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CRV

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## [ INFLUENCE OF MARKET TRENDS ON THE DAIRY SECTOR IN EUROPE AND THE USA ]

## **Preface**

For the fourth year of my study Livestock Management at Hogeschool van Hall Larenstein I have done my thesis at CRV in Arnhem. The subject of the thesis is the influence of the market trends on the dairy sectors in Europe and the USA.

The choice for CRV was because I have did my placement there already last year. I came back because the atmosphere in the company was nice. after my thesis I can say that it was a good choice to come back because the last four months I have experiences again as a nice period.

For this nice period I want to thank Theo and Mijke, for their supervision and help during my thesis. Also the other trainee Corine I want to thank for the nice period and of course Erik and René and all the other people from M&I and R&D for letting me experience a nice period of 4 months.

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## Summary

For CRV it is important that they can help the farmers to breed the cows they want. To offer the product the farmer wants to have, CRV has to look further in the future to help the farmers to breed a cow that is suitable for future conditions. It takes more than eight years to see influence of a bull that is used by CRV before it gets influence on the dairy herd. This is because of the long period that it takes before the bull is tested and the cows are raised.

To know which cow is needed in the future, there are different things you need to know. The current situation on the market is needed, which cows do the farmers have at this moment and on which parts is the focus of the farmer for breeding the next generation of cows and also what are the trends in the future for the dairy sector. With all this information together CRV knows which criteria they have to make to breed the cow that the farmers needs in the future. For this research there is looked to the market trends in the sector for the coming five till ten years.

To know what the most important trends are a literature research and interviews with experts in the field are done. To be sure that all the different trends are monitored used the destep model where all the trends are divided in six different groups.

In the coming ten years there will be many changes in the dairy sector. The major trends for the dairy sector are:

- Increase in the world population and the consumption pattern what results in an increase in the demand for dairy products.
- Different consumption pattern increase the demand for milk fat on the short term.
- Until 2050 the food production should increase with 70% to feed the whole world population.
- Due to the increase in use of biofuels there is a higher demand for arable production.
- Social acceptance of the way the products are produced is getting more important and how the influence of the sector is on the environment.
- Higher cost price because of higher soil, feed and labor prices.
- Level of automation is increasing on dairy farms.
- The legislation is has a major influence on the farm management.

These trends ask for a more efficient cow that is able to produce more output out of less input. This is for the reduction of the greenhouse gas emissions and the higher demand for food. For a good social acceptance it is important that the animal welfare is good, for CRV it means that they have to focus on a healthy cow. This healthy cow should have a good udder health, claw health, good fertility and a high resistance against other diseases. The healthy cow is also needed for the higher level of automation. Due to less time that can be spend per cow she should have less problems. To be handled by more machines it is also important that the cows are assertive so the farmer does not have to help the cows.

# 1. Introduction

For an AI-organisation it is important that they can help the farmers to breed the cows they want. To offer the product the farmer want to have, the AI-organisation has to look further in the future to help the farmers to breed a cow that is suitable for future conditions. When you select a cow today to be a bull mother it will take at least 8-10 years before this will have any influence on the dairy herd. First it takes almost 1 year before you will have a bull calf of these cow, before this bull is old enough to be tested it takes more than 1 year. The offspring of this test-period will come in production after 3 years (9 months until birth and 2 years to raise it until a dairy cow). On the moment that the first offspring is in production there comes information available about the level of the bull. If it is good enough the bull will be used as proven bull. After that moment it takes again 3 years before there will come thousands of daughters in production. So until this daughters are in production it takes at least 8 years. Before they will have more influence by making more lactations it costs again 2 years.

For an organisation like CRV it is very important that they are able to look 8-10 years into the future to predict what will be the demands of the market in that period. If CRV is not able to make a correct prediction they will offer the wrong bulls. If this is happening farmers can not find the bull they need at CRV and they will look to other bulls of other organisations. In this situation it is not profitable for both groups, the farmers can not get the best bulls that should fit into there system on that moment and CRV will loose a part of there customers. For this it is very important that CRV can make a good prediction of the future market demands.

This report is part of the breeding goal discussion from CRV. The total project is done to know how the sector is now, what is the position of CRV in comparison to the competitors and also what products do the farmers buy the most at this moment. But also what are the trends for the future, which trends are changing the cows that are needed. This can be trends in the cost price for the milk but also do the needs of farmers change and how do the competitors react on this.

The result of the breeding goal discussion should give a good view on what the trends in the dairy sector in the coming 5 till 10 years are. This are the market trends, needs of the farmer but also how can CRV react on the competitors, what do they sell and how is that in comparison with the products that CRV is offering. This should finally result in how the cow and bulls of the future should look like. Which are the major points that the cows should selected on in the coming years to be breed the cow that is needed to cope which the conditions that will come in the next 5-10 years.

As a part of this project in this report there will be made an overview of the most important market trends for the dairy sector.

The research question of this report will be : What is the influence of market trends on the dairy sector in Europe and the USA.

For the demand of the dairy products there will be made a global overview, but for the feed and dairy production the focus is on the United States and on Europe. There will be looked to the United States and Europe because the on main points these two areas can be compared and the trends will have the same influence on both countries. Also are both countries an important market for CRV.

In this report the trends are analysed according to the destep method what means that they are divided into 6 different groups. These are demographics, economical, social, technological, ecological and political. Within these 6 groups all the different trends with an influence on the dairy sector of the United States and Europe are covered. In chapter 2 the method will be described more precisely. Per group there will be made a separate chapter. At the end there will be a discussion about how these trends have an influence on the market and how they are influencing the demands of these market, and what is the effect that they will have on the cows and bulls of the future.

The research is done with a literature review but there are also some interviews held with experts from the field.

## 2. Destep method

In this report the trends are analysed according to the destep method<sup>1</sup>. There is chosen for the destep method because with this method it is possible to put all the trends that have an influence on the dairy sector in a logical order. By using this method it will be easier to group all the different trends and the chance on forgetting one will be lower. There is chosen for this method instead of a different one because the groups of the destep method are for the dairy sector the most important groups.

The destep method consist out of 6 different groups. These are demographics, economical, social, technological, ecological and political. Within these 6 groups all the different trends with an influence on the dairy sector of the United States and Europe are covered.

