_\_\_\_  
 – How much \_\_\_\_\_  
 – Repayment rate and interest rate \_\_\_\_\_

**Annual operation costs**

- 8.6 Costs for salaries at VMC \_\_\_\_\_
- 8.7 Power costs \_\_\_\_\_
- 8.8 Costs for fuel \_\_\_\_\_
- 8.9 Costs for detergent \_\_\_\_\_
- 8.10 Other regular operation costs \_\_\_\_\_
- 8.11 What are the yearly service fees for machinery service, spares and rubber?  
 \_\_\_\_\_

**Operation revenue**

- 8.12 Average price paid per litre to farmer: \_\_\_\_\_
- 8.13 Average revenue per litre milk sold to the dairy processor: \_\_\_\_\_

**Please provide copies or have available at visit:**

- Production statistics
- Delivery statistics
- Balance sheet and operational results

**QUESTIONNAIRE FOR MANAGER****Survey**

Question 1-3: Personal information  
 Question 4: VMC Information  
 Question 5: Economy  
 Question 6: Agreement  
 Question 7: Services at VMC  
 Question 8: Cow health  
 Question 9: Future

**NAME OF VMC:** \_\_\_\_\_

**NAME OF MANAGER:** \_\_\_\_\_

**2. PERSONAL INFORMATION**

1.1 Birth year 19\_\_\_\_

1.2 Sex

- 1) Man  
 2) Women

1.3 Civil status

- 1) Married  
 2) Not married  
 3) Widow/Widower  
 4) Other \_\_\_\_\_

**2. WORK EXPERIENCE**

2.1 Did you grow up on a dairy farm?

- 1) No  
 2) Yes

2.2 Have you owned and managed dairy cows?

- 1) No  
 2) Yes  
 3) Still have own dairy cows

2.3 How long have you been working at the VMC?

- 1) Less than 1 year  
 2) 1-5 year  
 3) 5-10 year

2.4 Earlier work: \_\_\_\_\_

**3. EDUCATIONAL BACKGROUND**

3.1 Kind of education

- 1) No education  
 2) Primary school  
 3) Secondary school  
 4) University  
 5) Other \_\_\_\_\_

3.2 Have you taken any courses for managing the VMC?

- 1) No  
 2) Yes What was it about?  
 1) Management  
 2) Technical maintenance procedure for equipment  
 3) Breeding  
 4) Feeding  
 5) Other: \_\_\_\_\_

3.3 Do you organize courses at the VMC for the farmers?

- No  
 Yes What are the course/courses about?  
 1) Herd management  
 2) Technical facilities  
 3) Breeding  
 4) Feeding  
 5) Other: \_\_\_\_\_

3.4 Under what conditions do you get paid?

- Depending on milk quality
- Depending on milk yield
- Independent
- Other: \_\_\_\_\_

#### 4. VMC INFORMATION

4.1 How many households are participating at the VMC? \_\_\_\_\_

4.2 Total number of dairy cattle at the centre? \_\_\_\_\_

4.3 Average number of cows milked every day? \_\_\_\_\_

#### 5. ECONOMY

5.1 Profitability of VMC? \_\_\_\_\_

5.2 Prices paid per litre milk to farmer? \_\_\_\_\_

5.3 Does the VMC have any quality payment system to farmer?

- No
- Yes
  - 1) Quality payment that include bacteria, inhibitor and somatic cell count
  - 2) Payment based on milk density and acidity
  - 3) Payment based on fat content using simple fat testing equipment
  - 4) Payment based on fat, protein, lactose and total solids
  - 5) Other: \_\_\_\_\_

