European Protein Ingredients Market

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Executive Summary

Introduction to the European Protein Ingredients Market

In the food industry proteins have both nutritional and functional applications. They can provide the essential amino acids needed for the growth and health of the human body, while the functional properties of proteins can alter the physical properties of the food itself. For example, proteins can improve the palatability, flavour and texture of food.

The following types of protein are included in this research service:

- Milk proteins
- Gelatine
- Egg protein
- Fish protein
- Meat protein
- Single cell protein
- Soya protein
- Gluten protein
- Pulse protein

Summary of Major Findings

In 2004 the European protein ingredients market was valued at 3.77 billion Euros. Figure 1-1 illustrates the revenue forecasts of the European protein ingredients market for the period 2001-2011.
Much of the European protein ingredients market is mature. The main growth areas have been in Eastern Europe or in rapidly growing added value applications such as functional food and sports products. There have been concerns surrounding particular protein sectors due to BSE and GM concerns. However, the impact of these market restraints are expected to lessen in the long term. Consumer health issues, such as allergies, continue to restrain growth in specific protein areas. Traditional nutritional applications for proteins are becoming more price competitive. As a consequence, suppliers are focusing on developing functional applications for their existing protein products. Moreover, some sectors of the European industry are under pressure from low price imports.

Examples of Key Challenges Facing the Industry

Continual Development of New Functional Products

Protein suppliers have been successful in expanding markets and their client base through the development of functional proteins. Proteins are used in numerous roles throughout the food industry as emulsifiers, gelling, foaming, whipping, colouring, coating and palatability agents. Protein manufacturers are expected to continue investing in the development of products that demonstrate specific functionalities in order to target new applications and remain competitive in the marketplace.
Maintaining Cost Effectiveness

In some market sectors, such as Eastern Europe, cost is a key purchasing criteria. Several segments of the European protein industry are anticipated to be under increasing threat from low cost imports, particularly from Asia. Therefore, the industry is expected to focus on cost reduction, and ensuring production and distribution efficiency.

The research service details other challenges with respect to specific market sectors.

Examples of Key Market Drivers

Increased Demand from Eastern Europe

Many countries in Eastern Europe are growing rapidly and demand for processed foods is increasing faster than in Western Europe. Furthermore, these markets are less affluent and this is driving a strong demand for proteins that can act as substitutes for other ingredients, especially if it results in cost savings.

Increased Demand for Functional Proteins

In general, the food industry is looking for improved functionality from its specialist ingredients. The demand for such products will continue to drive growth in the market throughout the forecast period.

The research service details other drivers with respect to specific market sectors.

Examples of Key Market Restraints

Health Issues

European consumers are increasingly aware of potential health concerns with regard to food ingredients. The BSE crisis has had a large impact on the animal protein market. There is also increasing concern about allergies and gluten and/or milk intolerance. The European Union (EU) requirements to list potential allergens on consumer packaging is expected to have an adverse impact on some products.

Mature End-user Markets

Some of the larger end-user markets for proteins, especially bakery and some meat products have matured, and are expected to show little growth throughout the forecast period (2005-2011).
The research service details other restraints with respect to specific market sectors.

The Milk Protein Market

The high nutritional value of milk proteins and good digestibility make them an ideal ingredient for sport and powdered diet supplements, or as milk replacements. In addition, milk proteins have excellent functional properties, as they act as emulsifying and foaming agents, while also exhibiting gelation and water-binding properties. The market for high value milk protein isolates and concentrates is one of the fastest growing sectors within the European protein ingredients market.

The Gelatine Market

Gelatine is an animal protein manufactured from collagen, which is derived from bovine, porcine, fish bones and hides (skin, tendons and ligaments). Its main application is in the confectionery industry, where it provides specific mouth feel properties. The BSE crisis has had a large impact on this industry. Prices can be volatile as there are competing applications and supply cannot be significantly increased in the short term.

The Egg Protein Market

While this research service includes egg white protein, it does not cover egg yolk or whole eggs. Egg white is nutritionally well balanced and has excellent functional properties. It is because of these functional properties (for example emulsifying, colouring, flavouring and binding) that egg white protein is used in bakery and meat products.

The Fish Protein Market

Fish proteins are supplied in the form of fish meal and are used in animal feed, pet food and aquaculture applications for their associated nutritional value. The European market has been severely affected as a result of the BSE crisis which resulted in an EU ban in the use of fish meal in ruminant feeds. In fact, volumes are believed to have fallen by over 30 per cent from 2000 to 2004.

The Meat Protein Market

Meat proteins include blood proteins and protein isolates derived from other sources, mainly collagens. They are used for binding and other functional properties in meat products, as well as for their associated nutritional value in pet food applications.
The Single Cell Protein Market

Single cell proteins include in active autolysed yeasts and mycoprotein. The former is used mainly as flavourings and seasonings, while the latter is utilised as a meat substitute.

The Soya Protein Market

The European soya protein market is the largest plant-based protein market in Europe. Products include flour, concentrates, isolates and textured products. The market has been affected by the GM issue, which has largely been influenced by consumer opinion. These concerns have also increased raw material prices, resulting in the loss of business in some price sensitive application sectors.

The Gluten Market

Gluten protein is made from both wheat and corn. Wheat gluten is used mainly in the bakery industry and corn gluten is used as an animal feed. The market has matured and is influenced by raw material supply. While both gluten market sectors have relied heavily on their key end-user market sectors, suppliers have worked to widen their application base by developing products with improved functionality.

The Pulse Protein Market

Pulse proteins are made mainly from peas. This is a small market, which has not grown as rapidly as was forecasted. The products have good functionality but are relatively highly priced, thus finding use only in niche applications. Other crops, such as lucerne and beans, are under investigation, and are expected to appear in the market as a protein source in the next five years.

Competitive Analysis

There are 100-150 significant manufacturers of protein ingredients currently active in Europe. Most of the individual protein markets are dominated by fewer than ten manufacturers and only a few companies are heavily involved in more than one market. There are a large number of distributors and in some markets, imports are an important part of the competitive environment. The big product blending companies, such as Kerry and Puratos, are also key participants.
There has been some industry consolidation in most market sectors. The reasons for the mergers include: economies of scale, the need to supply the whole European market (not just the home country) and in some cases, the poor performance of the protein market in the face of difficulties, such as the BSE crisis, the GM issue and cheap imports.

Recommendations

As the European protein ingredients market grows increasingly competitive and profit margins decrease, future sales and profit gain is expected to be derived by a thorough understanding of the needs of end-users. In order to make continuous improvements regarding the end-user needs, companies must be prepared to measure and monitor their customer bases constantly. Companies should undertake regular customer surveys to make sure specific needs are being addressed. This exercise has the potential to reveal unmet customer needs. These measurements must be monitored overtime to track the movement and trends of customer attitudes and behaviour.

Other recommendations for sales, research and development (R&D) as well as for business development have also been included, for example:

- Analysis of new product potential
- Acquisition analysis
- Competitive benchmarking
Introduction to the Industry

Proteins are an essential part of the human diet providing the amino acids needed for the growth and health of the human body. They are for their functional properties. e.g. emulsifying, binding and whipping properties. The food industry is the largest market for proteins, although they are used in the cosmetics, pharmaceuticals and other industries.

Until the 1970s the traditional source of proteins was from animals. Since then other methods have been developed to extract proteins from plant sources and microbial sources. In addition, there is a growing market for textured plant proteins as meat extenders.

This research service investigates the European protein ingredients market from 2001 to 2004, with forecasts to 2011.

The research service covers those products whose protein content has been increased by processing, so that the protein content is higher than what was in the original product. However, there are exceptions to this.

The research service is segmented by protein ingredient type:

- Soya proteins - excluding soya meal
- Gluten
- Pulse and vegetable proteins
- Milk proteins
- Egg proteins - egg white only
- Fish proteins
- Meat proteins - excluding dehydrated meats
- Gelatine
- Single cell proteins - excluding active yeasts
Furthermore, the market is analysed by:

- Application - bakery, meat products, dairy products and animal feed
- Usage - nutritional and functional

The geographic scope of the research is the 25 countries of the EU, plus Norway and Switzerland.
Industry Challenges

Several challenges faced by the total European protein ingredients market have been identified.

Figure 3-1 illustrates the impact of the industry challenges on the total European protein ingredients market for the period 2005-2011.

Figure 3-1
Protein Ingredient Market: Market Challengers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Challenge</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of added value functional products</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Addressing consumer health concerns</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Increased demand from eastern Europe</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Demand for blended products</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Improving cost effectiveness</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Demand for nutraceutical properties</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact of changing world market conditions</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Development of Added Value Functional Products

The proteins market, especially for nutritional applications, is very competitive and is often associated with low margins. Margins can be improved by developing added value functional products to meet the growing demand from large food manufacturers for ingredients that provide very specific functional benefits. Some of the larger protein suppliers have been successful in developing many of these products and this is expected to be a continuing requirement of the market throughout 2005-2011.
Addressing Consumer Health Concerns

Consumer health concerns, such as allergies or the use of additives or inherent product safety, have a significant impact on proteins and other food ingredients. Major retailers and food manufacturers usually react quickly to address such concerns, whether they are well founded or not. Industry trade associations and participants need to be aware of product safety issues and problems need to be addressed as quickly as possible. The industry also needs to ensure that it has adequate control over raw material and processing quality.

Increased Demand from Eastern Europe

Many new European Union (EU) members food industries are expected to experience faster growth rates compared to Western European countries. The protein ingredients market is expected to follow a similar trend. In particular, there is likely to be an increase in demand for lower cost proteins, such as meat substitutes and extenders. Protein suppliers will need to review their product ranges to take account of the increasing importance of this market. In addition, the new EU members may bring increased raw material supply for some protein groups e.g. meat and gelatine.

Demand for Blended Products

The demand for nutritionally balanced proteins is increasing. In the animal feed sector, the balance of the protein is directly related to the animal weight gain. The demand for nutritional balance in the food industry has come from markets such as sports supplements, energy snacks and beverages and functional foods. Protein ingredients lacking in nutritional qualities are often blended with other protein or ingredient sources to provide the required nutrition profile.

Blending and pre-mix companies are likely to play an increasing role in this market sector in the future. Protein suppliers need to consider whether they should increase their capabilities to develop and supply blended products.

Protein ingredient manufacturers need to work closely with both end-users and raw material suppliers. Collaboration within the food industry enables protein manufacturers to have a better understanding of the market processes and the function of their developed proteins. Moreover, partnerships with raw material producers allow protein manufacturers to influence the properties of the protein at its origin. For example, in varying the feed of cows or chickens, protein manufacturers can influence the functionality or nutritional properties of the protein product. The selection of the crop variety also influences the protein properties.
Improving Cost Effectiveness

In some applications, proteins represent a small percent of the total product cost. Consequently, short term price changes are not expected to have a big impact on protein use. However, there are many exceptions. In specific nutritional applications, slight fluctuations may have a dramatic effect and, in some cases, end-users would consider switching ingredients as a result. In these applications, the potential cost reduction obtained in the manufacturing process by using specific proteins can offer a competitive advantage. It is important for the industry to minimise process costs, raw material costs and distribution costs to ensure the protein type remains competitive against substitutes.

Demand for Nutraceuticals Properties

Specific segments of the functional food market within Europe have observed high growth rates (Frost & Sullivan, 2005). Although there are still restrictions on health claims, some restrictions are in the process of being reviewed. However, even with these restrictions, food manufacturers are increasingly emphasising product content - such as Omega-3 fatty acids or specific live bacteria, which they believe to have a positive association to health and wellness to the consumer. Proteins that have specific nutraceutical properties offer a similar advantage. For example, lysozyme contained in eggs protects the body against bacterial, viral or inflammatory diseases. In addition, egg proteins have immunostimulation and antihistaminic effects. By highlighting the nutritional benefits of specific protein sources in marketing documentation, the profile of protein ingredients as nutritional ingredient will increase.

Impact of Changing World Market Conditions

Parts of the industry are likely to be affected by changing world market conditions. Protein use in Asia is expected to increase rapidly, especially in China. This is expected to increase pressure on world prices and, in some cases, may lead to shortage of supplies. Fish protein is a key example. However, production capacity in Asia is likely to increase and as a result there will be an increase in low cost imports to Europe. This is already occuring in the European soya protein market. Manufacturers active in the European protein ingredients market will need to assess whether its worth shifting some or all of their production capacity to Asia in order to meet these changing market conditions. In addition, the industry may need to consider the possible impact of changes in regulations. For example, deregulation of the sugar industry may affect the price of gluten. Possible reform of the EU CAP system may affect markets such as the milk protein market.
Strategic Analysis of the European Protein Ingredients Market

**Market Size (Euros)**

In 2004, the market revenues of the European protein ingredients market were estimated to be 3.77 billion Euros.

**Market Size (Units)**

In 2004, volumes consumed in the European protein ingredients market were estimated to be 3,267,000 tonnes.

**Annual Market Growth**

In 2004, the European protein ingredients market revenues grew by 9.4 per cent.

**Market Growth by Compound Annual Growth Rate (CAGR)**

The CAGR for the European protein ingredients market by revenues for the period 2004 to 2011 is 2.0 per cent.

**Average Price**

The average price in the European protein ingredients market was 1.2 Euros per kilogram.
Price Range

The average price range of a protein ingredient source in the European market was 0.6 Euros to 10.7 Euros per kilogram.

Number of Competitors

There are at least 50 suppliers active in the European protein ingredients market.

Market Forecasts

In 2011, the European protein ingredients market is forecast to be worth 4.43 billion Euros, corresponding to market volumes of 3,876,000 tonnes.
Strategic Analysis of the Total European Protein Ingredients Market

Introduction to the Market

Market Overview and Definitions

Proteins are used throughout the food and beverage industry for both the functional and nutritional properties they provide.

The following protein sources are included in this research service:

- Milk proteins
- Gelatine
- Egg proteins
- Fish proteins
- Meat proteins
- Single cell proteins
- Soya proteins
- Gluten
- Pulse proteins

Milk Proteins

Milk proteins include casein/caseinates and whey proteins. Casein and caseinates are natural emulsifiers. Whey proteins are the by-product of cheese and casein manufacture. They can be used for their functional properties in the dairy industry and for their associated nutritional properties in nutraceutical, sports and dietary products.
Gelatine

Gelatine is manufactured from collagen, which is derived from animal bones and hides. It is used primarily for its functional properties. Its main end-user market is the confectionery industry, where it provides specific mouth feel properties.

Egg Proteins

Eggs are sold to the food industry as whole eggs, egg whites and egg yolks. Egg white is included in this research service because it has an extremely high protein content and is generally regarded by the industry as a protein product. Whole eggs and egg yolks are not included in the analysis. The main application for egg white is in the bakery industry where it is used for its functional properties.

Fish Proteins

Fish proteins are supplied as fish meal and are used mainly for their nutritional properties. The main end-user market for fish protein is in aquaculture (fish farming). Its use in animal feed has declined sharply in Europe as a result of European Union (EU) restrictions imposed after the Bovine Spongiform Encephalopathy (BSE) crisis.

Meat Proteins

Meat proteins include blood proteins and products derived from other sources such as collagen. The main application for meat protein products is in the meat industry as a meat extender and in pet food where it is used for its nutritional properties.

Single Cell Proteins

Single cell proteins include yeast extracts and autolysed yeasts (refined from yeast) and mycoproteins. For the purpose of this research service, active yeasts are excluded. The main market for yeast extracts is as a flavouring agent in a wide range of foods. The market for mycoprotein is as a meat replacement in vegetarian dishes.

Soya Proteins

Soya protein is divided into four separate markets:

- Grits
- Concentrates
- Textured products
- Isolates
Soya grits are manufactured by grinding and screening defatted soya flakes and they are used primarily in the baking industry for breads and biscuits. Soya protein concentrates are 65-70 per cent protein. Standard concentrates are used for animal feed, while many functional concentrates have been developed for human food applications. Textured soya proteins are manufactured from soya flours and concentrates. Textured soya proteins are used as a meat extender and as a protein source for vegetarian dishes. Finally, soya protein isolates contain at least 90 per cent protein and are used in the meat industry, as well as in sports and functional food products.

**Gluten**

Gluten is a natural component of cereal grains. It is principally manufactured from wheat and corn, but barley and rice are used as well. Wheat gluten is used mainly in bread, while corn gluten is used in animal feed and pet food.

**Pulse Proteins**

Pulse proteins are made mostly from yellow peas, though lupins are also used. They are nutritional and have good functional properties, but manufacturing costs are high, thus excluding their use from many applications. They are mainly used in speciality applications in the meat and bakery market.