Some of these 6 groups consists out of a few subtopics. The subtopics per group are:

- Demographics
  - Growth of the world population
  - Composition of the world population
- Economical
  - Economical growth
  - Dairy supply
  - Food production
  - Energy prices
- Social
  - Dairy consumption
  - Consumer opinions
- Technological
  - Automation
  - Sensor Technology
  - Genomic Selection
- Ecological
  - Rules and regulation about environment
- Political
  - Animal Welfare
  - Biofuels

For the demand of the dairy products there will be made a global overview, but for the food and dairy production the focus is on the United States and on Europe. This means that the demographics, social and a part of economical (economical growth and energy prices) will be done worldwide, the other groups will be done for the United States and Europe

## 3. Demographics

### 3.1 Introduction

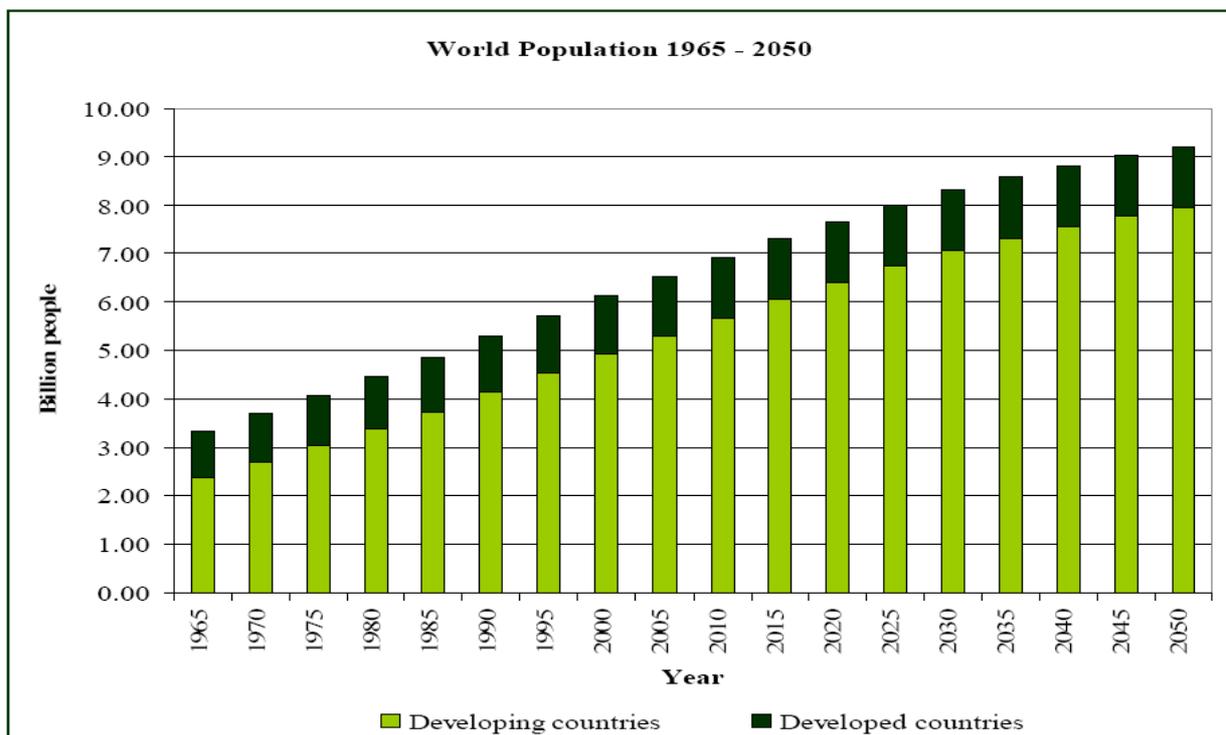
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<sup>1</sup> For an explanation of the Destep method look at <http://en.wikipedia.org/wiki/DESTEP>

To know how many dairy should be produced it is important to know for how many people you should produce it and what kind of people it are. Because not all the people will consume the same so you should know how many and where the people will live.

### 3.2 Population growth

In 2010 the world population was around the 6.9 billion people (Figure 3.2), the expectation for 2050 is around the 9.1 billion people (UN, 2011). That is an increase of more than 30%. The highest growth is expected to be in the developing countries, India, China, North Africa and South America. The expectation is that the growth of the population in the developing countries will decrease as the economy is improving.



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007)

**Figure 3.2: Expected world population until 2050**

### 3.3 Population composition

Besides the growth in numbers, the demographics will also change. On this moment 49% of the people live in cities. In 2050 70% of the population will live in urban areas (FAO, 2009). Due to better healthcare the people will live longer resulting in a higher average age of the people. Also the decreased birthrate will contribute to an increase of the average age of people. In the Netherlands the birthrate decreased from 3.1 in the beginning of the sixties until to 1.75 in 2009, the expectation is that this will stay the same in the coming decades (Piljic, 2010).

## 4. Social

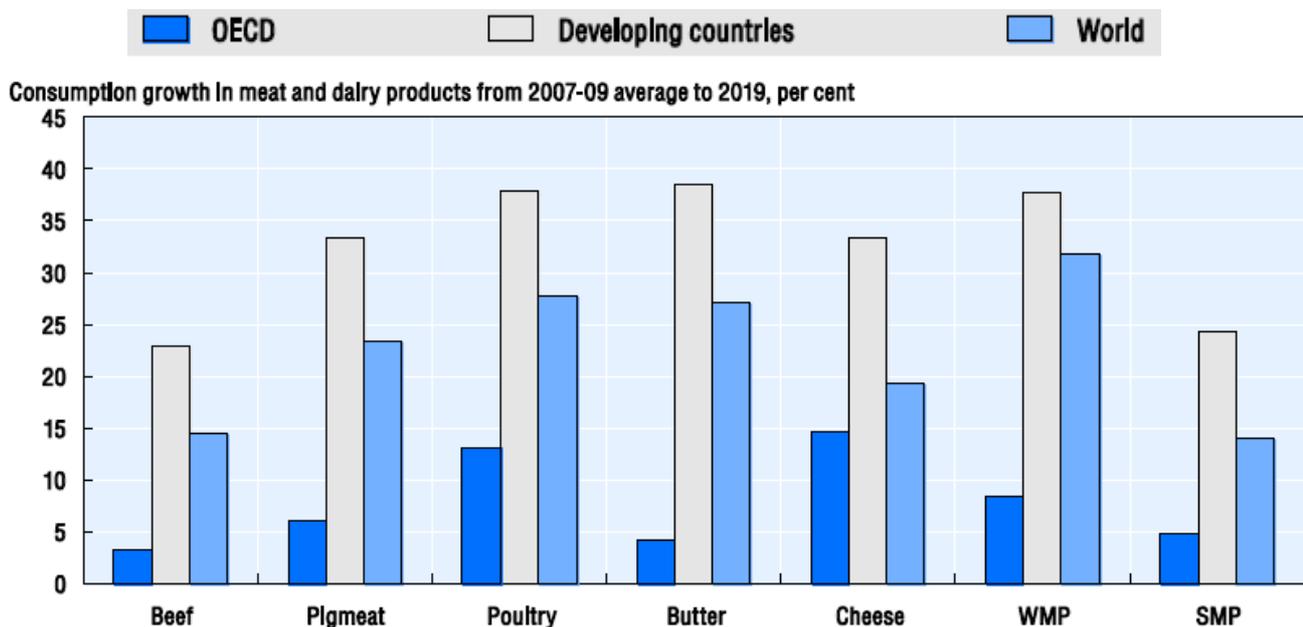
### 4.1 Introduction

The consumers are the group that have to buy the products that the sector is producing, to see what these groups want is important to know which products the sector should made. So in this chapter there is an overview of all the things that the consumers want and the influence of this on the dairy sector.