#### 6. AGREEMENT

6.1 How do farmers sign up to be members today? (What does the process and agreement look like?)

\_\_\_\_\_

6.2 How did the farmers sign up to be members to the VMC from the beginning? (How was the originally group created?)

\_\_\_\_\_

6.3 How well do the present agreement work?

- 1 Not so well
- 2
- 3
- 4
- 5 Very well

6.4 What works well with the agreement?

\_\_\_\_\_

6.5 Are there any problems associated with the current agreement?

\_\_\_\_\_

6.6 Does the VMC have any plans of altering/changing present agreement in the near future?

\_\_\_\_\_

6.7 Are there any possibilities for farmers to sign off membership?

\_\_\_\_\_

6.8 What are the possibilities for the VMC to exclude the farmer from delivering milk?

\_\_\_\_\_

\_\_\_\_\_

**7. SERVICES AT VMC**

7.1 What services are currently provided at the VMC?

- 1) Training/education
- 2) Feed (education, purchase)
- 3) Breeding (AI, education, etc.)
- 4) Communication (phone, internet)
- 5) Seed (for animal, for crop production)
- 6) Veterinarian
- 7) Other: \_\_\_\_\_

7.2 Any other services at the VMC you would like to introduce and/or developed further?

- 1) Training/education
- 2) Feed (education, purchase)
- 3) Breeding (AI, education, etc.)
- 4) Communication (phone, internet)
- 5) Seed (for crop production)
- 6) Veterinarian
- 7) Other: \_\_\_\_\_

7.3 What changes do you think have been the result for the farmer after they joined the VMC system? (Rank the three most important)

- 1) More milk produced
- 2) Higher price per litre of milk
- 3) Healthier cows
- 4) Change in workload and working condition
- 5) Safer and more regular income
- 6) Better milk quality
- 7) Improved standard of living
- 8) Improved knowledge of dairy/management
- 9) Other: \_\_\_\_\_

7.4 What services do you think are of most importance for successful development of VMC?

\_\_\_\_\_

7.5 What services are mostly used/asked for by farmers?

\_\_\_\_\_

7.6 What services works excellent, good, satisfactory or not very well?

\_\_\_\_\_

7.7 Do you think there is a reasonable balance between the need for training and the available training programs?

- 1) No
- 2) Yes

\_\_\_\_\_

**8. COW HEALTH**

8.1 How do the routines look like when you notice different health problems in the dairy herd? (When is treatment used? When not?)

\_\_\_\_\_

**9. FUTURE**

9.1 How do you perceive the development and long-term prospects of your VMC?

- 1) Slow
- 2) Unchanged
- 3) Rapid

\_\_\_\_\_

9.2 How do you perceive the development and long-term prospects of the VMC system as a concept?

- 1) Slower
  - 2) Unchanged
  - 3) Faster
- 

9.3 What kind of changes/improvements would you regard as desirable for a successful future for the VMC?

- 1) Milk quality improvement
  - 2) Larger VMC
  - 3) A larger number of VMC's
  - 4) More dairy cows per centre
  - 5) More milk per cow
  - 6) Other: \_\_\_\_\_
- 

9.4 What is the largest challenge facing the future of your VMC?

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**QUESTIONNAIRE FOR FARMERS****Survey**

Question 1-4: Personal and family information  
 Question 5: Farm composition  
 Question 6: Household income  
 Question 7: Relation to VMC  
 Question 8: Feed/feeding  
 Question 9: Breed/breeding  
 Question 10: Cow health  
 Question 11: Future

**NAME OF VMC:** \_\_\_\_\_

**NAME OF PERSON MILKING THE COW:** \_\_\_\_\_

**3. PERSONAL INFORMATION**

1.1 Birth year 19\_\_\_\_

1.2 Sex                      1.3 Civil status

- 1) Man                       1) Married  
 2) Women                 2) Not married  
 3) Widow/Widower  
 4) Child living at home  
 5) Other \_\_\_\_\_

**2. HOUSEHOLD COMPOSITION**

2.1 Number of persons in household: \_\_\_\_\_

2.2 Number of generations living in the household: \_\_\_\_\_

2.3 Age structure

Man	Women	Age

**3. WORK EXPERIENCE**

3.1 For how long time have your family had dairy cows?

- 1) Less than 5 years  
 2) 5-10 years  
 3) 10-20 years  
 4) More than 20 years