There are other protein ingredient sources offered in the European protein ingredients market such as potato proteins. These markets represent a small fraction of the total European protein ingredients market and have not been included in this research service.

In some applications, there is competition between the different types of protein. However, in many instances there is no effective competition because the proteins have unique functional properties, and cannot be replicated by alternative protein sources. Furthermore, the time taken to test new specifications is often a disincentive to switching ingredient sources or types.

In 2004, the European market for protein ingredients was 3.77 billion Euros.

**Market Drivers**

Figure 5-1 lists the drivers ranked in order of impact for the total European protein ingredients market from 2005 to 2011.
Increased Demand from Eastern Europe

Many of the economies of Eastern Europe are growing rapidly and the demand for processed foods is increasing faster than Western Europe. Furthermore, the Eastern European market tends to be less affluent. These factors are driving demand for low-cost protein sources that can be used as substitutes to other ingredients. This is likely to remain as an important driver throughout the period from 2005-2011, especially for meat and soya proteins.

Increased Demand for Functional Proteins

Much of the food industry is looking for improved functionality from its ingredients. The ability of protein manufacturers to design and develop specific concentrates and isolates for sauces, dairy products and a wide range of other processed foods is likely to be a driver for the market in the forecast period from 2005-2011.

The main advantage associated with this trend is that the protein sources used for specific functional properties are often less price sensitive than those that are used only for their nutritional properties.

Strong Demand for Functional Foods and Sports Products

Increasing demand for functional foods and sports products has been a strong driver for various protein sources, particularly for higher value milk proteins types. This is likely to remain as a driver in the market, even though the growth rate is expected to be slightly lower over the forecast period (2005-2011).

### Figure 5-1

Total Protein Ingredient Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increased demand from eastern Europe</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Increased demand for functional proteins</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Strong demand for functional foods and sports products</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Consumer health and safety concerns</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Recovery from BSE and other crises</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Increased demand from end-user industries</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Technical developments-new protein sources</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Consumer Health and Safety Concerns

Consumer health and safety concerns are very important, especially as supermarkets will often act quickly to address such issues. In many cases, the demand for proteins may be restrained by consumer concerns over allergies or safety issues. However, specific protein sources may also benefit because they are not associated with any particular allergies. The move towards 'clean' labels (fewer E numbers) may be a minor driver for proteins as other alternatives, such as emulsifiers and stabilizers, require E numbers. EU regulations requiring more detailed labelling are likely to drive growth in the protein ingredients market as end-users seek alternatives.

Recovery from BSE and Health Issues

The BSE crisis had a major negative impact on the European protein ingredients market. The use of animal proteins in the food industry was effected most. Since 2004, some of these restrictions are expected to be eased and consumer attitudes may change. Recovery of various markets are expected to be slow.

Increased Demand from End-user Industries

While much of the food market in Western Europe is mature with very low growth, there are still some growth sectors. These include confectionery (an important market for gelatine), ready meals, some meat products and dairy products (excluding milk). Growth in these markets is expected to be a key driver in the forecast period from 2005-2011.

Technical Developments - New Protein Sources

Various protein suppliers have had success in expanding their application base through the technical development of functional proteins, especially milk and soya protein categories. These high value-low volume sectors will continue to drive growth throughout the industry. New protein sources such as rice and lucerne are expected to be introduced in the future, although their impact will be minor during the forecast period (2005 - 2011).

Market Restraints

Figure 5-2 lists the restraints ranked in order of impact for the total European protein ingredients market from 2005 to 2011.
Consumer Attitudes to Health and Safety Issues

European consumers are increasingly aware of potential - real or imagined - health issues with regard to food ingredients. The BSE crisis had a severe impact on the animal proteins market, although in the long term the effect of BSE is expected to decrease and is likely to prove to be a minor restraint in the market.

There is also an increasing concern about allergies, gluten and milk intolerance. EU requirements to list potential allergens on consumer packaging is expected to have an adverse effect on some products. However, some protein sources such as pulses, which have not been associated with allergies may benefit.

Mature End-user Markets

Some of the biggest end-user markets for proteins, especially bakery and some meat products, are mature and are likely to show little growth in the forecast period. Saturated and low-growth end-user markets will continue to restrain growth in the market.

Cheap Imports

While Europe is a net exporter of many protein sources, the local industry is under threat from cheap imports from Asia e.g soya isolates from China.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consumer attitudes to Health and Safety Issues</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Mature end-user markets</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Cheap imports</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
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<tr>
<td>4</td>
<td>Raw material supply</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Price pressures</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
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</tbody>
</table>

Source: Frost & Sullivan
RAW MATERIAL SUPPLY AND REGULATION

Proteins come from natural sources and supply is subject to variations in quantity and quality. For instance, the supply of fish protein is limited by the total fish catch, while the supply of milk proteins in Europe is influenced by EU policies on dairy product stocks and price levels. The supply of soya protein, gluten and other vegetable proteins is affected by annual harvests. Moreover, soya supply is affected by the availability of non-GM material of which there is a shortage in 2005. The supply of gelatine is affected by competing demands for raw materials. These factors will continue to restrain growth in the market throughout the forecast period (2005 - 2011).

PRICE PRESSURES

Although there is likely to be short term fluctuations, a downward pressure on prices in the European protein ingredients market during the forecast period is expected. This pressure is likely to be partly due to cheaper imports of some protein sources from Asia and the possible reform of the EU CAP system towards the end of the forecast period. The animal feed market, where proteins are used for nutritional rather than functional purposes, is also subject to price pressures.

MARKET QUANTIFICATION

Market Engineering Measurements

Chart 5.1 illustrates the Market Engineering measurements for the total European protein ingredients market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>3,779 million Euros</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market size</td>
<td>3.3 billion Tonnes</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>9.4%</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>2.0%</td>
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<tr>
<td>Market age</td>
<td>Various</td>
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<tr>
<td>Average price</td>
<td>1.15 Euros per kilo</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Price range</td>
<td>0.4 - 12 Euros per kilo</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>26%</td>
<td>Increasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>100-150</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 5.3 illustrates the volume and revenue forecasts for the European protein ingredients market for the period 2001 to 2011.
In 2004, the European protein ingredients market was worth 3.77 billion Euros with a volume of 3.27 million tonnes.

Total market volumes fell during the 2001-2004 period. This decrease was partly attributed to the EU ban on the use of fish meal in most animal feed applications. In most other end-user sectors market, volumes grew slowly during this period. The milk protein sector showed the strongest growth.

The total market revenues fell from 2001 to 2003. Much of this reduction can be accounted for by the fish protein market although price pressures were felt in most markets. The egg protein sector was the only market that showed significant increase during this period.

In 2004, the total market revenues increased by 9.4 per cent, while volumes fell slightly. This increase in value was mainly because of average price increases in the milk protein market, especially for caseinates. The price of gelatine and egg proteins increased in 2004, while the average price of wheat gluten fell.

During the period 2005 to 2011, the total market revenues and volumes is forecast to increase at 1-3 per cent. It is expected that there will be unpredictable annual fluctuations due to supply shortages and changing EU regulations. Many markets are likely to face downward price pressures from cheap imports, over supply and the possible reform of the CAP system towards the end of the forecast period. However, there is likely to be driving upward price pressures that will counter balance these other factors. The EU move towards free range egg production and increased world demand for fish protein are examples.
During the period 2004-2011, the compound annual growth rate (CAGR) is likely to be 2.0 per cent by value.

Pricing Analysis

In 2004, the average price of all proteins was 1.2 Euros per kilo.

In 2001, the average price of all proteins was 1.1 Euros per kilo. From 2001-2004, prices fluctuated. In 2004, average prices increased, mainly due to increases in the price of milk proteins and gelatine.

Prices ranged from 0.4 Euros per kilo for some animal feed proteins, to over 100 Euros per kilo for specialist milk isolates and other products. Prices commanded for protein sources in low volume-high value applications such as pharmaceuticals are a lot higher. These end-user markets were not included in the analysis.

Although the average total average price for protein ingredients are expected to remain stable in the period 2005-2011, there is likely to be unpredictable fluctuations in the short term in individual market sectors. The sharp price increase in 2004 for milk proteins are expected to be followed by a slight price fall. There is likely to be some downward pressure on milk protein prices in the forecast period because of the raw material supply situation and changing EU regulations. Prices may rise for meat, fish and possibly egg proteins, while increased imports may put downward price pressure on soya protein market.

In 2011, the average price of the European protein ingredients market is estimated to be 1.1 Euros per kilo.

Trends by Product Type

Figure 5-4 shows the market revenues by protein type for the total European protein ingredients market for the period 2001-2011.
Milk proteins account for nearly 50 per cent of the total European protein ingredients market. The other major sectors are fish protein, soya protein and gelatine.

With the exception of the fish and gluten protein market, most sectors have experienced an increase in market revenues, with the milk protein market showing the fastest growth. Due to changes in EU regulations (caseinate subsidies), sales values increased sharply in 2004.

Most of the protein markets researched are expected to show higher growth rates during the forecast period (2005-2011) than they did in the period 2001-2004. The main exception is milk proteins. It is unlikely that an increase of this magnitude is expected to occur again. The fastest growing markets are likely to be fish protein (recovering from recent falls), meat protein and pulse protein. Despite a slow down in growth, the European milk protein market is likely to increase their share of the total protein ingredients market.

Usage Analysis

Figure 5-5 and Chart 5.2 illustrates the proportion of protein ingredients used in nutritional applications and functional applications in 2004.
Nutritional Demand

The functional properties of proteins are often enhanced by associated nutritional benefits. Protein ingredients are made up of essential amino acids, which play a strong role in the repair of damaged body tissue. After assimilation, protein can also provide bioactive peptides, minerals and vitamins. The main nutritional uses for proteins is in animal feed and pet food. Other food applications are as a meat extender and in specialist high value applications for sports and energy products. Over 50 per cent of fish and soya proteins are used for nutritional purposes and the application is also important for meat and milk proteins.

Functional Demand

Protein ingredients are used as whipping agents in the bakery, dairy and confectionery industries. Their glazing properties are used in bakery, sauces, dairy desserts and confectionery. They can act as good emulsifying agents and are used for their taste and colour in the meat industry, bakery, sauces, dairy, confectionery and pasta industries. Functional properties vary by protein type.
Over 60 per cent of gelatine, milk, egg and wheat gluten proteins are used primarily for their associated functional properties.

End-user Analysis

Figure 5-6 and Chart 5.3 illustrate an analysis by application for the total European protein ingredients market in 2004.

**Figure 5-6**

Total Protein Ingredients Market: End-user Analysis in Volumes (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal feed, pet food</td>
<td>31</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Dairy products</td>
<td>16</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>15</td>
<td>Stable</td>
</tr>
<tr>
<td>Bakery</td>
<td>12</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Nutraceuticals, sports, dietary</td>
<td>8</td>
<td>Increasing</td>
</tr>
<tr>
<td>Confectionery</td>
<td>7</td>
<td>Stable</td>
</tr>
<tr>
<td>Other food</td>
<td>11</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 5.3**

Total Protein Ingredients Market: Analysis by Market Sector (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Meat Products

The meat market accounted for 15 per cent of the total market value. This represents mainly soya, milk and meat proteins, as well as gluten and gelatine. Proteins were used as meat extenders and also for their functions such as binders, emulsifiers, water binders and textures. The demand is expected to increase during the 2004-2011 period, in particular in Eastern Europe where the products are used as low cost meat extenders.

Dairy Products

The dairy market accounted for 16 per cent of the total market revenues. Various proteins were used for their functional properties, such as a gelling and whipping agents and as a substitute for dried milk. The demand is forecast to increase during the 2005-2011 period.

Animal Feed

The animal feed market accounted for 31 per cent of the total market revenues. The animal feed market used whey proteins, corn gluten and soya proteins. The aquaculture market consumed mainly fish protein. The nutritional protein ingredient markets is highly price sensitive. In 2000, the market had declined in size, because of the ban on the use of animal proteins in feed, but is likely to recover during the forecast period from 2005-2011.

Functional Foods, Sports Products, Dietary Supplements

Since 2001, this has been the fastest growing market. The end-user market uses mainly high value isolates from milk protein, but also from soya and other protein sources. This end-user market is the focus of much product development, with many suppliers of protein ingredients adding products targeting specific requirements of this sector. This market is expected to experience medium - high growth in the period 2005-2008, although growth may be lower than 2009-2011.

Bakery

The bakery market uses mostly gluten and egg proteins, although soya, milk and pulse proteins are also used. Gluten is used to increase the protein content of flour, supplementing the existing protein found in the wheat. Furthermore, this protein also has associated functional applications as a strengthener, binder, emulsifier, and whipping agent. The demand from the bakery industry is expected to increase inline with growth within the bakery industry.

Other Food

Other markets include a wide range of processed foods such as sauces, soups and ready meals, as well as vegetarian meat substitutes, pharmaceutical products, and confectionary applications.
**Competitive Environment**

**Competitive Structure**

Figure 5-7 illustrates the competitive structure for the total European protein ingredients market in 2004. Most of the protein markets are dominated by a few suppliers. There are only a few companies that are heavily involved in more than one sector. There are over 50 significant manufacturers of protein ingredients active in Europe. There are perhaps 50-100 other small manufacturers, mainly local companies in the milk, egg and fish protein markets.

**Figure 5-7**
Total Protein Ingredient Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>100-150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Multinational food ingredient suppliers, proteins a by-product</td>
</tr>
<tr>
<td></td>
<td>Europe-based specialist producers; proteins main product</td>
</tr>
<tr>
<td></td>
<td>Distributors, importers</td>
</tr>
<tr>
<td></td>
<td>Product blenders and specifiers</td>
</tr>
<tr>
<td>Notable Mergers, Acquisitions</td>
<td>2004-DMV and Arla announce plans to merge</td>
</tr>
<tr>
<td></td>
<td>2004-Kerry Ingredients purchases protein business of Quest</td>
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<tr>
<td></td>
<td>2004-Degussa exits production of soya proteins</td>
</tr>
<tr>
<td></td>
<td>2003-Purchase by Gelita of several smaller gelatine producers</td>
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<td></td>
<td>2003-Chr Hansen exits food ingredient market</td>
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<td></td>
<td>2003-Purchase of gelatine business of Leiner by Tenderlesso and incorporation with PB Gelatines</td>
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<td>2003 Launch of Solae group-merger between DuPont and Bunge</td>
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<td>2002-Purchase of Cerestar by Cargill</td>
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<td></td>
<td>2002-DMV purchased Avebe (Netherlands)</td>
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<td></td>
<td>2000-Arla Foods takes over MD Foods</td>
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<td>2002-Purchase of Aveve and Ovonor by Eurovo</td>
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<td>2003-Proliant buys BHJ</td>
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<td>2002-Purchase of Rousselot by Sobel group</td>
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<tr>
<td>Competitive Factors</td>
<td>Price and low production costs</td>
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<tr>
<td></td>
<td>Product development for functional applications</td>
</tr>
<tr>
<td></td>
<td>Ability to source materials</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Animal and pet food</td>
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<tr>
<td></td>
<td>Dairy products</td>
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<td>Meat products</td>
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<td></td>
<td>Bakery</td>
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<tr>
<td></td>
<td>Nutritional/energy/sports</td>
</tr>
<tr>
<td></td>
<td>Confectionery</td>
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</tbody>
</table>

*Source: Frost & Sullivan*

Figure 5-8 lists the protein types offered by major market participants in 2004. Most sectors were dominated by fewer than ten suppliers.
**Figure 5-8**

Total Protein Ingredient Market: Protein Sources Offered by Major Market Participants (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>Milk</th>
<th>Gelatine</th>
<th>Egg</th>
<th>Fish</th>
<th>Meat</th>
<th>Single Cell</th>
<th>Soya</th>
<th>Gluten</th>
<th>Pulse</th>
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</table>
**Figure 5-8 (Continued)**

Total Protein Ingredient Market: Protein Sources Offered by Major Market Participants (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>Milk</th>
<th>Gelatine</th>
<th>Egg</th>
<th>Fish</th>
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</table>
In the milk, gluten and soya market, the dominant companies involved are large ingredient processors for whom proteins were one by-product. In contrast, the manufacturers of meat proteins and gelatine are specialist producers that do not produce other meat products.

In addition to manufacturers, there were a large number of distributors, blenders and importers. Distributors play an important role in numerous markets.

Major blending companies such as Kerry Ingredients, Puratos and G.C. Hahn play an important role in the industry. These companies buy in proteins and blend them to produce high value products for specific applications. The trend towards more functional designer ingredients is likely to benefit these major blenders.