## 4.2 Dairy consumption

Because of an increase in the economic growth especially in the less developed countries, the consumption pattern of these people will change to a diet with more animal products. This is because the cereals are cheaper, but when the economy is growing they can afford it to buy the more expensive dairy products and they want to buy it to follow the western lifestyle. In combination with a growth of the population it gives a high increase in dairy and meat consumption. The expected increase in dairy consumption from 2009 until 2019 is 30% for the non-OECD<sup>2</sup> countries (Figure 4.2.1) (FAO-OECD, 2010). In the developing countries the increase is the highest for the products with a higher fat percentage (whole milk powder (WMP) and butter) and is less for skimmed milk powder (SMP) that has a lower fat percentage. The consumption of dairy products is different from the western countries because the developing countries do not have a dairy history yet. For the western countries it is normal that the milk can be consumed without any additions to it. But the developing countries do a lot more with experimenting with new kind of additions to it or using only some components of the milk. The new combinations that are made can look strange to the western world but can be very popular in developing countries. Examples of these new products are the butter milk with peanut taste or the cheese with a small layer of chocolate (Fonterra, 2011).

Because of the increase in products with a higher fat percentage this will have also consequences for the production. In the European Union the farmers try to reach a high protein percentage in the milk with a low fat percentage because the value of protein is higher and a high fat percentage decreases the amount of milk the farmer can deliver in his quota. With the increase in demand for fat there is a gap between the supply and the demand, this results in an increase in the price that will be paid for fat. (IFCN, 2010; FrieslandCampina, 2011). The expectation is that the gap between the supply and demand for fat is covered in a period of approximately 5 till 10 years, because of an increase in the supply of milk fat. When the gap is covered the focus will be again more on protein.



### **Figure 4.2.1: The expected growth in percentage of the dairy and meat consumption**

For the increase in the dairy consumption there is a major increase needed of the feed production. Because dairy products are produced in a less efficient way than cereals, it costs more energy and space to produce.

#### **4.3 Consumer opinions**

In the dairy sector the opinion of the consumer is very important. The consumer has to pay for the products the sector makes, so when the consumer is not content about the products that are made or about the way they are made, it will decrease the income of the sector because there are less products sold. It is important that the sector listens to the wishes of the consumers. These wishes of the consumers are influenced by other consumers or media. If a certain issue is a hype media easily spread all over the world, also consumers spread it around worldwide by using social media as twitter or Facebook. Because many people use the (social) media it is possible that something what happens today is already influencing the consumer buying behavior tomorrow (CRVa, 2011).

The consumer opinion also depends on the level of the income. In the parts of the world where the economy is better the consumers will pay more attention to the way the product is produced. This results in that in North America, Europe and Oceania there is more priority on the production process than in Asia, Africa and South America. For the farmers in developed countries it means that their product has to meet higher standards like a maximum of somatic cell count in the milk before it can be delivered to the consumers, but European consumers to also expect from the sector that more cows will graze outside in the future. Also in well developed countries the level of interest of the consumer can differ (CRVa, 2011).

In the periods they have more money to spend they will look more to the quality of the products they buy, when the income level is lower they will look more to the price of the product because they can not afford it to buy a product that fits better to their wishes. But a similarity between all the consumers is that if their own health cannot be guaranteed than they will buy something else.

The most important issues for the consumers in the well developed countries are welfare, health, longevity of the cows and a lower influence of the dairy sector on the environment. Not for all consumers the issues are the same, there is a difference per country but also within these countries there are different groups that have different opinions about the importance of these issues. In a part of the countries there is also more attention for the influence of the dairy sector on the environment but there are major difference between countries. In countries where it is important the emission of methane and CO<sub>2</sub> and the pollution of phosphate and nitrate are important (CRVa, 2011)

## **5. Economical**

### **5.1 Introduction**

How are the economics influencing cost price, what is the effect of an in- or decrease of the economy on the cost price. How is the supply for dairy changing and what is the result for the food production. In this chapter there is an overview of all the influences of the economy on the dairy sector.

## 5.2 Economic growth

The economic growth will be the highest in the developing countries. The expected economic growth for India and China is for the period until 2019 between the seven and eight percent per year. For the EU-15 and the USA it is expected to be between the two and three percent per year (FAO-OECD, 2010; USDA, 2010).

## 5.3 Dairy supply

To provide the world population of enough dairy products there is a high increase needed in the total milk production. The average expected growth in milk production until 2019 is 2,2% per year (FAO-OECD, 2010; Van Berkum, 2008). This growth is approximately the same as the expected growth in the dairy consumption.

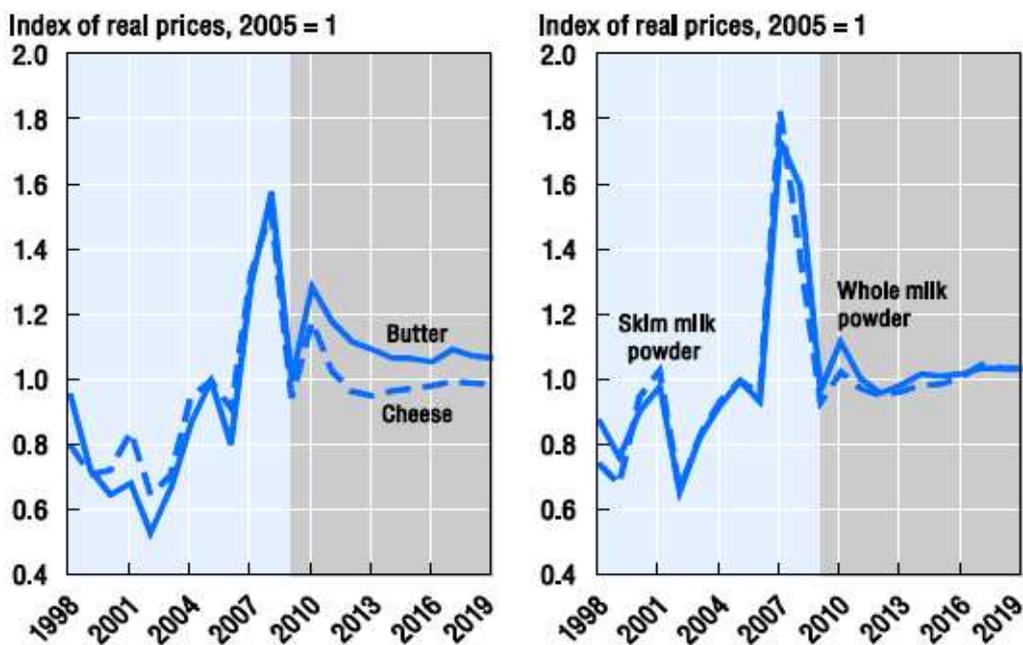
The highest growth is expected in the developing countries. In 2019 the milk production of India is almost the same as in the European Union (FAO-OECD, 2010). This is not only because of the expected increase in the production of India but mainly also because of the milk quota in the European Union that prevents the increase of milk production until 2015. The introduction of the milk quota in 1984 was because the supply of the dairy products was higher than the demand. Since the introduction of the quota the demand increased but the supply from the European Union stayed the same. The milk that was needed for the extra demand was produced in different parts of the world and the European Union lost a part of their market share.