3.2 How long have you been working with dairy cows?

- 1) Less than 5 year  
 2) 5-10 year  
 3) 10-20 year  
 4) More than 20 year

**4. EDUCATIONAL BACKGROUND**

4.1 Kind of education

- 1) No education  
 2) Primary school  
 3) Secondary school  
 4) University  
 5) Other \_\_\_\_\_

4.2 Able to read and write

- 1) No  
 2) Yes



**5. FARM COMPOSITION**

## 5.1 Farm enterprise

- 1) Dairy cows
- 2) Other animals (number): \_\_\_\_\_
- 3) Crop production (area): \_\_\_\_\_
- 4) Forage production (area): \_\_\_\_\_
- 5) Pasture (area): \_\_\_\_\_
- 6) Other \_\_\_\_\_

5.2 Size of farm (total area): \_\_\_\_\_

5.3 Who owns the land? \_\_\_\_\_

## 5.4 Number of cows in household

Tot. No of cows: \_\_\_\_\_

No. of lactating cows today: \_\_\_\_\_

No. of young cattle and calves: \_\_\_\_\_

5.5 How much time do you spend with your dairy cow/cows: \_\_\_\_\_ (h/day)

## 5.6 Who owns the cows?

- 1) You and your family
- 2) The VMC
- 3) The dairy processors
- 4) The state
- 5) Your employer
- 6) Other: \_\_\_\_\_

**6. HOUSEHOLD INCOME**

## 6.1 Major sources of income (rank the three most important)

- 1) Milk production
- 2) Other animals
- 3) Cattle sales
- 4) Cash crop
- 5) Income from off farm employment: \_\_\_\_\_
- 6) Other: \_\_\_\_\_

## 6.2 What are your main tasks within the household? (Rank the three most important)

- 1) Bring dairy cows to VMC
- 2) Animal care
- 3) Crop production
- 4) Child care
- 5) Cooking
- 6) Herd management
- 7) Other: \_\_\_\_\_

6.3 Is there any body else who sometimes brings the cows to the VMC? \_\_\_\_\_

6.4 One cows income: \_\_\_\_\_

6.5 How much are you paid per litre milk: \_\_\_\_\_

6.6 Are there any seasonal differences in how much you are paid per litre of milk?

- 1) No
- 2) Yes. How does it differ?

6.7 How many litres of milk do your cows' produce: \_\_\_\_\_/day  
\_\_\_\_\_/ year (lactation)

## 6.8 How often do you get paid from the VMC?

- 1) Once a week
- 2) Every second week
- 3) Once a month
- 4) Other: \_\_\_\_\_

## 6.9 How do you get paid?

- 1) Cash
- 2) Bank account

## 6.10 Would you like another payment scheme?

- 1) No
- 2) Yes. What kind of changes would you like to see?

6.11 How do you perceive VMC has changed your economical situation?

- 1) Higher income
- 2) A more safe income
- 3) More regular income
- 4) Other; \_\_\_\_\_

## 7. RELATION TO VMC

7.1 Did you join the VMC from the very beginning?

- 1) Yes
- 2) No. When? \_\_\_\_\_ (year)

7.2 How did you found out about the prospects of joining VMC?

- 1) From another farmer
- 2) From the dairy
- 3) From the community
- 4) From the VMC
- 5) Other: \_\_\_\_\_

7.3 What was the main reason why you signed up at the VMC?

- 1) Economical
- 2) Safe and more regular income
- 3) Dairy processor decision
- 4) Cooperative/community decision
- 5) Political decision
- 6) Other: \_\_\_\_\_

7.4 What kind of services at VMC do you use except for milking facilities?

(Rank the three most important)