There has been consolidation in most market sectors. In the milk protein market, DMV was planning to merge with Arla and in the soya protein market with the largest producer, Solae. The DMV and Arla proposed merger did not go ahead. Hansen, Quest and Degussa withdrew from the protein market. The reasons for the mergers include: economies of scale; the need to supply the whole European market and not just the home country; and in some cases, the poor performance of the protein market in the face of difficulties, such as the BSE crisis, the GM issue and cheap imports.

Protein ingredients are used in almost all food industry segments. Key end-user groups include: animal feed, meat product manufacturers, pet food manufacturers, bakery manufacturers and the dairy industry.

A key competitive factor is the ability to develop new products and modify specifications according to customers' specifications. Protein manufacturers are faced with new challenges from the food industry, both in terms of functionality and nutritional value. These manufacturers must follow end-user trends, and continue to stay responsive to customers needs if they are to survive in the increasingly competitive environment.

A second competitive factor is the ability to maintain prices. Most commonly this is done by improving the production process, adopting economies of scale or through the sourcing of raw materials.

<table>
<thead>
<tr>
<th>Company</th>
<th>Milk</th>
<th>Gelatine</th>
<th>Egg</th>
<th>Fish</th>
<th>Meat</th>
<th>Single Cell</th>
<th>Soya</th>
<th>Gluten</th>
<th>Pulse</th>
</tr>
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<tbody>
<tr>
<td>Triple Nine</td>
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</table>

Source: Frost & Sullivan
Furthermore, exercising more control over the whole production line, including the production of the raw material, is becoming more important. This can ensure the quality of the protein ingredient, satisfying regulatory requirements for traceability of ingredients.

Market Share Analysis

Figure 5-9 and Chart 5.4 illustrates the market share accounted for by key participants active in the total European protein ingredients market in 2004.

**Figure 5-9**
Total Protein Ingredient Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMV</td>
<td>11</td>
</tr>
<tr>
<td>Arla</td>
<td>9</td>
</tr>
<tr>
<td>Armor Proteine</td>
<td>6</td>
</tr>
<tr>
<td>Glanbia</td>
<td>5</td>
</tr>
<tr>
<td>Kerry</td>
<td>5</td>
</tr>
<tr>
<td>Others</td>
<td>64</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 5.4**
Total Protein Ingredients Market: Market Share Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
The total market was dominated by the milk protein producers as this sector accounted for nearly 50 per cent of the total market. DMV’s success was based on the strong milk producing industry in the Netherlands. Arla is the dominant milk producer in Scandinavia. The next largest suppliers - Armor, Kerry and Glanbia - were also milk protein producers.

Major distributors in the market include Univar, Acatris, Hahn, ACP and Camida.
Strategic Analysis of the European Milk Protein Market

Introduction to the Market

Market Overview and Definitions

Milk protein includes: casein, caseinates and whey proteins.

Caseins are typically obtained by spray drying clotted skimmed milk. While a lot of casein is used in the food industry, it has a large non-food applications market such as in glue and paint. In Europe, most non-food applications use low quality imported caseins.

Caseinates are obtained by further treatment of caseins and are present as alpha-casein, beta-casein and kappa-caseins. They are heat stable and easily dispersible, whereas caseins are less functional. Products can contain 1-2 per cent of sodium, potassium, magnesium or calcium.

Whey products include a range of whey proteins, including powders, concentrates and isolates. Whey is a by-product of cheese production and may also be made from casein. Whey is made up of protein, lactose, minerals and fat. These proteins include alpha-lactalbumin, beta-lactaglobulin, bovine serum, immunoglobulins and proteose-peptones. Historically, whey was discarded or used as low quality animal feed. However, environmental considerations have made it more difficult to discard whey. Over the last twenty years a range of whey products have been developed.

Milk proteins are used for both their functional and nutritional properties they provide. The nutritional value of milk proteins and their good digestibility makes them suitable for sport products, dietary supplements and as a milk replacement. Depending on the product, they also have excellent functional properties, such as emulsifying, foaming and water-binding.

The largest suppliers are DMV, Arla Foods and Armor Proteins.

The European milk protein market was valued at 1,704.3 million Euros in 2004 making it the largest protein market.
Market Drivers

Figure 6-1 lists the key drivers ranked in order of impact for the European milk protein market from 2005 to 2011.

**Figure 6-1**

Milk Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Good functionality</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Good nutritional value</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand from functional food and sports products</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Alternative to soya or meat protein</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Protein source cost vs Milk powder cost</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Technical developments</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Good Functionality**

Milk proteins have excellent functionality. They can be used to improve viscosity, texture and gelling properties, as well as for emulsifying and foaming. Caseinates exhibit high solubility, low viscosity, excellent emulsification capacity, clean flavour, freeze-thaw stability and a high fat and water binding capacity. Whey proteins have good whipping and foaming capacities, high solubility, gelation, water binding and emulsification properties. An example of a recent development is Lactalis, a new isolate that has not undergone any chemical, heat or enzyme treatment to compete with soya proteins.

The food industry has increased the demand for specific designer ingredients to meet the individual needs of particular applications. Each application has unique requirements. High viscosity and high gel properties are required for meat substitution, whereas low viscosity characteristics are important for beverages. Milk proteins are well placed to meet this demand, which is likely to be an important driver in this market during the period 2005-2011.

**Good Nutritional Value**

Milk protein has a high nutritional value and is easier to digest than plant proteins. 98 per cent of milk proteins are digested compared with 88 per cent of soya proteins. Furthermore, milk proteins benefit from a generally positive image and are used in energy and health products as well as products that claim to improve physical performance, such as sports supplements. Milk protein has a neutral taste, so does not require a flavour masking agent.
There is high amino acid content in milk protein and bioactive peptide fragments, which aid immune defences.

**Increased Demand from Functional Food and Sports Products**

The growing interest in functional food products is likely to be a driver for this market, especially in the early part of the forecast period with strong market growth expected.

**Alternative to Soya and Meat Protein**

Recent concerns over Genetically Modified (GM) ingredients has increased the price of non-GM soya, which has driven some companies to alternative ingredients. Although milk protein is not the cheapest alternative, it is believed to have captured some of this market. Non-GM soya prices are likely to continue to be high in the short term (2005-2006).

**Protein Powder Cost vs Milk Powder Cost**

An important use of milk proteins is to replace milk powder in dairy preparations. The substitute is largely on the basis of cost as powder milk is cheaper but contains less protein, and may not be as cost effective. The relative prices are likely to depend on many trends in the dairy industry, on subsidy levels and hence can not be easily predicted. The ease of availability of whey from cheese production tend to keep whey powder prices low. Due to this, it is believed that this will remain a key driver in the European milk protein market.

**Technical Developments**

Relative recent production technology such as extraction, purification and filtration, enables milk proteins to be supplied as a finer soluble compound or peptide, enabling them to be easily used in particular applications. Improvements in membrane technologies have resulted in an increase in the quality and number of products on the market.

There are also technical developments in the added-value fractions markets - lactoferrin and lactoglobulin among others. Although low in volumes, these products command high prices in markets such as infant formula products.

These developments are likely to drive the use of milk protein.

**Market Restraints**

Figure 6-2 lists the key restraints ranked in order of impact for the European milk protein market from 2005 to 2011.
**Price Levels and EU Subsidy**

Milk proteins command a higher price than their alternatives such as soya and gluten. While specific functional property advantages mean that there is no alternative to milk protein in many applications, there are some applications where higher prices are likely to result in the loss of market share. Changes in European Union (EU) rules and structural changes in the industry are both reducing the subsidies on casein. As a result, the price of caseinate increased sharply in 2004 to reach 6.0 Euros per kilo. This increase in price is likely to restrain growth in the market in the short term, although prices are expected to decrease in response to lower demand in the long term.

**Restricted Availability of Raw Materials**

The amount of milk proteins available in a given year is dependent on the amount of cheese produced. The manufacturers of caseinates are able to choose whether to produce caseinate or cheese according to the existing demand and profitability models. As a by-product of cheese and caseinate production, whey also depends on the production of lactoserum and the number of plants available to process the lactoserum. Limited raw materials are likely to restrain growth in particular ingredient segments through the forecast period (2005 - 2011).

**Competition from Plant Protein Sources**

Currently, there is significant efforts being made to research new plant protein sources, such as canola and lucerne. These products may be widely available in the latter stages of the forecast period. It is believed that they will be used in high value applications and in some cases will compete directly with milk proteins.
Increased Awareness of Lactose Intolerance and Milk Allergies

There is increasing consumer awareness of food intolerances, including lactose intolerance. In Finland 20 per cent of milk is now lactose-free and this has resulted in a greater use of alternatives such as soya milk. Some studies link the presence of autism in children to an inability to absorb and breakdown caseins and gluten. These factors are expected to be a continuing restraint on the European milk protein market during the forecast period (2005-2011).

Consumer Trends

In some countries, the number of vegan and vegetarian consumers is increasing and this is likely to be a minor restraint on the market in the short and long term.

Common Agricultural Policy (CAP) Reform

The EU has long-term plans to reform the Common Agricultural Policy (CAP) reform and this is likely to lead to lower subsidies for dairy products. This may act as a restraint on the market especially in the long term (2009-2011).

Market Quantification

Market Engineering Measurements

Chart 6.1 illustrates the Market Engineering measurements for the total milk protein market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
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<tbody>
<tr>
<td>Revenues</td>
<td>1,704.3 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>1,448,000</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>21.3%</td>
<td>Decrease</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.91%</td>
<td>N/A</td>
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<tr>
<td>Market age</td>
<td>Various</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>1.2 Euros per kilo</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Price range</td>
<td>0.4 - 100 per kilo</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>60%</td>
<td>Decreasing</td>
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<tr>
<td>Competitors (active market competitors in base year)</td>
<td>50-100</td>
<td>Increasing</td>
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</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 6-3 and Chart 6.2 illustrates the volume and revenue forecasts for the European milk protein market for the period 2001 to 2011.
In 2004, the European milk protein market was valued at 1,704.3 million Euros with a total tonnage of 1,448,000 tonnes.
Market revenues have been volatile on account of sharp changes in caseinate prices caused partly by reductions in EU subsidies. In the period 2005-2011, the volumes and revenues are forecast to increase, although there may be some pressure to reduce prices and short-term price volatility.

The compound annual growth rate (CAGR) for the period 2004 to 2011 is calculated at 1.9 per cent.

Product Analysis

Examples of products currently sold in the European milk protein market in 2004 include:

**Caseins**

Casein products come in two forms: acid casein and rennet casein. Rennet casein is formed by adding enzymes to skimmed milk and acid casein is formed by converting the lactose in skimmed milk into lactic acid through the addition of bacteria. Caseins are mainly used for animal feed, although they are used for non-food applications as well. Over 80 per cent of casein produced specifically for use in the food industry are transformed into caseinates.

**Caseinates**

Caseinates are hydrophilic proteins that constitute a good source of nutrition as they have a protein content of over 90 per cent. Consequently, they are used in nutraceutical products such as energy drinks and infant formulas. Moreover, they have good emulsification, aeration, viscosity and binding properties, which make them a suitable ingredient for meat and baked products. They have excellent organoleptic properties as well.

**Whey Proteins**

Whey is a by-product of cheese and casein production. Whey proteins are obtained by filtration of the lactoserum left over after the making of cheese and caseins. Their protein content varies between 12 and 33 per cent and they are used as an emulsifying agent or as a source of protein in dairy products, animal feed, ice cream and meal replacements. Whey proteins are rich in minerals, but as they contain lactose and other milk components in high concentrations they are unsuitable for many applications.
**Whey Protein Concentrate (WPC)**

WPC is available in a number of different concentrations ranging from 34 per cent up to 80 per cent. The protein level in the WPC powder depends on the type of filtration process utilised. The function of WPCs is either nutritional, as a source of proteins, or functional, where they are used as emulsifying agents or to provide texture and/or to increase absorption properties. WPCs are used throughout the food industry.

**Whey Protein Isolate (WPI)**

WPI is an ultra concentrated whey protein with a protein content of over 90 per cent. These products are used mostly by the dietetic industry in tube-feeding formulas, milk-allergy products, energy drinks and other applications that require high level of proteins. Glanbia has developed a new juice beverage containing whey protein isolate and both DSM and Kerry have developed isolates to add to sports drinks.

**Whey Protein Hydrolysate**

WPC can be hydrolysed and while this process does not alter the protein content, the proteins can be reduced to smaller units that are much easier to absorb by adding enzymes to the proteins before drying. It is for this reason that the hydrolysed proteins are often referred to as "pre-digested". Whey protein hydrolysates are used in dietetic foods.

**Pricing Trends and Analysis**

The average price of European milk proteins in 2004 was 1.2 Euros per kilo. The average price of caseins and caseinates in 2004 was 6.0 Euros per kilo. The average price of whey proteins in 2004 was 0.6 Euros per kilo.

Whey protein powders are priced from 0.4 - 1.2 Euros per kilo, while the prices of whey protein concentrates vary from 1.2 - 5.5 Euros per kilo depending largely on the protein content. However, the more concentrated products tend to command a higher price per unit of protein because of high quality and are designed to provide functional benefits as well as nutritional value.

Prices of caseinates range from 5.0 to 7.50 Euros per kilo, and the prices increased by over 40 per cent in 2004, following price decrease since 2001. The increase in price is due to a combination of factors such as stronger demand, reduction in the EU subsidy, shortage of supply and poor year for milk quality. In early 2005 prices are at their highest ever level.
The EU has been giving subsidies to caseinate producers. These subsidies have been reduced in recent years and are expected to be eliminated by 2009. Prices of caseinates are expected to fall over the next two years as demand falls slightly in response to the current high price. Thereafter, there may be a gradual increase as the EU subsidy is reduced.

Whey prices have increased in 2004 as a response to strong demand. Over the next few years cheese production is expected to grow, thus increasing the supply of whey. This may put a slight downward pressure on prices, and in the longer term possible reform of the CAP may also tend to reduce prices.

Usage Analysis

Figure 6-4 and Chart 6.3 illustrates the proportion of milk protein used in nutritional applications and functional applications in Europe in 2004.

**Figure 6-4**

Milk Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market share (%)--by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>33</td>
</tr>
<tr>
<td>Functional</td>
<td>67</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 6.3**

Milk Protein Market: Usage Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Nutritional Applications

Milk proteins are a good source of energy and have high nutritional value. Typically they are easier to digest than vegetable proteins. They are used in the substitution of other proteins, such as meat in processed food, where three to six per cent of the meat can be substituted by milk proteins, without affecting the taste or properties of the product. In dairy products, they can replace up to 100 per cent of the more expensive dehydrated milk, while retaining the majority of the product’s nutrititional value.

Milk proteins contain essential amino acids, such as histidine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophane and valine. Amino acids play a strong role in the repair of damaged body tissue and in aiding immune defences.

Nutritional applications are increasing their market share with the growth of the functional food, energy and probiotic market.

Functional Applications

Milk proteins are used mostly for their functional properties they provide. Milk proteins can be used to increase viscosity, texture, gelify, foam and emulsify food preparations. Furthermore, they do not lose their texturing properties with heat and can resist salt and acid pH more than any other protein sources. The functional properties of milk protein such as high water retention, make them useful in meat and baked good applications. The multiple functional properties of milk proteins constitute a strong competitive advantage, where the demand for high performance proteins is growing.

On account of their high price, the milk protein suppliers tend to focus on both the nutritional and functional qualities inherent within the milk protein type.

End-user Analysis

Figure 6-5 and Chart 6.4 illustrates an end-user analysis by application for the total European milk protein market in 2004.
FIGURE 6-5

Milk Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)–by Value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional foods, sports, dietary supplement products</td>
<td>20</td>
<td>Increasing</td>
</tr>
<tr>
<td>Dairy products</td>
<td>35</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>20</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Ice cream</td>
<td>5</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Bakery</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>Other food</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

CHART 6.4

Milk Protein Market: End-user Analysis (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

FUNCTIONAL FOODS, SPORTS, DIETARY SUPPLEMENT PRODUCTS

This category includes infant milk, enteral nutrition, diet supplements, meal substitutes and health/sport supplements. It is one of the most rapidly growing consumer food markets, with the perceived quality of the product being of greater importance than the price. Milk proteins are used in this sector due to their high digestibility, nutritive value and healthy image. This market has grown rapidly since 2000, but may stabilise in the next few years with a growth of 4-6 per cent expected in the period 2005-2011.

The milk proteins typically used in these applications include isolates and hydrolysates on account of their high protein content and nutritional value.
Dairy Products

This category includes soft cheese, yoghurt, dairy puddings, dairy spreads and cream as well as cheese analogues, toppings, cream substitutes and coffee whiteners. The dairy product market uses milk proteins for their texturing power and as stabilisers in yoghurt, processed cheese and spreads. Milk proteins are often used to substitute more expensive dehydrated milk without altering the taste. Their stability at an acidic pH allows their usage in real fruit yoghurts and preparations.