After 2015 there will probably be no quota anymore for the European Union, but it is not sure if the milk production in the European Union will increase fast after 2015. In the quota years of 2008/2009 and 2009/2010 the most countries did not delivered all the milk that they where allowed to do (Figure 5.3.1). In 2008/2009 the milk deliveries in the European Union where 4.2% below the quota, in 2009/2010 it was 7.0%. Most important factor was the low milk price in these period. Probably the milk production will increase when the milk price will be higher (ABN Amro, 2011). For the period after 2015 this will look the same, in periods with low milk prices the production will decrease because on that moments it is not profitable to milk. When the milk price increases and also the profitability the milk production will increase.



**Figure 5.3.1: % of milk delivered in comparison to the available quota for the European Union membership countries in 2008/2009 and 2009/2010(estimation)**  
**Source: ABN Amro, 2011**

In figure 5.3.2 there is shown that the expectation for the dairy prices in the coming years will be that the prices are lower than with the price peak of 2007/08, but they are higher than in the period 1998/2006. This is because of an increase in the demand from the developing countries. But when the prices should rise again to the level of 2007/2008 there will be probably also a fall in the price again because the people in developing countries can not afford it anymore and the demand will drop then.



**Figure 5.3.2: Realized and expected prices of dairy products, indexed for 2005**

## 5.4 Feed production

To feed this growing population there is a higher food production needed. The cereal production is on this moment 2.1 billion tonnes but in 2050 that need to be around the 3 billion tonnes, that is an increase of almost 50%. The production of meat need to increase with 200 million tonnes until a total production of 470 million tonnes (FAO, 2009). In 2010 there was 7 gigaton of grain equivalents needed to feed the world population, in 2050 this will be 12 gigaton of grain equivalents to feed the whole population (Van Ittersum, 2011).

The increase in feed production in the developing countries would come for 80% in increase in the yield per hectares, only 20% would come from expansion of arable land (FAO, 2009).

Because the increase in demand increases higher than the supply of feed the prices for feed will stay high. In 2007 there was a peak in the feed prices because of an increase in the demand and a decrease in the supply. The decrease in the supply was mainly because of problems with harvesting on the southern hemisphere. This in combination with an increase in the demand for the biofuels resulted in higher feed prices. The prices declined in the years after because the people in the developing countries could not afford it anymore so the demand for feed was decreasing also the good harvest worldwide was a cause. Now the prices are lower and the economy is recovering again the demand for feed is increasing. This is because of an increase in the demand in the developing countries but also an increase in the use of biofuels. The supply is not growing enough to fulfill these demand totally so the prices stay higher than in the period before the price peak of 2007 (Figure 5.4.1).

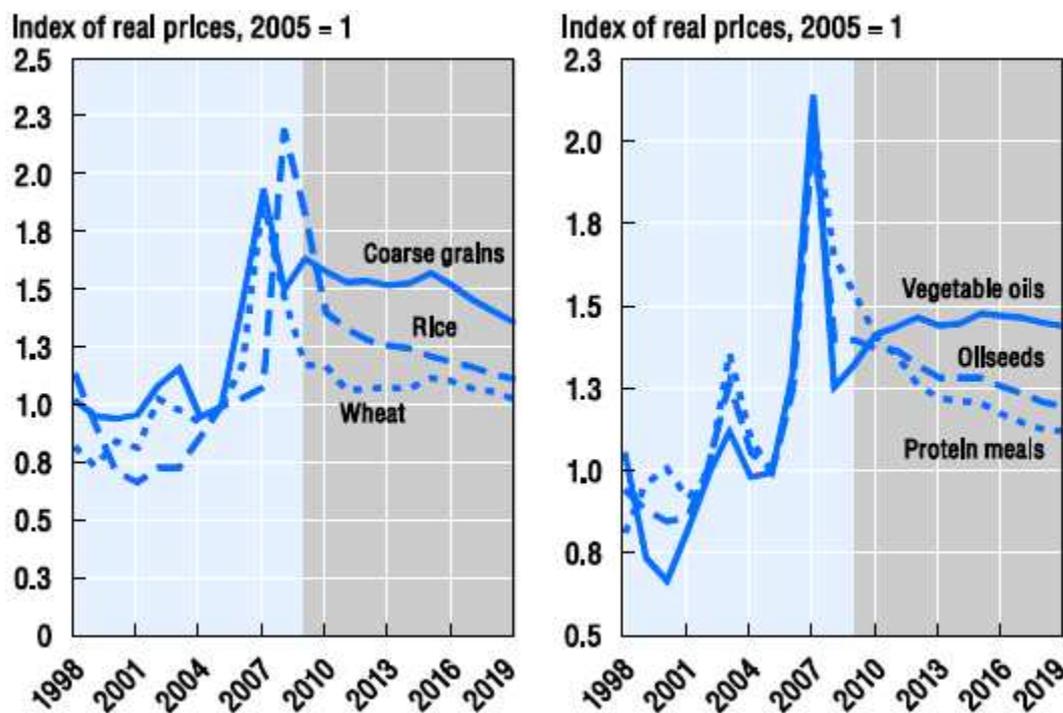


Figure 5.4.1: The realized and expected feed prices, indexed on 2005

## 5.5 Energy prices

In the last years there was a major increase in the world oil price (Figure 5.5.1). The expectation is that the price will rise in the coming years, but the increase in price depends on the situation in the middle-east, because most oil is produced in that

region. When the situation in this area is not stable it will decrease the production of the crude oil. A lower production results in a lower supply of oil, a lower supply gives a shortage of oil on the market and ends in higher oil prices for the consumers. The expectation for 2019 is that the price of one barrel is around the 100 US Dollar (FAO-OECD, 2010; USDA, 2010)