- 1) Training/education
- 2) Feed (education, purchase)
- 3) Breeding (AI, education, etc.)
- 4) Communication (phone, internet)
- 5) Seed (for crop production)
- 6) Veterinarian
- 7) Place for meeting
- 8) Other: \_\_\_\_\_

7.5 How do you regard the services provided at VMC?

- 1 Unsatisfied
- 2
- 3
- 4
- 5 Very satisfied



7.6 Have your expectations of VMC been met?

- 1 Not at all
- 2
- 3
- 4
- 5 Totally



7.7 Any other services at VMC you would like to se developed further?

(Rank the three most important)

- 1) Training/education
- 2) Feed (education, purchase)
- 3) Breeding (AI, education, etc.)
- 4) Communication (phone, internet)
- 5) Seed (for crop production)
- 6) Veterinarian
- 7) Other: \_\_\_\_\_

7.8 What kind of changes have been achieved since joining VMC?

- 1) More money per litre of milk
- 2) More milk produced
- 3) Healthier cows
- 4) Less work
- 5) Safer more regular income
- 6) Improved standard of living
- 7) Improved knowledge about dairy/management
- 8) Other: \_\_\_\_\_

7.9 Have you participated in any courses at VMC?

- 1) No
- 2) Yes Which? \_\_\_\_\_

7.10 Do you want to participate in courses at the VMC?

- No
- Yes Which? \_\_\_\_\_

7.11 What kind of agreement do you have with the VMC? (Written agreement, duration, and possibilities to negotiate)

\_\_\_\_\_

7.12 Are you satisfied with your agreement/contract with the VMC?

- 1 Not at all
- 2
- 3
- 4
- 5 Totally/Very

\_\_\_\_\_

7.13 Do you have any opportunity to withdraw from the agreement?

\_\_\_\_\_

\_\_\_\_\_

## 8. FEED/FEEDING

8.1 What kind of feed do you give your cow/cows?

A) Roughage

- 1) Straw
- 2) Hay
- 3) Silage
- 4) Pasture
- 5) Green chop
- 6) Other: \_\_\_\_\_

B) Concentrates

- 1) Grain corn
- 2) Soybean
- 3) Cereal/Grain
- 4) Cotton seed
- 5) Ready mix
- 6) Minerals
- 7) Other: \_\_\_\_\_

8.2 What kind of feed have you given your cow/cows today?

\_\_\_\_\_

8.3 Are there any seasonal differences in how the cows are fed?

- 1) No
- 2) Yes What kind of differences? \_\_\_\_\_

8.4 Water supply

- 1) Free access of fresh water most of the day
- 2) Once a day
- 3) Twice a day
- 4) Other: \_\_\_\_\_

\_\_\_\_\_

8.5 How often are the cows fed?

- 1) Free access  
 2) Once a day  
 3) Twice a day  
 4) Other: \_\_\_\_\_

## 9. BREED/BREEDING

9.1 What kind of breed is your cow/cows: \_\_\_\_\_

9.2 How old are your cows? \_\_\_\_\_

9.3 How many calves have your cow/cows had each?

Cow no.	Age of cow	No. of calves
Oldest		
Youngest		
Average		

9.4 How many calves were born last year? \_\_\_\_\_

9.5 How many of the calves died last year? \_\_\_\_\_

9.6 What is the most common cause of calf death?

- 1) Diarrhoea  
 2) Pneumonia  
 3) Malnutrition  
 4) Parasites  
 5) Other: \_\_\_\_\_

9.7 Do you let the calf suckle the cow?

- 1) No, why not? \_\_\_\_\_  
 2) Yes, for how long? \_\_\_\_\_

9.8 How old is usually the heifer at calving?

- 1)  $\leq 2.5$  years  
 2) 2.5-4 years  
 3)  $\geq 4$  years

9.9 For how long time do you milk your cow after her calving?

- 1)  $\leq 6$  months  
 2) 6-8 months  
 3) 8-10 months  
 4)  $\geq 10$  months