The market for these types of dairy products is growing at 3 per cent in Europe and the use of milk proteins in this sector is forecast to grow rapidly as companies develop highly specified products.

Meat Products and Ready Meals

Milk proteins are used for their texturing power, to bind fat and water together or as meat preservers. The main advantages of milk proteins, especially whey proteins, include:

■ Their solubility in salted mediums
■ Their emulsifying properties up to 50 degree Celsius
■ Their nutritional value

However, this market is slowly declining because of the high cost of milk proteins compared to other protein sources.

Ice Cream

Whey proteins can improve the freeze/thaw stability and body texture of ice cream and frozen desserts as well as aid coating stability. Furthermore, they can replace hydrocolloid stabilisers with possible cost savings. However, with changes in ice cream formulations, this is a declining market for milk proteins. Ice cream manufacturers are preferring a higher lactose content, which produce a firmer and dryer texture.

Bakery

In bakery applications, milk proteins are used for their functional properties and are in direct competition with low price plant and egg proteins. Milk proteins are still the protein source of choice in some applications, which utilise their high water retention power to provide a drier product texture.

Other foods

Other applications for milk proteins include animal feed, pharmaceutical products and emulsified foods such as mayonnaise and dressings. Animal feed uses milk protein for specialist applications such as baby calves milk.
A relatively new application for milk proteins is in beverages where whey protein can provide a neutral taste, clarity in solution and stability at high temperatures.

**COMPETITIVE ENVIRONMENT**

**Competitive Structure**

Figure 6-6 illustrates the competitive structure for the European milk protein market in 2004.

**Figure 6-6**

Milk Protein Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of companies in the market</th>
<th>50-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Dairy companies</td>
</tr>
<tr>
<td></td>
<td>Specialist ingredient suppliers</td>
</tr>
<tr>
<td></td>
<td>Distributors</td>
</tr>
<tr>
<td></td>
<td>Blending companies</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>3 Tiers</td>
</tr>
<tr>
<td></td>
<td>Milk and cheese producers</td>
</tr>
<tr>
<td></td>
<td>Specialist ingredient suppliers</td>
</tr>
<tr>
<td></td>
<td>Distributors</td>
</tr>
<tr>
<td></td>
<td>Blending companies</td>
</tr>
<tr>
<td>Notable Mergers, Acquisitions</td>
<td>2004-DMV and Arla announce plans to merge</td>
</tr>
<tr>
<td></td>
<td>2004-Kerry Ingredients purchased protein business of Quest</td>
</tr>
<tr>
<td></td>
<td>2002-DMV purchased Avebe (Netherlands)</td>
</tr>
<tr>
<td></td>
<td>2000 -Arla Foods takes over MD Foods</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Price</td>
</tr>
<tr>
<td></td>
<td>Product development and blending capability</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Producers of nutritional products, dairy products, bakery products</td>
</tr>
</tbody>
</table>

The industry is dominated by subsidiary companies of large dairy groups - Kerry Group, Arla Foods, DMV Campina, Sodiaal, Coberco and Bongrain. In Europe, the majority of the production occurs in the Netherlands, France and Ireland. Blending companies such as Quest and G.C Hahn are also important end-users, buying in proteins to use in formulations. Furthermore, distributors are important to this market and they account for a high percentage of sales. Large distributors include Amcan, Soussana, Muller and Derilac.
The most important competitive factor in the European milk protein market is the ability to offer protein types that meet the specific needs of the customer. Product quality is essential in the caseinates market and companies with an established reputation for quality have a competitive edge over lesser known companies.

Market Share Analysis

Figure 6-7 and Chart 6.5 illustrates the market share accounted for by major participants active in the total European protein ingredients market in 2004.

Figure 6-7
Milk Protein Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMV</td>
<td>25</td>
</tr>
<tr>
<td>Arla</td>
<td>20</td>
</tr>
<tr>
<td>Armor Proteines</td>
<td>15</td>
</tr>
<tr>
<td>Glanbia</td>
<td>10</td>
</tr>
<tr>
<td>Kerry Group</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 6.5
Milk Protein Market: Market Share Analysis (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
DMV Campina was leading player in Europe with an estimated market share of 25 per cent. Campina was one of the world’s five largest dairy groups and exports from its Netherlands base. It is particularly strong in caseinates. The company has developed lactoferrin, which acts as a meat preserver and a functional whey protein to replace gelatine in confectionery.

Arla Food Ingredients has a 20 per cent market share. Arla Food Ingredients is a subsidiary of Arla Foods of Sweden, and following the takeover of MD Foods, is now the largest milk processing company in Europe. The company is strong in caseinates and high value whey products.

In late 2004, DMV and Arla announced plans to merge their operations. A merged company would have nearly 50 per cent of the European market for milk protein. EU approval for the merger would have probably required some of this business to be sold. However, the merger plans were cancelled in April 2005.

Kerry Ingredients is one of the largest ingredient suppliers in the world. This Irish company produces whey proteins and is also a large ingredient blending company using a wide range of other proteins in its products. Glanbia Foods, also based in Ireland is a producer of caseinates.

Armor Proteines is a subsidiary of the large French dairy company - Bongrain Group. The company specialises in the production of functional milk components including wheys, caseinates, hydrolysates and peptides.

Other important suppliers include major dairy groups such as Besnier (France), Domo Food Ingredients (Netherlands), International Muller (Germany), Milei (Germany) and Borculo Domo (Italy).

Specialist suppliers include Volac International (U.K.) that have set up a joint venture with D.o.C. Kass (Netherlands) with a new 50,000 tonne capacity plant in the Netherlands to produce whey proteins and other whey products.

**Forecasts - Casein and Caseinate**

**Market Overview and Definitions**

Caseins and caseinates are rich in minerals and amino acids (glutamine and asparaginine).

Casein products come in two forms - rennet casein and acid casein. Rennet casein is formed by adding enzymes to skimmed milk, whereas acid casein is formed by converting the lactose in skimmed milk into lactic acid through the addition of bacteria. Around 40-50 per cent of caseins are converted to caseinates.
Caseinates are used for both their functional and nutritional properties. The high nutritional value of caseinates and their good digestibility make them an ideal nutritional ingredient. However, these proteins are mainly used for their functional properties - emulsification, viscosity and water retention among others.

The caseinates market is established and mature and is affected by the price of milk and milk powder. EU subsidies for caseinate production have been reduced and are likely to be phased out over the next few years.

In 2004, the European market for casein and caseinates was 145,000 tonnes representing a value of 872.6 million Euros. A small proportion of caseins are used for non-food applications.

In the past European production of caseins and caseinates had been higher than this - typically around 160,000 - 170,000 tonnes per annum. However, at least 70,000 tonnes of this is exported to non-European markets. Imports are approximately 50,000 tonnes per annum and some of which is non-food grade casein.

France and Ireland are the largest producers in Western Europe, while in Eastern Europe the significant producers are Poland and Russia. New Zealand is another significant world producer and the United States is a major importer of casein.

The main suppliers of caseins and caseinates include DMV, Armor, Glanbia and Arla.

Market Drivers

Figure 6-8 lists the drivers ranked in order of impact for the European casein and caseinate market from 2005 to 2011.

**Figure 6-8**

Casein and Caseinates Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Good functionality</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Good nutritional value</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand for functional food and sports products</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Alternative to soya and meat protein</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Perceived health benefit</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*
**Good Functionality**

Caseinates have excellent functional properties: high solubility, low viscosity, excellent emulsification capacity, clean flavouring, freeze-thaw stability and a high fat and water binding capacity. Moreover, they have good texturing characteristics.

The food industry has increased demand for speciality designer ingredients. Each application has unique requirements; high viscosity gels are preferred for meat substitution, but low viscosity characteristics are required for beverages. Caseinates are well placed to meet this demand, which is likely to be an important driver for this market throughout 2005-2011.

**Good Nutritional Value**

Caseinates contain specific essential amino acids that aid immune defences and mineral absorption. These nutritional characteristics are expected to drive growth in the market in the period from 2005-2011.

**Increased Demand for Functional Foods and Sports Products**

The growing interest in nutraceutical products is likely to be a driver in this market, especially in the earlier part of the forecast period. Milk proteins benefit from a generally positive image and are used in health products as well as products that claim to improve physical performance such as sports supplements. Milk protein also has a neutral taste that does not require a flavour masking agent.

**Alternative to Soya and Meat Protein**

Caseinates are used in the meat market for their texturing properties. In this market, caseinates have benefited from the increased price of non-GM soya proteins. Non-GM soya prices are likely to remain high in the short term, and this will continue to drive growth in the caseinate market.

**Perceived Health Benefit**

Milk proteins benefit from a positive healthy image and are used in the diet and sports supplement market.

**Market Restraints**

Figure 6-9 lists the restraints in order of impact in the European casein and caseinate market from 2005 to 2011.
Milk proteins command a higher price than alternative protein sources such as soya and gluten. While functional advantages indicate that there is no alternative to milk protein in many sectors, there are some applications where the higher prices are expected to result in the loss of market share. The changes in EU legislation and structural changes in the industry are reducing the subsidy on caseinates. The price increased sharply in 2004 to over 6.0 Euros per kilo. This subsidy is likely to be phased out over the next few years. Despite these higher prices, the rise is believed not to have covered the reduced subsidy. The current situation means that there is little incentive to invest in caseinate production. Volumes are likely to decrease with higher prices. However, prices are expected to decrease in response to lower demand in the long term.

**Figure 6-9**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price levels and reduced EU subsidy</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Milk powder supply and CAP Reform</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Competition from plant proteins</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Lack of development</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Increased awareness of lactose intolerance and milk allergies</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Consumer trends</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Price Levels and Reduced EU Subsidy**

Milk proteins command a higher price than alternative protein sources such as soya and gluten. While functional advantages indicate that there is no alternative to milk protein in many sectors, there are some applications where the higher prices are expected to result in the loss of market share. The changes in EU legislation and structural changes in the industry are reducing the subsidy on caseinates. The price increased sharply in 2004 to over 6.0 Euros per kilo. This subsidy is likely to be phased out over the next few years. Despite these higher prices, the rise is believed not to have covered the reduced subsidy. The current situation means that there is little incentive to invest in caseinate production. Volumes are likely to decrease with higher prices. However, prices are expected to decrease in response to lower demand in the long term.

**Milk Powder Supply and CAP Reform**

The caseinate market is heavily influenced by product supply and price in the milk powder market. The latter is affected by EU policies on prices and stock levels. It is believed that in the short term, milk powder may receive more favourable treatment, which is likely to restrain growth in the caseinate market.

In the longer term, the EU plans to reform the CAP system and this is likely to lead to lower prices for many dairy products, although any impact is unlikely until 2007 - 2011.
Competition from Plant Proteins

There is a lot of research and development going on in the sourcing of new plant proteins, such as canola and lucerne. These products may be widely available in the latter stages of the forecast period. It is believed they will have a market in high value applications and in some cases will compete directly with caseinates.

Lack of Development

Most development work on milk proteins is in whey proteins rather than caseinates.

Increased Awareness of Lactose Intolerance and Milk Allergies

There is increasing consumer awareness of food intolerances, including lactose intolerance. In Finland 20 per cent of milk is now lactose-free and this has resulted in a greater use of alternatives such as soya milk. Some studies link the presence of autism in children to an inability to absorb and breakdown caseins and gluten. These factors are expected to be a continuing restraint on the European milk protein market during the forecast period (2005-2011).

Consumer Trends

In some countries, the number of vegan and vegetarian consumers is increasing and this is likely to be a minor restraint on the market in the short and long term.

Market Engineering Measurements

Chart 6.6 illustrates the Market Engineering measurements for the European casein and caseinate market for 2004.
Chart 6.6
Casein and Caseinates Market: Market Engineering Measurements (Europe), 2004

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>872.6 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>145,000</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>29.2%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.97%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>6.0 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Price range</td>
<td>5-20 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>Over 10</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 6-10 and Chart 6.7 illustrates volume and revenue forecasts in the European casein and caseinate market for the period 2001-2011.
In 2004, the European casein and caseinate market was valued at 872.6 million Euros which represented 145,000 Tonnes.
The market is stable and has an established application base. Prices vary according to changes in EU subsidy as well as the supply and price of the source of milk products. In 2004, the prices increased by 31.9 per cent following a reduction in EU subsidy and partly as a result of poor milk supply in some regions.

A further reduction in EU subsidies is likely to increase price and restrain volume increases from 2005-2011. While the market is mature, there is some underlying growth in the caseinate market especially in functional food applications.

**Pricing Analysis**

The average price of caseinates in 2004 was 6.0 Euros per kilo. The price of casein was about 10 per cent lower.

The price of caseinates increased in the late 1990s. In 2001, the price fell along with the prices of most other dairy products. Since then, prices have increased with a notable increase of over 40 per cent in 2004. This rise was mainly due to the reduction in the EU subsidy. Stronger demand, a shortage of supply and a poor year for milk quality have also played key roles.

The EU has been giving subsidies to caseinate producers in order to help the European milk industry remain competitive in the world market. These subsidies have been reduced in recent years and further reductions are expected until the subsidies are eliminated.

The prices of caseinates are expected to fall over the period of 2005-2006 as demand falls slightly in response to the high prices. Thereafter, there may be a gradual increase as the EU subsidy is reduced.

**Usage Analysis**

Figure 6-11 and Chart 6.8 illustrates the proportion of casein and caseinate used in nutritional applications and functional applications in Europe in 2004.

**Figure 6-11**

Casein and Caseinates Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>30</td>
</tr>
<tr>
<td>Functional</td>
<td>70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Chart 6.8
Casein and Caseinates Market: Usage Analysis (Europe), 2004

Functional Application

Caseinates are mainly used for their functional properties such as their ability to improve viscosity, texture and emulsion in food preparations such as meat products and baked goods. Furthermore, they are relatively bland and have little flavour capacity allowing their usage in high concentrations. For example, they can be used in dairy products to replace up to 50 per cent of the protein supplied by powdered milk. They are also used as a replacement for other types of proteins. For instance in meat preparations, 3 per cent of the meat can be substituted by caseinates without altering the taste of the preparation.

Nutritional Application

Caseinates have a high nutritional content and are a good source of energy. They contain essential amino acids such as histidine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine, as well as minerals such as calcium. As a source of essential amino acids and minerals, caseinates are also considered to be a nutritional ingredient. They are utilised for their nutritional properties in infant formulas, sport diets, energy drinks and snacks.

End-user Analysis

Figure 6-12 and Chart 6.9 illustrates the end-user value analysis by application for the total European casein and caseinate market in 2004.
## Chart 6.9

Casein and Caseinates Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Foods, Sports and Dietary Supplement Applications</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>Dairy products</td>
<td>30</td>
<td>Stable</td>
</tr>
<tr>
<td>Meat products</td>
<td>30</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Animal Feed</td>
<td>20</td>
<td>Stable</td>
</tr>
<tr>
<td>Other food</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

### Functional Foods, Sports and Dietary Supplements

This category includes infant milk, enteral nutrition, dietary supplements, meal substitutes and health and sport products. It is one of the most rapidly growing consumer food markets and the perceived quality of the product is of greater importance in the nutraceuticals market than the price. Caseinates have limited use in this sector. This market has grown rapidly since 2001, but may stabilise in the short term with growth at 4-6 per cent expected for the period 2005-2011.
**Dairy Products**

This category includes products such as soft cheese, yoghurt, dairy puddings, dairy spreads and cream as well as cheese analogues, toppings, cream substitutes and coffee whiteners. This application sector uses caseinates for their texturing properties, as stabilisers in yoghurt, processed cheese and spreads. There are limited examples where caseinates are used for their nutritional benefits. The market for caseinate and casein in this application sector is growing at 3 per cent per annum in Europe. The use of caseinates in the sector is forecast to increase as companies develop highly specified products to target the needs of particular application sectors.

**Meat Products**

This category includes products such as sausages and ready meals. Caseinates are used for their texturing properties, to bind fat and water together and as meat preservers. This market is slowly declining mainly due to the high cost of milk proteins. Some companies prefer to use soya or gluten protein sources as alternatives.

**Animal Feed**

Caseins are used in animal feed applications, especially for calves milk applications in the Netherlands.

**Forecasts - Whey Protein**

**Market Overview and Definitions**

Whey is a by-product of cheese production and can be made from casein. It include proteins such as: alpha-lactalbumin, beta-lactoglobulin, bovine serum, immunoglobulins and proteose-peptones. Historically, whey was discarded or used as low quality animal feed. However, environmental considerations have made it more difficult to discard liquid whey. Whey products include powders, concentrates and isolates.