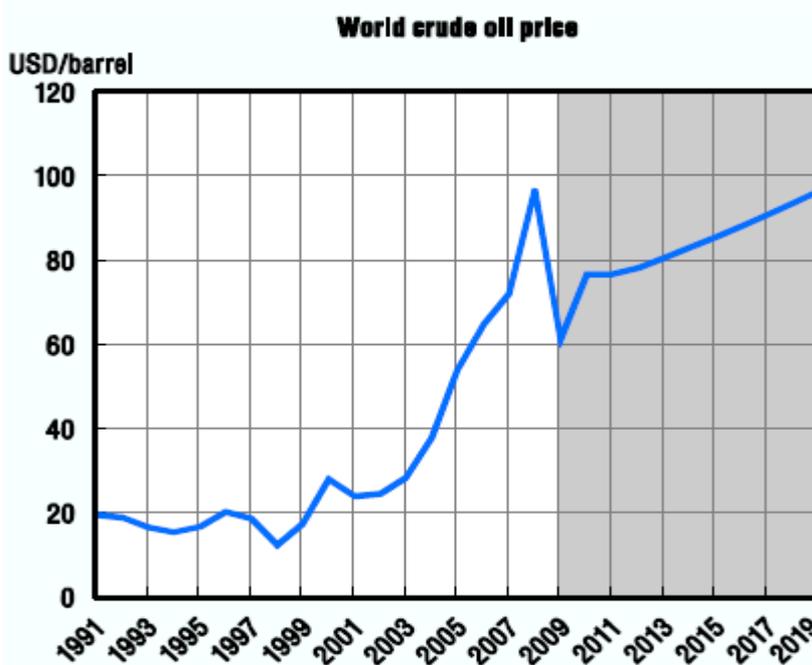


Figure 5.5.1: The world crude oil price per barrel in US Dollars

## 6. Ecological

### 6.1 Introduction

What are the rules and regulations from the government when they have it about the environment. How do the different governments in the world count the emission of greenhouse gas in the dairy sector.

### 6.2 Rules and regulations

The environment is going to play a major role in the dairy sector. In the well developed countries the role of the dairy sector in the environment is important in the eyes of the consumers. In these countries there are many projects to monitor and control the greenhouse gas emission in the dairy sector. Most projects are in the United States, New Zealand and the European Union (Guignard *et al.* 2009).

In the United States the main goal is first to collect comprehensive and accurate data that is relevant for decisions about future climate policies. But there is not made a decision yet about the final rules, so the exact requirements regarding the reporting and monitoring of greenhouse gas emissions are still unclear (Guignard *et al.* 2009).

In New Zealand the focus is based on the emission per produced kg milk and meat. It is important for these farmers to try to reach an efficient production (Fonterra, 2011). They should try to find the production level where it is the most efficient to produce the kg of milk in relation to the emission of greenhouse gasses. In the Netherlands and Belgium it is now focused on the amount of greenhouse gasses per animal that is present on the farm. Farmers in Belgium have to buy right per present animal so

for these farmers it is more important to reach a high production per cow than to reach an efficient production per kg of product.

Per kilogram of fat and protein corrected milk (FPCM<sup>3</sup>) the lowest emission is for North America and Europe (FAO, 2010). This is mainly because the production per cow is higher in this regions. When the production per cow is higher, there is less energy needed for the maintenance per kg milk, which results in a lower emission of greenhouse gasses per kg milk.

## **7. Political**

### **7.1 Introduction**

What is the influence of the politics on the dairy sector. Which points are important for the politic to focus on when they are talking about the dairy sector and in important which rules and regulations is this resulting for the dairy sector. In this chapter there is made an overview of these points.

### **7.2 Animal welfare**

The focus from CRV about animal welfare is:

- Monitoring and controlling the level of inbreeding
- Increasing the genetic resistance again diseases to improve the health of the cows
- Breeding on dairy strength, longevity, fertility and other traits that are related to a good animal welfare and health (CRVb, 2011)

The definition of the Dutch government about animal welfare is: "Animal welfare concerns the quality of live of the animal, the owner should respect the '5 freedoms'<sup>4</sup> and do not exceed the adaptive capacity of the animal." (Ministry of LNV, 2007)

The focus from the Dutch government on animal welfare is the housing, infection pressure, stable climate and the grazing possibilities for the cows. The housing is mainly focused on enough space for the cows and that the stable is designed to house the modern cows (Ministry of LNV, 2007). Mainly because the modern cow has different sizes than the cows of 10-20 years ago.

The European Union hopes that it is possible to set rules for the minimum level of animal welfare for products that are imported into the European Union. Because the rules for animal welfare result in a higher cost price for the farmers inside the Union. So the products from outside the Union have a lower cost price and that is no fair competition for farmers inside the Union. When the same rules are also for the imported products then it possible for European farmers to compete with the other farmers worldwide again.

### **7.3 Biofuels**

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<sup>3</sup> FPCM is milk corrected for its fat and protein content to a standard of 4.0% fat and 3.3% protein with the formula: raw milk (kg) \* (0.337 + 0.116 \* Fat content (%) + 0.06 \* Protein content (%))

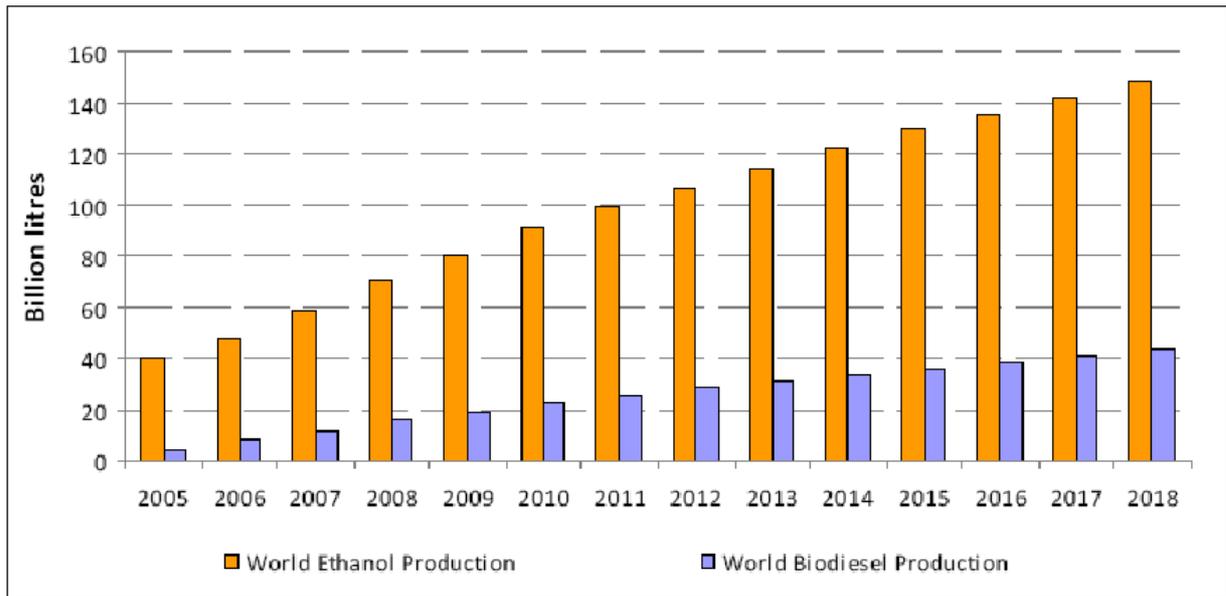
<sup>4</sup> The 5-freedoms are Freedom from hunger and thirst, Freedom from discomfort, Freedom from pain, injury and disease, Freedom to express normal behaviour, Freedom from fear and distress