9.10 How many months after calving does the cow usually become pregnant again?

- 1)  $\leq 3$  months  
 2) 3-6 months  
 3) 6-12 months  
 4)  $\geq 12$  months

9.11 Do the cows have any calving problems?

- 1) No  
 2) Yes, what kind of problem? \_\_\_\_\_

9.12 How are the animals bred?

- 1) Artificial Insemination (AI)  
 2) Natural breeding. Who owns the bull? \_\_\_\_\_  
 What kind of breed is he? \_\_\_\_\_

**10. COW HEALTH**

10.1 Different kind of health problem

(Rank the three most important)

- 1) Mastitis
- 2) Injured udder
- 3) Stomach disturbances
- 4) Leg and hoof problem
- 5) Under fed/Starving
- 6) Worms
- 7) Lice, flea etc
- 8) Ticks
- 9) Decreased fertility
- 10) Pneumonia
- 11) Other problems: \_\_\_\_\_

10.2 Has the health of your cow/cows changed since joining VMC?

- 1) No
- 2) Yes. In what way? \_\_\_\_\_

**11. FUTURE**

11.1 Do you want to increase your number of cows if it is possible?

- 1) No
- 2) Yes

11.2 Do you think you can increase the amount of milk per cow?

- 1) No
- 2) Yes. How? \_\_\_\_\_

11.3 Do you think you will continue to deliver the milk to the VMC in 2-5 years?

- 1) No
- 2) Yes

11.4 How do you see your farm develop in 2-5 years?

\_\_\_\_\_

\_\_\_\_\_

**QUESTIONNAIRE FOR DAIRY PROCESSER****Survey**

Question 1-3: Personal information

Question 4: Dairy information

Question 5: Economy

Question 6: Agreement

Question 7: Dairy and VMC

Question 8: Cow health

Question 9: Future

**NAME OF DAIRY:** \_\_\_\_\_**NAME OF PERSON:** \_\_\_\_\_**4. PERSONAL INFORMATION**

1.1 Position in the Dairy: \_\_\_\_\_

1.2 Birth year 19\_\_\_\_

1.3 Sex

- 1) Man  
 2) Women

**2. WORK EXPERIENCE**

2.1 Did you grow up on a dairy farm?

- 1) No  
 2) Yes

2.2 Have you owned and managed dairy cows?

- 1) No  
 2) Yes  
 3) Still have own dairy cows

2.3 How long have you been working at the Dairy processor?

- 1) Less than 1 year  
 2) 1-5 year  
 3) 5-10 year  
 4)  $\geq$  10 year

2.4 Earlier positions: \_\_\_\_\_

**3. EDUCATIONAL BACKGROUND**

3.1 Kind of education

- 1) No education  
 2) Compulsory school  
 3) Secondary school  
 4) University  
 5) Other \_\_\_\_\_

3.2 Have you taken any courses for managing the Dairy?

- 1) No  
 2) Yes What was it about?  
 1) Management  
 2) Technical  
 3) Milk quality  
 4) Microbiology  
 5) Other: \_\_\_\_\_

**DAIRY INFORMATION**

4.1 How many VMC's are delivering their milk to this dairy? \_\_\_\_\_

4.2 Are there any milk collecting centres delivering milk to this dairy?

- 1) No  
 2) Yes. How many centres and how much milk is delivered (litres)?  
 \_\_\_\_\_

4.3 Are there any collections directly from farms to this dairy?

- 1) No  
 2) Yes. How many farms and how much milk is collected (litres)?