The high nutritional value of whey proteins and their good digestibility make them a suitable ingredient for sports products, but these proteins are also used for their associated functional properties. Whey proteins have good emulsifying and viscousifying properties and are used to texture food without altering the taste.

In 2004, the whey protein market was 831.7 million Euros.

The main suppliers are DMV, Arla and Armor Proteine.
Market Drivers

Figure 6-13 lists the drivers ranked in order of impact in the European whey protein market from 2005 to 2011.

**Figure 6-13**

Whey Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Good functionality</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Good nutritional value</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Alternative to soya or meat protein</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Increased demand for functional foods and sports products</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Raw material supply</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Cost effective vs milk powder</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Perceived health benefit</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>Technical developments</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

**Good Functionality**

Whey proteins have excellent functional properties. They can be used to improve viscosity, texture and gelling properties, as well as for emulsifying and foaming.

The food industry has increased demand for specific designer ingredients to meet the individual needs of particular applications. Each application has unique requirements. High viscosity and high gel properties are needed for meat substitution, but low viscosity characteristics are important for beverages. Whey proteins are well placed to meet this demand, which is likely to be an important driver in this market during the period 2005-2011.

**Good Nutritional Value**

Whey protein has a high nutritional value and is easier to digest than plant proteins. 98 per cent of milk proteins are digested compared with 88 per cent of soya proteins. Furthermore, milk proteins benefit from a generally positive image and are used in energy and health products as well as products that claim to improve physical performance, such as sports supplements. Milk protein also has a neutral taste, and so does not require a flavour masking agent. There is also a high amino acid content in milk protein and bioactive peptide fragments, which aid immune defences.
Alternative to Soya and Meat Protein

Recent concerns over Genetically Modified (GM) ingredients has increased the price of non-GM soya, which has driven some companies to alternative ingredients. Although whey protein is not the cheapest alternative, it is believed to have captured some of this market. Non-GM soya prices are likely to continue to be high in the short term (2005-2006).

Increased Demand for Functional Food and Sports Products

The growing interest in functional food products is likely to be a driver for this market, especially in the early part of the forecast period with strong market growth expected. DSM, Kerry and Glanbia have all developed products that can be added to sports beverages.

Raw Material Supply

Whey protein is a by-product of cheese production and as production and demand for cheese is expected to increase over the forecast period, this should lead to an increased supply of whey. Environmental considerations make it increasingly difficult to dispose of surplus whey as a waste material, which gives more incentive to producers to develop value added products.

Cost Effective vs Milk Powder

An important use of milk proteins is to replace milk powder in dairy preparations. The substitute is largely on the basis of cost, as powder milk is cheaper but contains less protein, and may not be as cost effective. The relative prices are likely to depend on many trends in the dairy industry, on subsidy levels and hence can not be easily predicted. The availability of whey from cheese production may keep whey powder prices low, and due to this it is believed that this will remain a key driver in the European milk protein market.

Perceived Health Benefit

Milk proteins benefit from a positive and healthy image. This factor continues to drive growth in the whey protein market especially in the functional food and sports nutrition markets.
TECHNICAL DEVELOPMENTS

Relatively recent production technology such as extraction, purification and filtration, enables milk proteins to be supplied as a finer soluble compound or peptide, enabling them to be more easily used in particular applications. Improvements in membrane technologies have resulted in an increase in the quality and number of products in the market.

There are also technical developments in the value added fractions markets - lactoferrin and lactoglobulin among others. Although low in volumes, these products command high prices in specific application sectors such as infant nutrition.

These developments are likely to drive growth in the whey protein market.

Market Restraints

Figure 6-14 lists the restraints ranked in order of impact in the European whey protein market from 2005 to 2011.

Figure 6-14

Whey Protein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price levels and EU subsidies</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Competition from plant proteins</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Increased awareness of lactose intolerance and milk allergies</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Consumer trends</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Labelling</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

PRICE LEVELS AND EU SUBSIDY

Milk proteins command a higher price than their alternatives such as soya and gluten. While functional advantages mean that there is no alternative to milk protein in many applications, there are some applications where higher prices are likely to mean that other protein sources may be preferable. Changes in EU legislation, proposed CAP reform and structural changes in the industry may put upward pressure on prices, especially in the latter stages of the forecast period.
Competition from Plant Proteins

Currently, there is significant efforts being made to research new plant protein sources, such as canola and lucerne. These products may be widely available in the latter stages of the forecast period. It is believed that they will be used in high value applications and in some cases will compete directly with milk proteins.

Increased Awareness of Lactose Intolerance and Milk Allergies

There is increasing consumer awareness of food intolerances, including lactose intolerance. In Finland 20 per cent of milk is now lactose-free and this has resulted in a greater use of alternatives such as soya milk. Some studies link the presence of autism in children to an inability to absorb and breakdown caseins and gluten. These factors are expected to be a continuing restraint on the European milk protein market during the forecast period (2005-2011).

Consumer Trends

In some countries, the number of vegan and vegetarian consumers is increasing and this is likely to be a minor restraint on the market.

Labelling

More restrictions on ingredient labelling may have an adverse impact on specific applications. However, this restraint is believed to impact other protein sources more than the whey protein market.

Market Engineering Measurements

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>831.7 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>1,303,000</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>14%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.85%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Various</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>0.6 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Price range</td>
<td>0.4 - 100 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>50%</td>
<td>---</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>Over 10</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*

Market Forecasts

Figure 6-15 and Chart 6.11 illustrates volume and revenue forecasts in the European whey protein market for the period 2001-2011. Europe is a net exporter of whey powder.
In 2004, the European whey protein market was valued at 831.7 million Euros which represented 1,303,000 Tonnes.
Total volumes are likely to increase in the forecast period although there is expected to be a corresponding decrease pressure on prices. The forecasting analysis includes whey powder, as well as demineralised product.

Whey powders that contain less than 15 per cent protein and are considered a commodity product. In terms of volumes they are the largest segment of the total whey protein market. Prices of standard powders (12-15 per cent protein content) are 0.40 - 0.50 per kilo Euros and these prices are generally stable. However, in 2003, prices decreased on account of over supply. Prices, although they can be volatile in the short term, are likely to remain stable over most of the forecast period. Prices range from less than 1 Euros per kilo for WPC15 to around 3 Euros per kilo for some specialised products. WPC 30-35 are priced at 1.40 to 1.70 Euros per kilo.

Production of whey powders is likely to increase as cheese production increases. Although whey manufacturers are putting more effort into increasing sales of their higher added value concentrates and isolates, the sales of whey powders is also likely to increase.

A lot of this market is mature. Ice cream and dairy products account for a high proportion of use. Changes in the ice cream market are expected to lead to a decline in WPC use and the volume growth in this market is likely to be only 2-3 per cent per annum.

The WPC 60-85 market is the fastest growing sector of the European whey protein market. Europe exports a large quantity of whey concentrates. The WPC market is driven demand in the nutraceuticals and sports product market and this is where the major suppliers are putting much of their development efforts. Growth in these markets is likely to decrease and therefore R&D efforts should focus on identifying new food applications.

Whey protein isolates are used almost exclusively in sports and energy products. While these markets have grown rapidly, many companies have preferred to use WPC80 rather than isolates, which are much more expensive.

Overall market growth in the European whey protein market is expected to be lower than previous years and there may be some downward pressure on prices.

Product Analysis

Whey Powder

Whey is a by-product of cheese production. Whey powders are obtained by filtration of the lactoserum left over after the making of cheese and caseins. Their protein content vary between 12 and 33 per cent and they are used mainly as a protein source in dairy products, animal feed, ice creams and meal replacements as well as an emulsifying agent. They are rich in minerals, but contain lactose and other milk components in high concentration, which render them unsuitable for many applications.
Whey Protein Concentrate (WPC)

WPC is available in a number of different concentrations ranging from 34 per cent up to 80 per cent. The protein level in the WPC powder depends on the type of filtration process chosen. The function of WPCs is either nutritional, as a source of protein, or functional, e.g. as an emulsifying agent providing texture and/or to increase absorption properties. WPCs are used throughout the food industry.

Whey Protein Isolate (WPI)

WPI is an ultra concentrated whey protein and typical protein content is over 90 per cent. The products are used mostly by the dietetic industry for tube-feeding formulas, milk-allergy products, energy drinks and other applications that require high levels of protein. Glanbia has developed a new juice beverage with whey protein isolate and both DSM and Kerry have developed isolates to add to sports drinks.

Pricing Analysis

The average price of all whey proteins in 2004 was 0.6 Euros per kilo.

Whey protein powders are priced from 0.4 - 1.2 Euros per kilo. The prices of whey protein concentrates vary from 1.2 - 5.5 Euros per kilo depending largely on the protein content. The more concentrated products tend to command a higher price per unit of protein and are often designed to provide functional benefits as well as nutritional benefits.

The average price of WPC with 60-85 per cent protein content was 4.20 Euros per kilo.

The average price of whey protein isolates in 2004 was 8.00 Euros per kilo. Whey prices fell in 2003, but increased in 2004 as a result of strong demand.

Milk protein isolates such as phosphopeptides, casomorphine, lactorphine and lactoferricines, which are obtained by enzymatic hydrolysis were used mainly in the pharmaceutical industry and typically command prices as high as 100 Euros per kilo.

Usage Analysis

Figure 6.16 and Chart 6.12 illustrates the proportion of whey protein used in nutritional applications and functional applications in Europe in 2004.
Nutritional Applications

Whey proteins are a good source of energy with a high nutritional value. They contain essential amino acids such as histidine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Whey protein also contain bioactive peptide fragments, which aid immune defence and facilitate mineral absorption. They are often used to replace other protein sources, such as meat in processed food. In dairy products they can replace up to 100 per cent of powdered milk. The principal application for WPC is as a nutritional ingredient in sports drinks, energy snacks, infant formula, milk replacers and animal feed. Whey protein isolates are used in sports drinks and other functional food products.

Functional Applications

Whey proteins are used to increase viscosity and to improve texture, gelling and emulsification properties. The main advantage associated with the use of whey protein is the 'extreme'
conditions that they can withstand. For example, whey proteins maintain their texturing properties at temperatures up to 50 degree Celsius, which makes them an ideal textural for baked goods. Moreover, they are able to resist acid pH, which makes them a suitable ingredient for real fruit dairy products.

End-user Analysis

Figure 6-17 and Chart 6.13 illustrates the end-user value analysis by application for the European whey protein market in 2004.

**Figure 6-17**

Whey Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional foods, sports, dietary supplement products</td>
<td>25</td>
<td>Increasing</td>
</tr>
<tr>
<td>Dairy products and desserts</td>
<td>40</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>8</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Ice cream</td>
<td>8</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Bakery</td>
<td>12</td>
<td>Stable</td>
</tr>
<tr>
<td>Other applications</td>
<td>7</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 6.13**

Whey Protein Market: End-user Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
**Functional Food, Sports and Dietary Supplements Products**

This category includes functional foods such as infant milk, enteral nutrition, diet supplements, meal substitutes and health/sport supplements. It is one of the most rapidly growing consumer food markets, with the perceived quality of the product being of greater importance than the price. Milk proteins are used in this sector due to their high digestibility, nutritive value and healthy image. This market has grown rapidly since 2000, but may stabilise in future, with growth at 4-6 per cent in the period 2005-2011.

This application sector uses mainly whey protein concentrates, whey protein isolates and hydrolysates (made from concentrates).

**Dairy Products and Desserts**

This category includes products such as soft cheese, yoghurt, dairy puddings, dairy spreads and cream as well as cheese analogues, toppings, cream substitutes and coffee whiteners. The dairy product market uses milk proteins for their texturing power and as stabilisers in yoghurt, processed cheese and spreads as well as for their nutritional value. Milk proteins are often used to substitute more expensive dehydrated milk without altering the taste.

**Meat Products**

This category includes whey proteins used in products such as sausages and ready meals. Milk proteins are used for their texture improvement abilities, to bind fat and water together or as meat preservers. The main advantages of whey protein in this application sector are: their solubility in salted mediums, their emulsifying properties up to 50 degree Celsius and their nutritional value. However, this market is slowly declining because the high cost of milk proteins in comparison to other protein sources.

**Ice Cream**

Whey proteins help improve the freeze/thaw stability and body texture of ice creams and frozen desserts, as well as aid coating stability. Furthermore, they can replace hydrocolloid stabilisers with a possible cost saving. However, with changing ice cream formulations this is likely to be a slowly declining market.

**Bakery**

Whey proteins have been used in the bakery sector for many years. Whey proteins are utilised for their functional properties and are in direct competition with lower price plant and egg proteins. However, milk proteins still maintain some market share on account of their high
water retention power, which traps moisture and results in the final food product having a
drier texture.

Other Applications

Other applications for milk proteins include animal feed, pharmaceutical products and emul-
sified foods such as mayonnaise and dressings.

A relatively new application is functional beverages where the whey can provide a neutral
taste, clarity in solution and stability at high temperatures.

This section analyses the European milk protein market. It provides general definitions of the
different market drivers and restraints that are bound to have a major impact on the milk
protein market. The section offers estimates for the base year 2004 and provides forecasts up
to the year 2011 of the market. The market is also analyzed based on the trends relating to
price, product along with an estimate on the market share of the participants. The section
also describes the trends by application along with the competitive structure of the milk
protein market.
Strategic Analysis of the European Gelatine Market

Introduction to the Market

Market Overview and Definitions

Gelatine is an animal protein manufactured from collagen. Collagen is derived from bovine, porcine, fish bones and hides (skin, tendons and ligaments). Gelatine comprises 83-88 per cent protein, 10-15 per cent water and 1-2 per cent minerals. It contains all but one of the main amino acids essential for the human body (the exception is tryptophane).

During manufacturing, chemical and physical treatment is used to remove extraneous matter and produce purified collagen. The collagen is then dissolved in hot water, where extraction and filtration processes are used to produce a concentrated solution of gelatine, which is then sterilised. A gel is formed after cooling, which is extruded and dried with the product supplied as a powder or as granulates. The powders are then activated by placing in water. 'Instant' products require no soaking time and are used for stabilising food such as dessert.

Gelatine melts at 37°C and becomes firm when it cools. The main application for gelatine in the food industry is in confectionery, where it is used for its associated mouth feel benefits. Gelatine is also used as a stabiliser, an emulsifier and a foaming and binding agent. It is translucent and neutral tasting. Moreover, gelatine is used to provide protein enrichment and to replace fats or carbohydrates. Gelatine is finding increased use in functional foods, pharmaceutical and meat products. Gelatine also has applications outside the food industry, such as the photographic film industry, though these applications are not included in the scope of this study.

The Bovine Spongiform Encephalopathy (BSE) crisis had a big impact on the European gelatine market. The use of bovine sources by gelatine manufacturers fell by an estimated 60 per cent. The crisis led to a shortage of supply of gelatine, and there was more activity in the development of vegetable-derived alternatives. Up until the BSE crisis, most food gelatine was derived from bovine sources. However, the crisis caused a rapid shift to porcine raw material sources and to a lesser extent, fish sources. The industry claims that gelatine is safe from BSE and participants active in the market advocated that all raw materials are from approved sources and processing methods will eliminate any BSE. Since 2001 the food industry has to a limited extent, returned to bovine sources.
In 2004, the gelatine market was estimated at 510.7 million Euros. Most gelatine production comes from Europe and North America. In Europe, there are three leading suppliers - Gelita Group, Rousselot and PB Gelatins. These companies account for over 60 per cent of the total production.

**European Legislation**

Directive 1999/724/EC details the conditions for the production of edible gelatine, from the supply of raw material to the delivery of the product. It requires the traceability of raw materials to confirm it is fit for human consumption.

Regulation 2001/999/EC amended this directive to list Specified Risk Materials (SRM), which could not be used in the production of edible gelatine as a result of the BSE crisis. Specified Risk Material (SRM) included: brain, spinal cord, and vertebrae of cattle.

These regulations are expected to be superseded by the Food Hygiene Regulations, expected to come into force in January 2006. However, these new regulations are not expected to have much impact on the use of gelatine.

The separate treatment of food and pharmaceutical applications has led to some perceived inconsistencies in the regulation of gelatine use. This is mainly because food applications are assessed to eliminate possible risk, while pharmaceutical use accepts ‘reasonable’ risk, given the inherent risks associated with the use of pharmaceutical products.

Pharmaceutical applications are covered by directive 1999/82/EC and hence require a Certificate of Suitability for bovine bone gelatine. Pharmaceutical capsules are an important use for bovine gelatine, the use of which is still possible under this regulation.