When the oil prices are high most consumers do not decrease their use of the oil. Mostly because the consumer depend on it. Only the households that can not afford it anymore will decrease their oil use. On the long term there is searched for other alternatives to reduce the use of oil. That is reason why the production of biofuels is increasing in the last years. Because the oil prices are still rising the expectation is that the biofuel production will also increase in the coming years. The biofuels are produced mostly out of wheat, grains, vegetable oils and sugars. The higher prices that is paid for these products results in a higher production for these products. Partly this higher production can be reached by increasing the yield per hectare, but mostly farmers increase the amount of hectares for these products. This results in less hectares available for food and feed production, nature or urbanization. The first loss in hectares for the food production can be corrected by the usage of fallow soils and nature. But these places are not never-ending so there will be a time that all the land that can be used for feed production is in use. So it will not be an endless option to increase the amount of biofuels out of these products.

In the period 2007-2009 the average world production was 74,257 million liters of ethanol per year (Figure 7.3.1). The two main producers in this period where the United States and Brazil. Together they where responsible for 80% of the total production in ethanol. For 2019 there is a projected growth of 6.3% per year for the world production of ethanol. The total production should then reach almost 160,000 million liters of ethanol. The United States and Brazil will stay the two main producers but will lose a part of there market share to the European Union. This is due to an expected growth of more then 11% per year of the production in the European Union. In 2019 the expected market share of the European Union is 11% (FAO-OECD, 2010).

For Biodiesel the production was between 2007-2009 mainly based in the European Union. They produced 8 million liters of the total world production of 15 million liters. The United States, Argentina and Brazil follow with a market share of respectively 15, 9 and 7%. For 2019 the expected production is 41,000 million liters, that is a growth of 7.3% per year. In 2019 India will also be a main player on the biodiesel market. In 2009 their market share was less than 1% but with an expected increase of 34.5% per year they will increase their market share until 7% in 2019 (FAO-OECD, 2010).

## World ethanol and biodiesel projections, 2005-2018



Source: FAO-OECD Outlook (2009)

**Figure 7.3.1: The expected production for biofuels until 2018 in billion litres**

The production of the biofuels has a high influence on the feed production. In 2009 20% of the sugarcane was used for the production of biofuels. In Brazil it was almost 50% of the 8 million hectares produced that was used for the ethanol production (Pelkmans *et al.*, 2009; FAO-OECD, 2010). On this moment this gives no problems for the sugar market because there are high surpluses of sugar but with the increase in use for biofuels these will decrease. So for the future this can lead to a shortage of sugar. The sugar is used a lot for biofuel production because of the low production costs. This is because the residues of the production process are used as energy supply for the production. Especially in Brazil where the most sugar is produced the climate is good for a high yield per hectare and also the labor is cheaper (Pelkmans *et al.* 2009).

For the production of ethanol in the United States there is used a lot of maize. In 2007 they used 21% of their total maize production for the production of ethanol. The expectation is that it is increasing until 30%. Because of the higher demand for maize for the biofuel production the price is increasing. This results in a higher production of maize because farmers choose to grow more maize instead of soya. The decrease in the soya production is compensated by a higher production in Brazil (Pelkmans *et al.* 2009). But there is a limit in that production because also in Brazil there is not an unlimited amount of hectares available for the feed production. For Europe the production of biofuels is mainly of rapeseed. 60% of the rapeseed that is produced in Europe is used for the production of biodiesel (Pelkmans *et al.*, 2009).

In China is the production with 4,000 million liters of ethanol in 2007-2009 similar to the European Union in that period. In 2007 the government already expected problems with the feed production so they stopped new projects with ethanol that was produced out of edible grains (Pelkmans *et al.*, 2009).

The use of biofuels is similar to the production. The highest use of ethanol is in The United States, Brazil and the European Union. The demand in The United States and the European Union is higher than the supply but the countries import it from Brazil

where the demand is lower than the supply. Other importers of ethanol are Canada and Japan (FAO-OECD, 2010; USDA, 2010)

For biodiesel the European Union is the main consumer. They are not only the main producer but also the main importer of biodiesel. Argentina and the United States where in 2007-2009 the main exporters but the demand in the United States is increasing more than the supply so in 2019 they will become an importer of biodiesel (FAO-OECD, 2010; USDA, 2010).

The biofuels are promoted by the governments. The goal of the European Union was to have an average use of 5.75% biofuels in the transport sector in 2010. To promote this it is possible for countries to apply for dispensations for taxes for the biodiesels. This can be very attractive for car drivers because in the Netherlands you paid in January 2011 for one tank of petrol almost €30,- of taxes (KNMV, 2011).

## **8. Technological**

### **8.1 Introduction**

The technique in the dairy sector is also innovating. These techniques can also have an influence on the demands the farmers make for dairy cows. In this chapter there will be made an overview of the most important new techniques and automation that have an influence on the cows that are needed in the future or methods that can help to breed the cows of the future.

### **8.2 Automation**

The dairy farms are expanding. There are many farms that stop with their farm. To compensate the loss of milk from the farms that are stopped the remaining farms increase their production. To increase the number of cows on a farm there are two options. The first one is to increase the number of employees, but it is hard to find a well educated and good manageable employee that are payable, so the most farms choose for an increase in the kg of milk per employee. The increase in kg of milk per employee results in less time that an employee can spend on each cow. For these farms it is important that the cows they have are suitable for that management. They need cows that have less problems.

To increase the amount of milk per employee there is an increase in the automation level on the most farms. The number of farms that milk their cows with a milking robot is increasing. In 2009 there where worldwide 8,000 farms that milk their cows with a milking robot. More than 90% of these farms are located in North-West Europe. In Denmark there is the highest concentration, 22% of the Danish farms are milking automatically (Murray, 2010). The most farms with a milking robot are located in the Netherlands. In 2009 there where 1,905 farms with an automatic milking system, that is almost 10% of the Dutch farms. In 2010 it where already 2,252 farms (KOM, 2011).