4.4 Approximately number of dairy cattle at all VMC together? \_\_\_\_\_

4.5 Average amount of milk collected every day?

Total for this Dairy: \_\_\_\_\_

From VMC's only: \_\_\_\_\_

4.6 Max capacity of milk collected from VMC (and MCC): \_\_\_\_\_ Litres

4.7 State seasonal variation:

How much is the maximum daily collection of milk: \_\_\_\_\_

How much is the minimum daily collection of milk: \_\_\_\_\_

Which month/months do the Dairy collect most milk: \_\_\_\_\_

Which month/months do the Dairy collect least milk: \_\_\_\_\_

Other seasonal differences?  
 \_\_\_\_\_

## 5. ECONOMY

5.1 Ownership of Dairy?

- 1) Private  
 2) State

5.2 Do the Dairy own any VMC's?

- 1) No  
 2) Yes. How many? \_\_\_\_\_

5.3 Prices paid per litre milk to VMC today? \_\_\_\_\_

5.4 Prices paid per litre milk to VMC average over the year? \_\_\_\_\_

5.5 Max price paid per litre milk to VMC? \_\_\_\_\_

5.6 Min price paid per litre milk to VMC? \_\_\_\_\_

5.7 Is all the milk delivered to Dairy cooled down before delivery?

- 1) No. Is there any difference in the price paid compared with the cold milk?  2) Yes

5.8 Any quality payment system to VMC?

- 1) No  
 2) Yes  
 1) Quality payment that include bacteria, inhibitor and somatic cell count.  
 2) Payment based on milk density and acidity  
 3) Payment based on fat content using simple fat testing equipment  
 4) Payment based on fat, protein, lactose and total solids  
 5) Other: \_\_\_\_\_

## 6. AGREEMENT

6.1 How do VMC's sign up to be members today? (What does the process and agreement look like? Is it possible to provide copies of the present agreement?)

\_\_\_\_\_

6.2 How did the VMC's sign up to be members to the Dairy from the beginning? (How was the originally group created?)

\_\_\_\_\_

6.3 How well does the present agreement with the VMC work?

- 1 Not so well  
 2  
 3  
 4  
 5 Very well

6.4 What works well with the agreement?

6.5 Are there any problems associated with the current agreement?

\_\_\_\_\_

\_\_\_\_\_

6.6 Does the Dairy have any plans of altering/changing present agreement in the near future?

---

6.7 Are there any possibilities for VMC's to sign off membership?

---

6.8 What are the possibilities for the Dairy to exclude the VMC from delivering milk?

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6.9 Under what conditions is it possible for the Dairy to refuse the delivered milk?

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## 7. DAIRY AND VMC

7.1 Is the Dairy organising any courses for the manager at the VMC?

No

Yes What are the course/courses about?

1) Herd management

2) Technical facilities

3) Milk quality

4) Microbiology

5) Other: \_\_\_\_\_

7.2 Is the Dairy organising any courses for the farmers at the VMC?

No

Yes What are the course/courses about?

1) Herd management

2) Technical facilities

3) Milk quality

4) Microbiology

5) Other: \_\_\_\_\_

7.3 What kind of changes have been the results since VMC started? (Rank all relevant)

1) More milk collected

2) Better milk quality collected

3) Change in cost and work for collection

4) Safer more regular deliveries

5) Safer dairy products

6) Improved knowledge about relation with milk producer

7) Other: \_\_\_\_\_

7.3 Is there a balance between supply and demand for milk?

1) No. Does it depend on any seasonal differences?

2) Yes

7.3 If there are any seasonal differences in the delivery of milk are there any plans for making the differences less noticeable?

1) No

2) Yes. How? (For example different payment system)

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## 8. COW HEALTH

8.1 What are the routines when noticing different medical residues in the milk?  
(What kinds of residues are there?)

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**9. FUTURE**

9.1 How do you estimate the development and long-term prospects of this Dairy?

- 1) Slow
  - 2) Unchanged
  - 3) Rapid
- 

9.2 How do you estimate the development and long-term prospects of the VMC system as a concept?

- 1) Slower
  - 2) Unchanged
  - 3) Faster
- 

9.3 What kind of changes/improvements in the VMC system would you regard as desirable for a successful future for the Dairy?