**Market Drivers**

Figure 7-1 lists the drivers ranked in the order of impact for the European gelatine market from 2005 to 2011.

**Figure 7-1**

Gelatine Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>European industry boosted by strong exports</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Strong established demand from confectionery market</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand from the pharmaceutical and dietary supplement industry</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Established functional benefits</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Increased supply from new EU member countries</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Increased confidence in raw materials</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*
European Industry Boosted by Strong Exports

The European industry is a net exporter of gelatine. Since 2001, export markets have grown, and the Chinese demand for confectionery has been particularly strong. Although the largest gelatine suppliers are based in Europe, they often have production facilities in other regions as well, and they have been able to adapt their manufacturing capacities to meet global demand. The strong global demand for gelatin has increased price and helped drive revenue growth in the European market.

Strong Established Demand from Confectionery Market

The total European confectionery market is growing at three per cent per annum. Within this market, gelatine is used for pastilles and other 'gummy' products for which it provides a characteristic mouthfeel. This mouthfeel is partly a reflection of the fact that gelatine melts at 37 C (body temperature). The continued development of the confectionery market is expected to be a key driver for the market growth of gelatine over the forecast period.

Increased Demand from the Pharmaceutical and Dietary Supplement Industry

Together the pharmaceutical and dietary supplement industry is the second largest user of gelatine. Gelatine in this application sector is predominantly used in capsules. The industry has been experiencing increased demand for soft gel capsules, which is expected to drive the growth for gelatine over the forecast period. Furthermore, the pharmaceutical industry continues to use bovine products, unlike most of the end-user sectors in the food industry. Increased demand for soft gel capsules will continue to drive further growth in the European gelatine market.

Established Functional Benefits

Of all the protein sources available, gelatine possibly has the widest range of functional benefits. It is used in the food industry as a stabilizer, an emulsifier and as a whipping agent. It is also used as a film, for its adhesion properties. In beverages, it is used as a fining agent. The pharmaceutical industry uses gelatine for both hard and soft capsules. These wide-ranging functional properties of gelatine help to minimise the risk of substitution in a market that is considered to be highly price sensitive.

Increased Supply of Raw Material from New EU Member Countries

The supply of raw material for gelatine manufacture is considered to be erratic and has contributed to short-term price volatility. The new EU members, especially Poland, are likely
to provide additional raw material and are no longer expected to be limited by import taxes. The new member states are likely to add to price pressure from the demand side as well. These factors are expected to help drive growth in the gelatine market in the short and long term.

**Increased Confidence in Raw Materials**

Consumer confidence is starting to return following the BSE crisis and many in the food industry now considers the use of gelatine as safe. Provided there are no other health care issues that arise, consumer confidence should continue to improve over the forecast period.

**Market Restraints**

Figure 7-2 lists the restraints ranked in order of impact for the European gelatine market from 2005 to 2011.

**Figure 7-2**

*Gelatine Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price levels and sensitivity</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>'Health' issues with raw materials</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Supply of raw materials</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Development of gelatine 'alternatives'</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Price Levels and Sensitivity**

In some application sectors (excluding confectionary), markets are extremely price sensitive. This is particularly challenging for ingredient suppliers as in some cases end-users are able to easily switch to other protein sources or ingredients if prices get too high. Unfortunately the price of gelatine is likely to change in response to the supply situation and other external factors. The BSE crisis led to a rapid increase in the price of gelatine, and prices increased again in 2001 in response to the foot-and-mouth crisis. They increased again in 2004 after two years of stable, or lower prices, in response to increased demand from China and other developing markets. Over the forecast period, increased production capacities are expected, but in the short term, prices are likely to remain high. The United States is already starting to import gelatine from India. High prices have restrained growth in some sectors of the market.
'Health' Issues with Raw Materials

The European gelatine market was affected by the BSE and the foot-and-mouth crisis. These have led to restrictions on raw material supplies, and adverse consumer perceptions towards the product. The restrictions on the use of bovine sources led to a rapid price increase for gelatine and has reduced sales volumes. In addition, there is an increased consumer awareness of health concerns that may be associated with food ingredients, which is expected to continue to restrain market growth.

Supply of Raw Materials

The production of gelatine is dependent on the supply of porcine and bovine materials. At present, supply cannot be readily increased to meet demand. Thus, when supplies are limited, as with the BSE crisis, this can quickly lead to shortages and higher prices. This has an obvious impact on volume growth.

Another factor that can affect price is the trends in the marketplace for alternative applications. There has been an increase in demand for pigskin in the United States as a food ingredient, in response to the increasing popularity of the Atkins diet. The demand from Eastern Europe for porcine raw materials as a meat alternative has also increased. This led to an increase in price and a reduction in raw material stocks for gelatine. Furthermore, price increases are expected in 2005. It is not clear as to how long the demand from these alternative applications is likely to remain.

Conversely, the new EU member states, such as Poland, may increase the sources of raw materials, which may help alleviate this problem.

Development of Gelatine 'Alternatives'

The BSE crisis, in particular, led to increased efforts to develop vegetable-based alternatives. Products based on carrageenan and pectin were introduced and, in a limited number of applications, these replaced gelatine. While gelatine has regained some business since 2002, some users have adapted their products to utilise vegetable derived products and have shown no signs of switching back to gelatine in the future.

In addition, there has been some substitution of gelatine by whey in the dairy industry, partly on account of difficulties in sourcing porcine gelatine.
Market Quantification

Market Engineering Measurements


Chart 7.1
Gelatine Market: Market Engineering Measurements (Europe), 2004

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>510.7 million euros</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>100,000 tonnes</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>10.7%</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>2.34%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>5.1 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Price range</td>
<td>3.8 - 6.2 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Potential revenues</td>
<td>600.3 million</td>
<td></td>
</tr>
<tr>
<td>Market concentration (percent of base year market</td>
<td>Over 60%</td>
<td>Increasing</td>
</tr>
<tr>
<td>controlled by top three competitors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of competitors</td>
<td>10-20</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan
Market Forecasts

Figure 7-3 and Chart 7.2 illustrates market forecasts for the European gelatine market for the period 2001-2011.

**Figure 7-3**

Gelatine Market: Volumes and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>538.5</td>
<td>(1.1)</td>
<td>91.0</td>
<td>(2.2)</td>
</tr>
<tr>
<td>2002</td>
<td>490.5</td>
<td>(8.9)</td>
<td>94.0</td>
<td>3.3</td>
</tr>
<tr>
<td>2003</td>
<td>461.2</td>
<td>(6.0)</td>
<td>97.0</td>
<td>3.2</td>
</tr>
<tr>
<td>2004</td>
<td>510.7</td>
<td>10.7</td>
<td>100.0</td>
<td>3.1</td>
</tr>
<tr>
<td>2005</td>
<td>570.4</td>
<td>11.7</td>
<td>102.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2006</td>
<td>561.0</td>
<td>(1.6)</td>
<td>104.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2007</td>
<td>568.5</td>
<td>1.3</td>
<td>107.0</td>
<td>2.9</td>
</tr>
<tr>
<td>2008</td>
<td>575.3</td>
<td>1.2</td>
<td>110.0</td>
<td>2.8</td>
</tr>
<tr>
<td>2009</td>
<td>583.6</td>
<td>1.4</td>
<td>113.0</td>
<td>2.7</td>
</tr>
<tr>
<td>2010</td>
<td>594.7</td>
<td>1.9</td>
<td>116.0</td>
<td>2.7</td>
</tr>
<tr>
<td>2011</td>
<td>600.3</td>
<td>0.9</td>
<td>121.0</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

**Chart 7.2**

Gelatine Market: Volumes and Revenue Forecasts (Europe), 2001-2011

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
In 2000 prices and revenues increased rapidly following the BSE crisis. There was an obvious decreased demand for bovine raw material sources. In 2001, prices increased again in reaction to the foot-and-mouth epidemic in the United Kingdom.

In 2002 and 2003, the market stabilised, and prices fell by 10 per cent. Volumes consumed in Europe increased by 3 per cent. Export volumes increased, and major suppliers have sourced more of their products from factories in North and South America.

In 2004, the European gelatine ingredient market was valued at 510.7 million Euros, corresponding to volumes of 100,000 tonnes. Non-food applications are expected to account for an additional 10 per cent.

From 2005 - 2011, the European gelatine market volumes are forecast to grow at 2 to 4 per cent annually, while global demand is expected to increase more rapidly. The increased volumes are expected to be driven largely by the demand from the confectionery market. Prices increased in the second half of 2004 and further rises are forecast in 2005. Prices are likely to be influenced by the supply situation and likely to remain high in the short term. From 2006 - 2011, additional production capacity is expected to be established in developing markets, reducing the pressure on price.

The compound annual growth rate (CAGR) for the period 2004 to 2011 is calculated at 2.3 per cent. The forecast analysis has made the assumption that no further health or food and safety issues arise in the livestock industry.

Pricing Analysis

The price of gelatine tends to fluctuate because supply is relatively unstable. Price is also affected by changes in demand for competing uses of raw material such as porcine skins. The price difference between top-grade and low-grade products is about three Euros per kilo - a range from 3.8 to 6.2 Euros in 2004. Quality and price are largely related to 'bloom' measure or product firmness.

The price of gelatine doubled from 1997 to 2001 and reached 5.9 Euros per kilo in 2001. This was mainly because of the impact of the BSE crisis in the United Kingdom, which led to the banning of bovine materials for the production of gelatine. This health crisis was then followed by the foot-and-mouth epidemic, which led to a restriction on the UK export of sheep products. These restrictions were lifted only in 2003. Moreover, these various crises led to a fall in total meat consumption, which has reduced the supply of raw material for gelatine. Suppliers to some extent can mitigate the effect of supply restrictions by sourcing from their factories in other regions.

The average price of gelatine reached 5.1 Euros per kilo in December 2004. Prices increased by 7.4 per cent during 2004 but are still lower than the previous high in 2001. Further increases are expected in 2005.
After the expected price increase in 2005, stable supply and the ability to meet demand, will lead to price decreases. An inherent inelasticity of supply means that annual fluctuations of ten per cent are possible. In the medium term, an increase in world gelatine production capacity in developing countries is expected to lead to further price reductions.

Product Analysis

Gelatines are generally classified by the processes used during manufacture and their gel strength.

Manufacturing Process - Type A (Acid) and Type B (Lime)

For Type A, the raw materials (usually skins) are placed in a vessel containing an acid solution, which is washed with cold water. For Type B, the raw materials (usually bones) are placed in liming pits and soaked in a lime suspension for several weeks.

After these processes, the gelatine is extracted from the raw material with hot water. Each batch of material usually undergoes several extractions. The first extraction obtains the highest quality gelatine in terms of viscosity, gel strength and low colour. The quality is reduced at each subsequent extraction.

Gel Strength

The strength of a set of gelatine, or its 'rigidity' is a function of its concentration, pH, temperature and time. It is measured on a Bloom scale:

- Low Bloom - gel strength less than 12
- Medium Bloom - gel strength between 120-220
- High Bloom - gel strength above 220

The higher the Bloom, the higher the product grade and price.

Viscosity, pH and moisture tests are also carried out along with various microbiological tests to ensure that product quality standards are adhered to.

Application Dependent

Gelatine is supplied in various forms. The form used is very dependant on application. Protein hydrolysates and products with a low Bloom value can be produced by an additional thermo-bio process. These dissolve very easily, are completely digestible and have a bland taste. These products are used in dietetic products and other applications due to their ability
to act as a carrier. They are also provide an excellent source of protein. However, they have no real gel strength.

**Vegetable Replacements**

Vegetable-derived products are promoted as 'gelatine replacements' although there is a debate as to whether they can be defined as gelatine. The products used are based on pectins, alginates and starches. Their functional properties are different from those of conventional gelatine, which means that final products have to be re-formulated in order to accommodate them.

**Usage Analysis**

Figure 7-4 and Chart 7.3 illustrates proportion of gelatine used in nutritional applications and functional applications in 2004.

**Figure 7-4**

Gelatine Market: Usage Analysis in Market Revenues (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Functional</td>
<td>&gt;90</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 7.3**

Gelatine Market: Usage Analysis in Market Revenues (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
For most products, the gelatine content makes up less than one per cent of the total ingredients. For ‘gummy’ confectionery and some desserts, gelatine content can be as high as 5 to 10 per cent of the total ingredients.

End-user Analysis

Figure 7-5 and Chart 7.4 illustrates the end-user value analysis by application for the European gelatine market in 2004.

**Figure 7-5**

Gelatine Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—by Value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confectionery</td>
<td>56</td>
<td>Stable</td>
</tr>
<tr>
<td>Functional Foods, Pharmaceuticals and Dietary Supplements</td>
<td>19</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>9</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Dairy products and Desserts</td>
<td>6</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Other food</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 7.4**

Gelatine Market: End-user Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Confectionery

The confectionery segment is the main user of gelatine in Europe, representing 50 per cent of the total market. This application employs high-quality gelatine that cannot be easily substituted because of the need for a specific mouth feel. In caramel and liquorice, gelatine improves palatability, while in shaped products it stabilises the product structure.

Gelatine can provide gel and foam formation and it has many emulsification properties. The use of gelatine also improves texture, and provides a slow melt rate that adds to product enjoyment. While gummy products can contain up to 7 per cent gelatine by product weight, foamed confectionary typically contains between 2 to 3 per cent by product weight.

The confectionery segment is expected to grow at 3 to 4 per cent per year. The market outside Europe, especially in Asia, is likely to grow faster, putting pressure on European supply and prices.

Functional Food, Pharmaceutical and Dietary Supplement Market

This sector accounted for 19 per cent of the total European gelatine market. Gelatine is used as a binding agent and for coating in tablets and cough pastilles. It is also used for soft and hard capsules, and high bloom-rated gelatine products are utilised for hard capsules. Gelatine can represent up to 40 per cent of product content by weight. Porcine gelatine is less suitable for capsules. Bovine gelatine is preferred. This market is forecast to grow at 3 to 4 per cent. Growth is primarily driven by increased in demand from the dietary supplement and pharmaceutical sector.

Meat Products

In 2004, the meat sector was the third largest food market for gelatine in Europe. Gelatine is used to produce clear sliceable meat and ham. Gelatine gives body and structure to products that would otherwise fall apart. For example, gelatine acts as a binding agent in sausages.

In 2004, the European meat products market grew at two to three per cent following a decline after the BSE crisis.

Dairy Products and Desserts

Gelatine is used in dairy dessert, yoghurt and cream products, where its functional properties (for example, stabilising and emulsifying) are utilised. Jelly for example is a mixture of sucrose and gelatine, and such products may contain up to 10 per cent gelatine.
While the market for dessert and yoghurt is growing at 3 to 4 per cent per annum in 2004 in Europe, the use of gelatine is falling slightly because of substitution by whey proteins. Gelatine is also used for low fat products, where it provides a mouth feel that is similar to that of full fat products.

**Other Applications**

Other applications that use gelatine as an ingredient include pet food, the clarification of wine and beer/fruit juice, where very small quantities of low-bloom gelatine are required.

**Competitive Environment**

**Competitive Structure**

Figure 7-6 illustrates the competitive structure for the European gelatine ingredient market in 2004.

**Figure 7-6**

Gelatine Market: Competitive Structure (Europe), 2004

| Number of companies in the market | 10-20 |
| Types of competitors              | Specialist gelatine producers |
| Tiers of competition              | 3 |
|                                   | Global producers, with raw material-decreasing facilities and so on |
|                                   | Regional producers-Europe only |
|                                   | Distributors active locally-wide range of products |
| Notable acquisitions, mergers     | [Period has been given for the other M&As-pls chk if it needs to be given here as well] Purchase by Gelita of several smaller gelatine producers |
|                                   | 2002-purchase of Rousselot by the Sobel group |
|                                   | 2003-purchase of the gelatine business of Leiner by Tenderlesso and incorporation with PB Gelatines |
| Competitive factors               | Price, and low production costs |
|                                   | Service, customisation, formulation |
|                                   | Ability to source materials |
| Key end-user groups               | Confectionery, pharmaceutical, meat industry, dairy, bakery |

*Source: Frost & Sullivan*
Most gelatine manufacturers are specialist companies, and other protein and food ingredients are not an important part of their business. Gelatine suppliers normally do not supply composite or blended products (where gelatine is combined with other proteins or ingredients). The actual product formulation is often done by food processors or by specialist formulators who buy the gelatine from the manufacturers.

About 80 per cent of the gelatine is sold directly to users by gelatine suppliers. The other 20 per cent is sold through distributors. Most of the major chemical distributors have gelatine in their portfolio.