### **8.3 Sensor technology**

With the higher level of automation on farms there is also an increase in the data that comes available. With the introduction of the milking robots there came information available about the amount of visits per day, the connection time of the teats, weight of the cow, milking speed, milk production and milk quality. Some of these data was already available but on these farms it was measured every day instead of once per month what give more accurate data to work with. To gather this information CRV

has to cooperate with other companies because CRV does not register this data. That is done by the producers of the systems that record the data (Roelofs, 2011; van der Beek, 2011).

## **8.4 Genomic Selection**

The use of genomic selection is increasing. Because the real genetic information of these animals is now earlier available than before the use of genomic selection, it is possible to select the animals which have a better genetic value earlier. With the information the generation-interval can be decreased and also the number of failures can be minimized. It is also possible to select more on a specific trait. When you want to achieve a breeding goal with a high longevity there is the possibility to achieve to faster because you can select the young animals with a high value for this first.

With genomic selection it is also easier for farmers to select on farm level, it is possible to test all your calves with genomic selection and then raise only the best calves of this group. Previously the farmer needs to raise all the calves to know how good they were or he should select the calves on how they look like and how their parents performed. Then it was good possible that the heifers that the farmer got for replacement had a high level of failure because they performed less than the farmer had expected.

With all the information that comes available with the new technologies there will be more possibilities to breed for the cow that is needed. Nowadays there is the opportunity to record more data from the cows, also the data is more reliable than it was before these technologies. With the new techniques it is also possible to breed for new traits like feed efficiency or maybe the milk composition, because there comes information available that was not measurable before these technologies (van der Beek, 2011).

## **9. Discussion**

### **9.1 Arable production**

The food production should increase in the coming years to support the world population of enough food because of an increase in the use of biofuels and a change in the consumption pattern of the population in the developing countries. The change in consumption pattern results in a lower cereal use for the human population but an increase in the use of cereals for the production animals. It is less efficient to feed the cereals first to the animals to produce animal proteins instead of give it directly to the humans. That is the reason that it costs nowadays more feed to provide the world population of food.

The increase in feed production has also an influence on the grass production. The competition for the land that is available for the feed production will increase, which result in higher prices for the feed but also for the land. The higher land prices makes the production of grass more expensive so the farmers should try to use the grass they have on the most efficient way to avoid the necessary increase of expensive ground.

It is most likely that the prices for food will increase in the coming periods because the demand for food is rising faster than the supply. For the dairy sector this means an increase of the cost price, because the feed for the cows is an major part of this. To reduce the feed costs it is important that the feed is used for efficiently. This can be done by a more efficient cow and a more healthier cow. A cow that is more

efficient will use less feed per kg of product milk and meat. Which result in a lower amount of feed cost per kg of milk.

Also a healthier cow result in a higher efficiency. This cow is less often sick and will have a higher chance on a longer lifespan. This is more efficient because an older cow uses less energy for growth, heifers use a part of the feed for the growth and this is inefficient. Also is a longer lifespan resulting in a lower cull rate, when the cull rate is lower it is possible to raise less young stock. This results in a higher efficiency because the young stock that you do not have to raise do also not eat any feed. A high amount of young stock is inefficient because these animals eat feed but during the first two years of their life they do not deliver any milk or meat to compensate these feed intake.

So to cope with a higher price for feed it is important that the cows are more efficient and are healthier. So they use less feed and stay longer on the farm.

## **9.2 Demand for dairy**

The increase in the demand for dairy is because of an increase in population and economy. The growth of the consumption depends on the prices for the dairy products. When the prices rise too fast the consumption will decrease, this is because in the developing countries the costs for food are a major part of their budget and an increase in price have more influence than in the western countries where the part of the budget for food is lower. When the demand drops the prices will also drop, which results in a fluctuating market. This shows that the dairy consumption is very dependent on the prices and the economic growth. Because when it is too expensive people will not buy it but also when the economic growth is lower than expected the increase in consumption will go slower than expected. This is because with the expected dairy consumption they also use the expected economic growth. When the growth of the economy is lower than expected the change into a more western diet will also go slower, what means that the demand for animal products will be lower than expected. It shows that dairy products are a kind of luxury for this people, when the people have to decrease their expenses the dairy products are one of the first things that will be changed for a cheaper alternative.

## **9.3 Dairy supply**

After 2015 the milk quota in the European Union will be reformed. Many people think that the milk production will increase because then there are no restrictions anymore for farmers to produce the more milk. But not only the milk quota is a restriction for farmers but also the environment is influencing the possibility to reach a high milk production. In many countries there is a pressure on the sector to reduce the influence from the dairy sector on the environment.

If farmers want to increase their production it is important that they will cope with the environment. They have to try to reduce the pressure on the environment. To reduce it the dairy cows they have need to be more efficient, a cow that is producing more efficient is able to reach a higher milk production with the same amount of greenhouse gas emission as a cow that is less efficient. For farmers it is important to breed this cows because than it is possible to reach a higher milk production without the discharge of manure or buying new land.

## **9.4 Milk price valuation**

Because of the difference in consumption pattern between the western- and the developing countries the production should react. The value of fat is increasing to stimulate the farmers to increase the fat content in the milk. In the European countries this can be difficult because with the quota they are not able to deliver unlimited milk fat to the dairy factories. They will have to make the choice for what is more profitable, deliver less milk with a higher fat percentage or continuing with the current strategy and produce more milk with a low fat content.

The increase of the value for fat will not take forever. Because the expectation is that farmers choose to increase their fat production when they will get paid a higher price, the gap between supply and demand for milk fat will probably be covered in a period between the 5 and 10 years. When there is no need anymore to increase the fat production it is not longer necessary to promote the production by a higher fat price.

It is not sure what the higher price for fat will have for influence on the breeding strategy of farmers. This is because the most and fastest effect will be if the feed ration of the cows is changed. When farmers should change their breeding strategy to a higher focus on the fat percentage it takes at least three years before there will be any result. Because the higher fat price will not take forever it is most likely that farmers choose to increase the fat percentage and not with different bulls. They probably only use the bulls with a very low fat percentage less often.

### **9.5 Consumer opinions**

The opinion of the consumer is getting more influence in the future. The focus from the consumer is most on the animal welfare and the greenhouse gas emission. With the increase in use of (social) media there will be more hypes from the consumers because they have the possibility to spread their opinion fast and also worldwide. This can be positive for the sector but also negative. All the opinions of consumers or organizations about the sector, it does not matter if they are positive or negative are known by a lot of people. So it is possible that the opinion of a small group of people, who are active on these media can influence many people around the world. It is for the sector an opportunity to make their image on this media more positive so the negative opinions gets less attention. The focus should be most on animal welfare because that is the issue that gets the most publicity. The sector has to secure a good animal welfare by increase the health and longevity of the cows to have an influence on those media.