- 1) Milk quality improvement
  - 2) Larger VMC
  - 3) A larger number of VMC's
  - 4) More dairy cows per centre
  - 5) More milk per cow
  - 6) Other: \_\_\_\_\_
- 

9.4 What is the largest challenge facing the Dairy today?

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9.5 What is the largest challenge facing the future for the VMC's?

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9.6 How much more milk will the Dairy process in 5 years?

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9.7 How much of that increase will come from the VMC?

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9.8 What can the Dairy do to speed up the milk production from the VMC's?

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## SCC result from 7 June – 9 July 2005

No.	Date	SCC/ml
VMC 1aS	2005-06-10	3 399 000
		3 401 000
VMC 1bS	2005-06-10	1 874 000
		1 755 000
VMC 2S	2005-06-11	1 700 000
		1 725 000
VMC 3S	2005-06-12	345 000
		394 000
		544 000 (from mcc)
		613 000 (from mcc)
VMC 4S	2005-06-13	2 259 000
		2 032 000
Farm 1S	2005-06-14	2 948 000
		2 425 000
VMC 5S	2005-06-15	963 000
		950 000
		307 000 (from mcc)
		451 000 (from mcc)
Farm 2S	2005-06-16	263 000
		-
VMC 6S	2005-06-17	211 000
		267 000
VMC 7S	2005-06-18	711 000
		646 000
VMC 8S (TBC test)	2005-06-21	1 462 000
		1 282 000
	2005-06-22	2 375 000
		2 252 000
VMC 9S	2005-06-23	1 069 000
		1 082 000
VMC 10H	2005-06-28	815 000
		773 000
VMC 11H	2005-06-29	883 000
		813 000
VMC 12H	2005-06-30	4 971 000
		3 593 000
VMC 13H	2005-07-01	1 414 000
		1 043 000
VMC 14H	2005-07-02	1 047 000
		1 102 000
VMC 15H	2005-07-04	1 968 000
		1 969 000
16H Farm garden	2005-07-05	616 000
		611 000
Big farm H	2005-07-06	347 000 Rotary
		472 000 Rotary
		67 000 Parallel
		70 000 Parallel
		178 000 Mixed
		158 000 Mixed
Extra VMC HeiNan	2005-07-07	1 068 000
		1 193 000
State farm HeiNan	2005-07-08	353 000
		315 000

(S stands for ShiJiaZhuang in Hebei and H stands for Hohhot in Inner Mongolia)

**Name of VMC's visited during field study  
7 June – 9 July 2005**

Dong Su VMC (Sanlu)
Sanlu's Dairy cow base at TongYe
Sanlu's VMC at Begaoli
GuoFu ShengBang Dairy Co. Ltd (Sanlu)
Chang Jian VMC (Sanlu)
Zhuanghu VMC (Sanlu)
Huihai VMC (Sanlu)
Barui VMC (Sanlu)
Heng Yuan VMC (Sanlu)
Mengniu Villag
Wuchuan Green Village (Mengniu)
Mengniu breed aquatics base
Shangtucheng VMC (Mengniu)
Yaofu VMC (Mengniu)
ShebiYa VMC (Yili)
Yili company sixth Farm Garden



## Sales Contract for Village Milking Centre construction and Milk Collection

**Party A (Milk Collector): Mengniu Milk (Group) Co., Ltd.**

**Party B(VMC investor) :**

**ID No.:**

Both parties reach following consensus on VMC's establishment after full negotiation on the basis of equality, mutual benefit.

### I. Contract subject & Property law relation:

Party A is responsible for inspection receiver & purchase of the milk collected from Party B. Party B is VMC's sponsor and has the property ownership which is invested by itself. Both parties are independent civil subject. Both take their own civil liability. And have civil rights and takes individual civil liability.