**Market Share Analysis**

Figure 7-7 and Chart 7.5 illustrate the share represented by each of the major participants active in the European gelatine market in 2004.

**Figure 7-7**

Gelatine Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelita Group, Rousselot Group, PB Gelatins</td>
<td>90</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 7.5**

Gelatine Market: Market Share Analysis (Europe), 2004

The three largest gelatine manufacturers have operations on a global scale.
Gelita Group (the operating company of DGF Stoess) is the world's largest supplier and has a capacity of 70,000 tonnes per annum. The company has production facilities in Germany, Sweden, the United States, South Africa, Australia and New Zealand. It also has its own raw material processing plants in Germany and in other regions. In recent years, it has purchased Extraco (Sweden), Kind & Knox (the United States) and Dynagel (the United States).

Rousselot Group is a subsidiary of the Dutch company, Sobel NV. Until 2002 the company was called SKW Biosystems. In 2002, it was sold by its then owner - Degussa - to Sobel. The company has eight production plants in Europe, North America and South America, with a capacity of about 60,000 tonnes.

PB Gelatins is a subsidiary of the Belgian chemical company, Tessenderlo Group. Tessenderlo Group acquired the Leinder Davis Gelatin business in 2003. The group has a production capacity of almost 30,000 tonnes per annum, with facilities in Europe, the United States and Argentina.

The leading manufacturers have a secure position in the market, having a wide range of products and several production plants in existence. This enables them to offer a wide range of specifications, from one of their production facilities. The decision on where to produce a specificifcation is dependent on expertise or the availability of raw material. Often these companies are able to avoid raw material supply constraints by sourcing from alternative regions in the company in times of shortages. Intracompany sales between the different units of the main suppliers is an important feature of the market.

Other significant suppliers include:

- Ets Weishardt: France (fourth largest supplier)
- Reinert Gruppe: Germany
- Italgelatine SpA: Italy
- Lapi SpA: Italy
- Ewald Gelatine: Germany
- Junca Sa: Spain
- Trobus: the Netherlands

Croda Colloides, a producer based in the United Kingdom, stopped its gelatine production in 2003. This was mainly due to raw material supply difficulties.
Strategic Analysis of the European Egg Protein Market

Introduction to the Egg White Protein and Egg Protein Isolate Market

Market Overview and Definitions

Eggs are made up of:

- egg white (albumen)
- egg yolk (58 per cent)
- shell (27 per cent)
- waste (15 per cent)

Egg white comprises approximately 85 per cent protein, whereas egg yolk contains 31 per cent protein. Whole egg is made up of approximately 46 per cent protein.

The World Health Organisation (WHO) has indicated that egg protein should be considered the standard against which all other protein is measured. In addition, egg has excellent functional properties.

Eggs are sold to the food industry as whole egg, egg yolk, egg white and egg protein isolates. Products are available as liquids, at various concentrations or as dry powders/flakes. For the purpose of this study, the protein ingredients that have been researched are those where the protein content has been increased by processing. Whole egg, egg yolk and egg white is sold as a functional ingredient with little concentration done. Whole egg and egg yolk are not covered in this study. The market for egg protein isolates and egg white was quantified.

Egg White Protein

The European market for egg white protein was sized at 97,000 tonnes and valued at 210.6 million Euros in 2004. Approximately 28 per cent of the market by value is accounted for by liquid egg. In terms of volumes, the market was broken down into 22,000 tonnes of powder and 75,000 tonnes of liquid egg.
Egg white protein is used in the food industry for its associated functional properties. It has excellent emulsifying, colouring, flavouring and binding properties. It is also used as a protein source in nutritional applications. Furthermore, it is used in most food industry segments, although its main end-user markets are in the bakery and meat industry.

The main suppliers of egg white protein in Europe are Nive, Belovo, Sanovo Foods, Igreca and Eurovo.

**Egg Protein Isolates**

In 2004, egg protein isolates represented a small fraction of the egg protein market with an estimated revenues generated of 8.0 million Euros in Europe. Europe also exports a large percentage of its protein production, mainly to the Asia. The products are of high value and have been an area of development activity, with companies seeking new applications in pharmaceuticals and functional food products. However, these new applications have very low volume and the market has to an extent become a commodity market, with most products sold for the preservation of cheese and wine.

Specific markets within this segment include lysozyme, avidin, ovomucin, ovalbumin and ovotransferrin. Apart from lysozyme, which is used in the cheese and wine industries as a preservative, egg protein isolates are used in the pharmaceutical industry and in various nutritional and functional food applications.

There are only a few suppliers of egg protein isolate - Sanovo Foods is the largest supplier, with Nive and Belovo also supplying to the market.

**Market Drivers**

Figure 8-1 lists the drivers ranked in order of impact for the European egg protein market for the period 2005 to 2011.

**Figure 8-1**

Egg White Protein and Egg Protein Isolate Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increased demand for functional proteins</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Excellent nutritional value</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Ease-of-use</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Consumer acceptance</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Nutraceutical properties</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Potential new applications in pharmaceuticals</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Increased use in value-added applications</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*
Increased Demand for Functional Proteins

Egg protein is highly versatile ingredient and is widely used for its associated functional properties. It is used as a whipping agent in the dairy and confectionery industry. It acts as a good binding agent and is used in the meat industry in sausage and ham for this purpose. It is also a stable in oil-based emulsion. Egg protein prevents the formation of crystals in sugar saturated solutions, as it is resistant to stretching, bending and shearing. The functional properties of egg protein make it ideal in specific applications and this constitutes a strong driver as the industry looks for increased functionality from ingredients and food additives.

Excellent Nutritional Value

Egg protein contains all the essential amino acids and has a relatively low calorie content. It is rich in some vitamins as well as in essential salts and minerals such as iron and phosphorus. These good nutritional properties mean that egg protein can be widely used as a protein source in meal replacements and in baby food, as well as in some ready meals and sports and dietary products. The nutritional properties of egg protein are expected drive growth during the forecast period.

Ease of Use

Egg white protein is available at various concentrations and can be supplied frozen, as a liquid, powder or flakes. The use of powders is increasing. In powder form, transportation costs are minimised and the food processor is able to reconstitute the product in the factory. A disadvantage of liquid egg is its short life span. Although the introduction of aseptic filling of liquid egg has eliminated this problem, it has increased its cost.

Consumer Acceptance

Egg products benefit from a healthy image and few people exclude them from their diets. At a time when animal products are regarded with scepticism by the public and with concern from GMOs, egg proteins constitute a safe solution for a food industry in search of a protein source. This consumer tolerance is likely to be a key driver towards the continued use of egg protein in the food industry.

Nutraceutical Properties

Egg protein such as lysozyme protects the body against bacterial, viral or inflammatory diseases. Egg protein has been shown to have immunostimulation and antihistaminic effects. Egg protein is used in the pharmaceutical industry for this reason. There is increasing use of egg proteins in nutraceutical products and infant formula for their specific health benefits.
Egg white is rich in lipids essential to the human body. Research and development is actively being conducted in this area. In the long term, this additional research is likely to reinforce the nutraceutical value of egg protein.

**Potential New Applications in Pharmaceuticals**

The European egg protein isolate market has been driven by efforts to find potential new applications in both pharmaceutical and high-value nutraceutical products. Currently, progress has been slow and few significant applications have been found. Suppliers continue to focus development efforts in these markets and as long as it continues, this is expected to be a driver for this market.

**Increased Use in Value-added Applications**

There is a strong trend towards the customisation of proteins in high value-added applications such as functional foods, and specialist nutritional products, a phenomenon that milk proteins have exploited successfully. This trend is likely to lead to new developments and end-users for egg protein isolates. This factor is likely to contribute to revenues growth in the medium and long term.

**Market Restraints**

Figure 8-2 lists the restraints ranked in order of impact for the European egg protein market from 2005 to 2011.

**Figure 8-2**

Egg White Protein and Egg Protein Isolate Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oversupply and price</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Mature end-user markets</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Consumer concerns</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Functional disadvantages</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Competition from other proteins</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>EU move to free range production</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Price</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>High Risk Ventures</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*
Oversupply and Price

Egg white is to some extent a by-product for the egg industry. In the past, egg white has been treated as a commodity and has been priced accordingly. There has been an oversupply which has a subsequent impact on price. The European industry exports over 50 per cent of its production of egg white proteins. All these factors have limited growth of the market.

Mature End-user Markets

The main end-user markets for egg protein are in the bakery and meat industry. Both of these markets are considered mature, with little volume growth in Europe. While the industry seeks new applications in markets such as pharmaceuticals, the lack of growth in its main markets is expected to be a restraint to further growth throughout the forecast period.

The consumer market for eggs is relatively stable, which can put additional pressure on the profitability of the industry.

Consumer Concerns

There are a number of consumer concerns surrounding the use of eggs:

- Eggs are perceived as having high cholesterol content and intake should be limited.
- A small proportion of the population is allergic to ovalbumin, which is the main component of egg white protein.
- Eggs and egg products have had bad publicity due to intensive farming methods and periodic health scares. The salmonella infection has been the major concern of the egg industry in the recent past, but with the increase of health safety measures it constitutes more of a potential problem than a real threat.

The concern about egg safety is likely to constitute a restraint to market growth throughout the forecast period.

Functional Disadvantages

Egg protein has some practical disadvantages in that it does not dissolve easily in water and the taste is considered, by most people, to be less pleasant than alternative proteins. These factors will restrain growth in particular application sectors.

Competition from Other Proteins

In many applications, egg protein is an essential component of the recipe they are used in, and can not be readily substituted by other protein sources. However, in some applications, they can be substituted by other protein sources, such as soya, wheat or milk proteins. Egg
proteins are subjected to direct price competition from these products. This commonly occurs in the bakery industry, where soya protein is used in combination with egg protein to reduce the amount of the latter in the product.

Over the past two years, egg protein prices have been strong, partly due to the rise in soya prices, but also because of a shortage of product in the U.S. market. In the short term, the continued high price of soya products and milk protein is likely to reduce price pressure in the egg protein market, but in the later stages of the forecast period, this price pressure may increase.

EU MOVE TO FREE RANGE PRODUCTION

EU discussions may result in the reduction or elimination of intensive chicken farming. Such a development is expected to increase the cost and price of egg products. However, any legislation is unlikely to be operative until 2009-2010 and hence any impact on the market is expected only at the end of the forecast period.

PRICE

With an average price of nine Euros per kilo, protein isolates are considered expensive in contrast to other protein sources available. The use of protein isolates in the past has been restricted to the use of lysozymes as an alternative to sulphates in preserving cheese and wine.

HIGH-RISK VENTURES

This market for egg protein isolates has not developed as quickly as anticipated. The standard applications for the preservation of cheese and wine have made progress. However, there is still yet to be major development in other sectors. Although the larger participants are using their technical expertise to develop new markets, there is a certain amount of risk and investment required with no promises of long term awards. This has been a minor factor in restraining growth in the market.

MARKET QUANTIFICATION - EGG WHITE PROTEIN AND EGG PROTEIN ISOLATE

Market Engineering Measurements - Egg White Protein

Chart 8.1 illustrates the Market Engineering measurements for the European egg white protein market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>206.6 million euros</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>97,000 tonnes</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>9.6%</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.5%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>2.3 Euros/kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Price range</td>
<td>0.5 - 9.0 Euros/kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>47%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>Less than 10</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Engineering Measurements - Egg Protein Isolate

Chart 8.2 illustrates the Market Engineering measurements for the European egg protein isolate market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>8.0 million euros</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>900 tonnes</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>5.3%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.55%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Developing</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>8.9 Euros/kg</td>
<td></td>
</tr>
<tr>
<td>Price range</td>
<td>7-15 Euros/kg</td>
<td></td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>Over 80%</td>
<td></td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>Less than 10</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Egg White Protein

Figure 8-3 and Chart 8.3 illustrate the volume and revenue forecasts for the European egg protein market for the period 2001 to 2011.
Figure 8-3
Egg White Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>166.2</td>
<td>---</td>
<td>91,300</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>173.2</td>
<td>4.2</td>
<td>93,100</td>
<td>2.0</td>
</tr>
<tr>
<td>2003</td>
<td>188.5</td>
<td>8.8</td>
<td>96,000</td>
<td>3.1</td>
</tr>
<tr>
<td>2004</td>
<td>206.6</td>
<td>9.6</td>
<td>97,000</td>
<td>1.0</td>
</tr>
<tr>
<td>2005</td>
<td>204.2</td>
<td>-1.2</td>
<td>99,900</td>
<td>3.0</td>
</tr>
<tr>
<td>2006</td>
<td>202.1</td>
<td>-1.0</td>
<td>101,900</td>
<td>2.0</td>
</tr>
<tr>
<td>2007</td>
<td>206.3</td>
<td>2.1</td>
<td>104,900</td>
<td>2.9</td>
</tr>
<tr>
<td>2008</td>
<td>212.9</td>
<td>3.2</td>
<td>107,000</td>
<td>2.0</td>
</tr>
<tr>
<td>2009</td>
<td>223.3</td>
<td>4.9</td>
<td>108,100</td>
<td>1.0</td>
</tr>
<tr>
<td>2010</td>
<td>229.3</td>
<td>2.7</td>
<td>108,100</td>
<td>0.0</td>
</tr>
<tr>
<td>2011</td>
<td>235.6</td>
<td>2.7</td>
<td>108,600</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 8.3
Egg White Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
The European egg white protein market is estimated to be valued at 206.6 million Euros in 2004, for a volume of 97,000 tonnes. The average price was 2.3 Euros per kilo. Note: Prices are the average for all products, including liquid and powder products.

Prices fell sharply in the late 1990s, but increased in 2002 when there was a shortage of egg white in the U.S. market. In 2003, prices increased partly in response to the hot summer in Europe. In 2004, further increases came about because of health safety concerns and supply shortages. Few users can shift from egg protein to an alternative product quickly, as a complete product reformulation is often required. Despite the price increase over the past two years, the egg industry tends to suffer from overcapacity, and prices are more likely to decrease than increase in 2004 - 2006. Sharp short-term variations are possible. Throughout 2005 - 2011 period, there is unlikely to be any significant price rise, as oversupply in the European market continues. However, towards the end of the forecast period, prices may increase as the market restructures itself and EU regulations may mean that there is a shift to free range egg production.

The compound annual growth rate (CAGR) in terms of revenues for the period 2004 to 2011 is 1.5 per cent.

**Egg Protein Isolate**

Figure 8-4 and Chart 8.4 illustrate the volume and revenue forecasts for the European egg protein isolate market for the period 2001 to 2011.

**Figure 8-4**

Egg Protein Isolate Market: Volumes and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>7</td>
<td>---</td>
<td>780</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>7.3</td>
<td>4.3</td>
<td>820</td>
<td>5.1</td>
</tr>
<tr>
<td>2003</td>
<td>7.6</td>
<td>4.1</td>
<td>860</td>
<td>4.9</td>
</tr>
<tr>
<td>2004</td>
<td>8</td>
<td>5.3</td>
<td>900</td>
<td>4.7</td>
</tr>
<tr>
<td>2005</td>
<td>7.3</td>
<td>-8.8</td>
<td>940</td>
<td>4.4</td>
</tr>
<tr>
<td>2006</td>
<td>7.7</td>
<td>5.5</td>
<td>980</td>
<td>4.3</td>
</tr>
<tr>
<td>2007</td>
<td>8.1</td>
<td>5.2</td>
<td>1020</td>
<td>4.1</td>
</tr>
<tr>
<td>2008</td>
<td>8.5</td>
<td>4.9</td>
<td>1060</td>
<td>3.9</td>
</tr>
<tr>
<td>2009</td>
<td>8.9</td>
<td>4.7</td>
<td>1100</td>
<td>3.8</td>
</tr>
<tr>
<td>2010</td>
<td>9.4</td>
<td>5.6</td>
<td>1150</td>
<td>4.5</td>
</tr>
<tr>
<td>2011</td>
<td>9.4</td>
<td>0.0</td>
<td>1200</td>
<td>4.3</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
In 2004, the market for egg protein isolates generated revenues of 8.0 million Euros, representing volumes of 900 tonnes.

In the absence of major new applications, the market has grown less quickly than anticipated. In certain segments of the industry it is believed that there is a market potential in excess of 5,000 tonnes, but the timescale for achieving this cannot be predicted.

During the 2005-2011 period, the growth rate of the demand in volume is expected to remain consistent at approximately 3.5 per cent, unless new markets are found for these products.

The compound annual growth rate (CAGR) for revenues is 1.5 per cent for the period 2004-2011.