For the farmers the extra requirements that the consumer asks should not be difficult to meet because the consumer and the farmer both want the same. It is sometimes from a different point of view but you reach it with the same management. The consumers wants to see a cow that is healthy because then they get the feeling of a good welfare. Also the farmers wants to see a healthy cow because these cows cost less time, a longer lifespan and a higher production. So the opinion of the consumer should not be seen as an extra obstacle but more as an extra motivation to reach the goal that the farmers want to reach.

### **9.6 Automation**

There is also a trends that is stimulated from the sector side, the kg of milk per employee will increase in the coming years. Many farms are expanding but it is hard to find good employees that are payable. Due to the increasing labor prices the increase in number of cows is higher than the increase in employees. To compensate this many farms increase their level of automation. For cows this mean that the farmer has less time for them and they will come more in contact with the robots. Not all cows fit in this system. To function well a cow need to have less

problems because the farmer has less time to solve them and they need to be assertive because they need to visit the robots enough times per day without stimulation of the farmer.

The higher level of automation will have a major influence on the breeding strategy of farmers. There is a big difference between different cows if they are suitable for robotic milking and also not all the cows have no or a few problems. With the breeding strategy it is possible to breed on the cows that are better suitable. The trends of automation is very good visible and it is most likely that it will continue in the coming decades. So for an organization as CRV it is important that they can deliver the farmers bulls that give daughters that are good suitable for robotic milking and that have less problems so they fit better in a system where there will be less time spend per cow.

### **9.7 Influence on cow of the future**

The higher prices for soil, feed and labour makes it important that the dairy cow of the future will be more efficient. Because the price for the dairy are increasing due to a higher demand but the cost price is rising relatively more. The cow on the future should react on this by being more efficient. That results in less feed per kg milk but also less labour that has to be spend per cow. An efficient cow is also better for the environment because she has a lower emission of greenhouse gasses and also less pollution of nitrate and phosphate.

The cow of the future should also be healthy, because a healthy cow stays longer on the farm what gives a lower replacement rate and less young stock. These factors results in an efficient use of feed because older cows are more efficient because they produce less milk and the lower emission of USA and the EU in comparison to the rest of the world shows that a higher milk production is more efficient.

Also is a healthier cow a cow with less problems because she will have a higher resistance. This will give less claw problems, less mastitis and a good fertility. So the farmer should spend less time on treating her with medication. To reduce the time per cow it is also important that the cow is assertive so the farmer should not spend to many time on the cow.

## **10. Conclusion**

- Margins for farmers will decrease, because of an increase in the feed-, soil- and labour prices. The higher milk prices can not compensate the feed prices enough.
- The influence of the consumer opinions is increasing, due to the increase of (social) media and the growth in economy there will be more attention to animal welfare, the emission of greenhouse gasses and pollution of nitrate and phosphate in the environment.
- Value of milk fat will increase for a short term period of approximately 5-10 years.
- Due to the expanding of farms what results in a higher level of automation and more kg milk per employee, the cow of the future should have less problems.
- To cope with the higher cost price and more pressure on the environment, the cow of the future should be more efficient.

**References:**

- ABN Amro. Vrije zuivelmarkt, bedreiging of kans? 2011
- Beldman. A., Daatselaar. C., Galama. P. and Prins. B. Trends and challenges in world dairy farming. 2010
- Beldman. A.C.G., Jager. J.H., Dellen. L. van, and Zijlstra. J. Nationale en internationale ontwikkelingen rond schaalvergroting in de melkveehouderij. 2006
- Belt. R. van de, and Sjaauw-Koen-Fa. A.R. Grenzen aan wat de aarde te bieden heeft. 2010
- Berkum. S. van. De internationale zuivelmarkt nu en in de toekomst. 2008
- Bracke. M. Animal welfare in a global perspective. 2009
- CRVa. Presentation for the Fokkerijraad. 2011
- CRVb. Internal document on ethics. 2011
- FAO. How to feed the world in 2050. 2009
- FAO. Greenhouse Gas Emissions from the dairy sector. 2010
- FAO-OECD. Agricultural Outlook 2010-2019. 2010
- FAPRI. U.S. and world agricultural outlook. 2010
- Ferrari. P. and Roest. K. de. Strength and weaknesses for the animal of upgraded welfare standards. 2009
- Guignard. C., Verones. F., Loerincik. Y. and Jolliet. O. Environmental/ Ecological Impact of the dairy sector: Literature review on dairy products for an inventory of key issues list of environmental initiatives and influences on the dairy sector. 2009
- Ittersum. M. van, Voedselzekerheid in 2050 op wereldschaal haalbare maar enorme opgave. 2011
- LEI. Antibioticagebruik in de veehouderij. 2010
- Ministry of LNV. Nota Dierenwelzijn. 2007
- Murray. B. Better breeding with automated milking systems. 2010
- Oudendag. D.A. and Kuikman. P.J. Effecten van extensivering van de melkveehouderij op de emissies van broeikasgassen. 2003
- Pelkmans. L., Dobbelaere. S., Borgo. E. Situatieschets biobrandstoffen. 2009
- Piljic. D. Het demografische tij keert. 2010
- USDA. USDA Agricultural projections to 2019. 2010

Zeijts. H. van, Eerdt. M.M. van, Willems. W.J., Rood. G.A., Boer. A.C. den, and Nijdam. D.S. Op weg naar een duurzame veehouderij. Ontwikkelingen tussen 2000 en 2010. 2010

**Expert opinions:**

Beek. S. van der, expert opinion, Manager Team Strategic Marketing, 2011-05-12

Linde. R. van der, expert opinion, Team Research and Development, 2011-04-11

Roelofs. R., expert opinion, Global Product Portfolio, 2011-03-29

**Books:**

IFCN Dairy Report 2010

**Internet:**

[www.fonterra.com](http://www.fonterra.com)

[www.frieslandcampina.com](http://www.frieslandcampina.com)

[www.danone.com](http://www.danone.com)

[www.nestle.com](http://www.nestle.com)

[www.deanfoods.com](http://www.deanfoods.com)

[www.kraftfoodscompany.com](http://www.kraftfoodscompany.com)

[www.dfamilk.com](http://www.dfamilk.com)

[www.prodzuivel.nl](http://www.prodzuivel.nl)

[www.fao.org](http://www.fao.org)

[www.oecd.org](http://www.oecd.org)

<http://data.un.org/Data.aspx?q=world+population&d=PopDiv&f=variableID%3a12%3bcrlD%3a900> 2011-04-26

[http://www.stichtingkom.nl/index.php/stichting\\_kom/category/statistiek](http://www.stichtingkom.nl/index.php/stichting_kom/category/statistiek) 2011-03-30

<http://www.knmv.nl/knmv/nieuws/brandstof-duurder-wegens-accijnsverhoging> 2011-05-18