### II. Construction of VMC.

1. Party B is willing to establish VMC by collection capital himself and submit all fresh milk to Party A.
2. The VMC must be constructed according to the following criteria:
  - (1) legal usage of VMC land & house
  - (2) VMC must be complete shut-off and the floor must be indurated.
  - (3) Definite scale to ensure cows are capable of being milked.
  - (4) Ventilation, heat preservation, drainage of VMC
  - (5) Install refrigeration facility & milking facility. Milk can be collected from Party B if all facilities are reviewed and accepted by Party A.
3. Party B shall give RMB1000 to Party A as on-time construction deposit, which is identified in "VMC Questionnaire" by relative management director. Deposit will be owned by Party A if the construction can't be finished on time and the contract will be terminated then.
4. Refrigerator facility and milking facility must be purchased and installed which are required by party A. Another agreement will be signed.

### III. Submit, transportation, price & payment for fresh milk.

1. Party B's milk must comply with fresh milk standard by party A. Party A's fresh milk quality inspection is essential for acceptance. Milk by several farmers will be rejected.
2. The daily milk collection quantity is no less than \_\_\_ ton.
3. Party B will be punished to pay RMB5,000 for each contract which is signed between Party B and other enterprise or person for fresh milk sales. If nothing happens as described in Article 5 No. 1, party A is not allowed to sign milk contract with any unit or person.
4. Party A's quality tour inspector and VMC's guidance can monitor and manager VMCs at any time to ensure good milk quality and Party B shall give support on supervising the milk.
5. Milk quality difference, transportation and milk payment will be paid by party A from 18<sup>th</sup> to 30<sup>th</sup> of every month. The payment must be transferred to individual farmers who supply VMCs with fresh milk. Milk payment belongs to farmers. Party B is not allowed to decrease, delayed to pay or occupy it.
6. If party B gives better quality milk, Party A will make accounting statement on the basis of "fresh milk

quality audit standard”.

7. Party B shall arrange milk transportation and send milk to the destination required by Party A. Party B takes all the risks before milk is delivered to destination. Party A will not take any responsibility for any loss, deterioration, following situations:

- (1) accidents caused by local government
- (2) any problem not caused by force majeure

IV. Party B is not allowed to sell, rent and mortgage VMC during the contract duration without Party A’s approval. Party B shall submit VMC’s transfer agreement to Party A if it is approved by Party A. The transfer agreement will not take effective until new milk sales contract is signed by Party A and the VMC’s new owner. Otherwise, Party B shall pay RMB100,000 as penalty for breach of contract.

V. Termination and Violation responsibility:

1. The contract can be terminated by Party A for following situations:

- (1) Delayed set-up of VMC
- (2) VMC doesn’t reach the requirement by Party A
- (3) Milk collection quantity doesn’t reach the contract figure.
- (4) Unqualified milk by Party B
- (5) Impossible to milk the cow in one location
- (6) Provide other enterprise or person besides party A with fresh milk within the contract duration
- (7) Transfer, rental or mortgage of VMC without party A’s approval.
- (8) Submit wrong, milking quantity
- (9) Modify or delete farmers’ milking info.
- (10) Party B violates supervision regulation of milk quality by Party A
- (11) Other activities have bad effect on farmers and party A.

2. Any party who terminates the contract without another party’s agree, shall pay RMB100,000 for fine for breach of contract.

3. If quality doesn’t meet the requirement by Party A, party B shall follow the regulation for bad quality supply.

4. If party A delays to pay party B milk quality difference and transportation expense, party A shall pay party B penalty on the basis of bank interest during the same period.

VI. Supplemental agreement could be signed for any issues uncovered in the contract.

VII. Any disputes could be solved by negotiation. Any party could appeal to local court if negotiation fails.

IX. The contract is in two original. Both parties take one original and each one has same effect.

X. The contract takes effective when both parties sign the contract.

XI. The contract duration is from \_\_\_\_\_ to \_\_\_\_\_.

Party A: Mengniu Milk (Group) Co., Ltd.

Attorney:

Party B:

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