**Pricing Analysis**

The average price of liquid egg white protein was 0.85 Euros per kilo in 2004. The average price of egg white powder was 2.3 Euros per kilo in 2004. Protein isolates, such as lysosine, are the most expensive of egg proteins, and have an average price of 8.9 Euros per kilo.

To some extent, egg protein prices depend on the market price of eggs, which is subject to an eighteen-month variation corresponding to poultry stock turnover. Prices are also subject to occasional over supply and to poultry diseases among other factors. Egg shell prices can vary by up to 100 per cent in a few months. These price variations affect the price of protein, and liquid egg in particular, which has a shelf life of just one to two weeks. The prices of protein...
powders tend to fluctuate less as the shelf life of the product increases. Protein powder suppliers can alter their production schedule so that products are available in Spring, when egg production is traditionally highest and price increases are less likely. Egg protein prices will always be subject to sharp short-term variations.

Prices fell sharply in 1999-2000, but have risen since. In 2003, prices were high because of the hot summer in Europe. In 2004, prices at times increased by 50 per cent in response to poultry diseases and poor egg production rates. In early 2005, prices dropped again. The overall price trends conceal sharp short-term price movements, which have some impact on demand. In order to stabilise prices, egg protein manufacturers have tried to develop the value-added application area, offering egg proteins that have superior functionality and nutritional properties.

As a market, the egg industry is still considered to be oversupplied in a lot of sectors. This will continue to put pressure on prices despite short-term variations. However, as leading suppliers reorganise production, price pressures may ease. Moreover, if the EU legislation leads to the phasing out of intensive egg production, prices could rise at the end of the forecast period.

**Product Analysis**

**Egg White Protein**

Egg proteins are available in powdered, liquid and frozen forms of varying concentration with added salt or preservatives.

Powder is often used because it can be easily handled and transport costs are lower. In addition, some users see powders as safer from a health perspective, because pasteurised liquid eggs have a short shelf life. Most of the larger suppliers supply most of their products as a powder, whereas many smaller companies, especially in Southern Europe, still supply egg white as a liquid. Examples of powdered products found in the market include the following:

**Egg White: High Whip**

Typical product description: De-sugared, spray-dried and pasteurised egg white.

High whip egg white exhibits good whipping properties, comparable to that of fresh liquid egg white at the same pH. The volume and the standing of the foam are more or less equivalent. High whip is mainly used in bakery industry (in biscuits) and confectionery (in nougat, meringue, marshmallow, chocolate mousse, where good whipping properties are paramount.

**Egg White: High Gel**

Typical characteristics: De-sugared, spray-dried and pasteurised egg white powder.
High gel egg white is used as a binding agent, having a much better gel strength than fresh liquid egg white at the same pH. During heat-induced denaturation, high gel coagulates in a pseudo-crystalline lattice, as opposed to fresh egg white, which coagulates as an amorphous material. This provides the gel a good resistance to stretching, bending and shearing. High gel egg white is mainly used in meat (sausage, hamburger or ham), fish cakes, crab sticks, surimis and potato mixes, where good binding and water retention are necessary. High gel egg white can also be used to produce stable oil-based emulsions.

**Egg Protein Isolate**

Egg protein isolates are primarily used for their associated functional properties. These properties vary according to the type of protein.

**Lysozyme Hydrochloride**

Lysozyme hydrochloride is used in both the food and the pharmaceutical industries. The main uses of lysozyme in the food industry is linked to its ability to selectively inhibit the uncontrolled growth of clostridium tyrobutyricum during the maturation of cheese. This is utilised, in particular, in cheese made from pressed and cooked curd (for example, swiss cheese, parmesan, edam, gouda, cheddar and many others). This product is also used as a preservative for highly priced wines as an alternative to sulphates.

In the pharmaceutical industry, the ability of egg white lysozyme to protect the human body against bacterial, viral or inflammatory diseases has been reported in many scientific papers. It is used in aerosols for the treatment of bronchopulmonary diseases and for its prophylactic function against infectious pathology of the buccal cavity, especially relating to dental caries. It is also found in droplets for nasal tissue protection and various therapeutic creams designed for the protection and topical reparation of certain dystrophic and inflammatory lesions of the skin and soft tissues. Antihistaminic effects have also been reported.

**Avidin**

Avidin binds the water-soluble vitamin H (d-biotin). The affinity of Avidin for d-biotin has been widely used in molecular biology, affinity chromatography, enzyme linked immunosorbent assay (ELISA), histochemistry, cytochemistry and molecular recognition/labelling.

- **Ovomucin Hydrochloride**: Ovomucin hydrochloride forms extensive hydrogen bonds with water and gives rise to a characteristic gel-like structure.

- **Ovalbumin**: Ovalbumin is the major protein in egg white. It can be used as a carrier, stabiliser or blocking agent by the food industry.

- **Ovotransferrin Hydrochloride**: Ovotransferrin binds transition metals (Fe[III], Cu[III] and Al[III]). Ovotransferrin can be used as a nutritional ingredient in iron-fortified products such as iron supplements, iron-fortified mixes for instant drinks, sport bars, protein supplements and iron-fortified beverages. There is also evidence of an antibacterial effect of ovotransferrin.
Usage Analysis

Figure 8-5 and Chart 8.5 illustrate the proportion of egg protein used in nutritional applications and functional applications in 2004.

**Figure 8-5**

Egg White Protein and Egg Protein Isolate Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional Demand</td>
<td>12</td>
</tr>
<tr>
<td>Functional Demand</td>
<td>88</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 8.5**

Egg White Protein and Egg Protein Isolate Market: Usage Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Nutritional Demand**

Egg proteins are often considered a desirable protein source because they contain all the essential amino acids, which play a strong role in the repair of damaged body tissue. They are used in the replacement of other types of proteins such as meat or fish, or as a principal source of protein (for example in baby food). In the bakery industry, egg proteins can replace shelled eggs while maintaining the product’s nutritional value.

The nutritional value of egg proteins is enhanced by the associated health benefits. Egg proteins are rich in bioactive peptides such as ovomucoide and lysozyme, which carry minerals such as copper and zinc through the body. In addition, egg products are rich in vitamins A, B, D, E, and K and in cholesterol, which are essential requirements for the nervous system and for general health.
**Functional Demand**

The functional properties associated with the use of egg proteins still remains the predominant reason for their use in the food industry. They are used as whipping agents and binding agents in the bakery, dairy and confectionery industries. Egg proteins are also used for their taste and colour in the bakery and meat industry.

The multiple functionality of egg proteins constitutes a factor driving growth in the food industry, where the demand for high-performance protein is constantly growing.

**End-user Analysis**

Figure 8-6 and Chart 8.6 illustrate the end-user value analysis for egg protein by application in 2004.

**Figure 8-6**

Egg White Protein and Egg Protein Isolate Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakery</td>
<td>55</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>25</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Functional Foods</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 8.6**

Egg White Protein and Egg Protein Isolate Market: End-user Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Bakery

The bakery sector is the largest user of egg proteins. Egg proteins are used for their associated whipping, glazing, emulsion, taste and binding properties. Egg white is also used for its associated colour properties, for example, in meringues and cream. The usage of egg proteins is increasing in the bakery sector with many end-users preferring their use over shelled eggs or whole egg ingredients.

Meat Products

Egg white proteins are used in the meat industry as a source of protein and as a binding agent in products such as beef burgers. They compete to some extent with meat and soya proteins.

Nutraceutical Products

Egg proteins are used in the sports beverage, health drinks, meal replacements and other applications. The nutritional products market is anticipated to continue to grow throughout the forecast period.

Competitive Environment - Egg White Protein and Egg Protein Isolate

Competitive Structure

Figure 8-7 illustrates the competitive structure for the European egg protein market in 2004.
Liquid egg white is produced by a large number of companies involved in egg cracking and the supply of whole eggs to the food industry. The production of liquid egg white is often a by-product of the production of egg yolk. Liquid egg white has only a short shelf life and cannot be pasteurised in its liquid form. Large quantities of liquid egg white are sold to egg white powder producers, though products are also sold directly to food manufacturers. Overall there are over 100 companies producing liquid egg white for industrial use, many of which are small companies supplying only to their national markets.

The supply of egg white powder (albumen) is dominated by five companies.

The market has witnessed some vertical integration, with some companies involved in each segment of the supply chain, from feeding hens, to egg cracking and protein production. For example, Igreca which is involved in the sale or cracking of shelled eggs, also manufactures egg protein. Increased integration makes it easier for companies to develop new products.

Historically, companies have been confined to their national markets, but are now following strategies of globalisation by either acquiring other companies or expanding their regional coverage. Egg protein manufacturers are also in the process of increasing their product range in order to gain a competitive advantage, with many offering taylor-made products to meet specific customer requiremets. Nive, for instance, has developed egg white proteins available
in flake which makes them suitable for meringue applications. Manufacturers have also
widened the ovoproduct range, offering a series of mixes of egg and sugar or milk.

**Market Share Analysis**

Figure 8-8 and Chart 8.7 illustrate the European egg white protein market share analysis for
2004.

**Figure 8-8**

Egg White Protein and Egg Protein Isolate Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Igreca</td>
<td>16</td>
</tr>
<tr>
<td>Eurovo</td>
<td>16</td>
</tr>
<tr>
<td>Sanovo Foods</td>
<td>15</td>
</tr>
<tr>
<td>Nive</td>
<td>12</td>
</tr>
<tr>
<td>Belovo</td>
<td>12</td>
</tr>
<tr>
<td>Others</td>
<td>29</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 8.7**

Egg White Protein and Egg Protein Isolate Market: Market Share Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Nive held a strong position in the Dutch market, its home country, and has developed a strong position in most European countries either directly or through the acquisition of other companies. Despite this activity, the company has lost overall market share to other companies in Europe.

Sanovo Food, a Danish group, has production facilities in Denmark and Germany (through the purchase of EiProdukte GmBh) and focuses on product development. It is the leading supplier of egg protein isolates.

Belovo is 25 per cent owned by Michael Foods, a diversified U.S. food production company. The company is a leader in protein isolates and focuses on the functional design of egg products, with varying whipping strength, and gel strength.

Igreca, based in France, has an integrated egg breaking and processing facility and is now one of the two largest producers of egg white powder.

Eurovo, an Italian company, also has ensured it had a strong market position within home country before it increased its activity in Europe. It purchased Aveve of Belgium and Ovonor of France.

Other manufacturers of protein powders include Endhoven (the Netherlands), ABCD (Matines) France and Ovifrance (France)

The major blending companies such as Kerry Ingredients and G. C. Hahn among others are also significant market participants.
Strategic Analysis of the European Fish Protein Market

I N T R O D U C T I O N T O T H E M A R K E T

Market Overview and Definitions

Fish protein concentrate comes in the form of fish meal, either as a concentrate or as an isolate. Fish meal is made from inedible fish and trimmings from human grade fish, and is primarily used in fish feed, animal feed and pet food. All fish proteins are used exclusively for their nutritional benefits.

Fish protein concentrate typically contains between 60-70 per cent protein. Fish protein concentrates are manufactured by removing the water and fat content of fish by mechanical action and through the use of solvents.

Fish protein isolate typically contains between 75-80 per cent protein content and is better known as surimi. Surimi consists of a concentrated fish paste and is made from fish that has been skinned, boned, and minced. Surimi is generally mixed with wheat flour, egg white and salt, and is coloured, flavoured and shaped to look like the product it imitates. Surimi is used either to imitate other fish products or as a fish extender. It is the only fish protein used in human food. The concentrates are not usually suitable because the manufacturing process is not hygienic enough and the final product may contain traces of rancid fat and have poor organoleptic properties.

The major producers of fish protein are based in Chile, Peru, Scandinavia (Denmark, Norway, Iceland), the United States, Russia and Japan. World trade is dominated by Scandinavia and South America, which export most of their production. Most exports go to China, the Far East and various European countries. The main European producers are Triple Nine and Skagen.
In 2004, 30 million tonnes, representing 32 per cent of the total (inland and marine) world catch, were used to manufacture fish proteins and fish oil. The world production of fish meal (higher than 2003, but lower than 2002) is 6.0 million tonnes.

In 2004, the European market for fish protein generated revenues of 458.6 million Euros. The market has fallen about 30 per cent since 2001 as a result of the EU ban on the use of fish meal in ruminant feed.

Market Drivers

Figure 9-1 lists the drivers ranked in order of impact for the European fish protein market from 2005 to 2011.

**Figure 9-1**

Fish Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase in aquaculture production</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Relaxation of ruminant feed ban</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Suitability of fish protein for aquaculture</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Low cost in comparison to other proteins</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Source:** Frost & Sullivan

**Increase in Aquaculture Production**

Until about 1990, the world fish catch increased virtually every year. Since then, it has remained stable or higher in some years and lower in others. Total fish consumption has, however, continued to increase. The shortfall in fish catch is made up by the increased production of farmed fish, which in 2003 accounted for an estimated 20 per cent of world fish consumption. The increase in farmed fish has led to an increase in the demand for fish feed, of which fish meal is a major component. With increased concerns about fish stock, restrictions are likely to result in a lower total fish catch in the future. This is expected to result in an increase in the demand for farmed fish and fish feed. The aquaculture business is located mainly in Asia, especially in China. The demand for fish meal in the aquaculture market is expected to grow by at least 10 per cent per annum throughout the forecast period. This is likely to be a major driver in the market.
Relaxation of Ruminant Feed Ban

The EU ban on the use of fish meal in ruminant feed led to a 30 per cent decline in market size. The ban is expected to be lifted in 2005 or 2006 and some of the lost market will be gradually regained.

Suitability of Fish Protein for Aquaculture

Fish protein is the most suitable protein for carnivorous fish, as it is easily digestible. It also has a high protein value - 65 per cent compared to most vegetable proteins. Fish protein also contains various Omega-3 fatty acids that are thought to be advantageous for human health and are not found in other proteins.

Low Cost in Comparison to Other Proteins

Fish proteins are among the cheapest animal proteins available in the market, and they are balanced in essential amino acids and minerals. The increasing interest from food manufacturers for cost-effective protein sources is expected to increase the potential market for fish proteins during the 2005-2011 forecast period. The number of these new applications is increasing, but is considered to be relatively low in volume.

Market Restraints

Figure 9-2 lists the restraints ranked in order of impact for the European fish protein market from 2005 to 2011.

Figure 9-2

Fish Protein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EU ban on ruminant feed</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Production constraints</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand from China</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Strong organoleptic properties</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Vegetable Proteins as substitutes</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
EU Ban on Ruminant Feed

In 2000, the ruminant feed sector accounted for 10 per cent of the European fish protein market. As a result of the BSE crisis, the EU introduced a ban on the use of fish meal in ruminant feed to prevent cross-contamination to other larger feed markets such as poultry and pigs. This led to a steady reduction in the total market for fish protein in animal feed applications. A measuring technique has been developed to detect 0.1 per cent bonemeal content in feed. The EU has stated its intention to lift the ban, on the condition that all producers use the system and have adequate monitoring facilities in place. The ban is expected to be lifted in 2005 or 2006, following which fish protein suppliers may regain some of their old markets. Some poultry end-users have switched to vegetable protein and are expected to be reluctant to switch back to fish protein.

Production Constraints

The European fish protein market is very dependant on the fish catch. This can vary by about 10-15 per cent from year to year and is dependant on environment conditions, such as the El Nino effect in South America. The international market works with a level of buffer stocks to smooth price fluctuations, but fluctuations still exist. There is an increasing number of restrictions on sea fishing with both the Chile and Peru Governments regulating the fish catch. The EU is taking similar action. World production is likely to slow down throughout the forecast period, and this is expected to restrain the growth of the European fish protein market.

Increased Demand from China

China is now the largest user of fish meal and the demand is increasing rapidly. Most fish meal is imported and it is expected to impose pressure on world prices and reduce consumption in Europe.

Strong Organoleptic Properties

The strong taste and smell of fish protein limits its use in nutritional applications. Most fish proteins are restricted to animal feed and pet food, where organoleptic properties are not a barrier. Human consumption is restrained to fish protein products made of surimi. Negative organoleptic properties associated with fish protein are expected to continue to be a restraint to the growth of the market.

Vegetable Proteins as Substitutes

As the aquaculture market is growing, the industry has been focussing on the development and the suitability of alternatives. Vegetable proteins can be used as a substitute, although
they are less digestible and often contain more carbohydrate and fibre. Trials show that about 20 per cent of fish protein can be replaced with vegetable proteins without adversely effecting fish growth.

**Market Quantification**

Market Engineering Measurements


**Chart 9.1**

Fish Protein Market: Market Engineering Measurements (Europe), 2004

**Market Engineering Drives Market**

Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>458.6 million euros</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>740,000 tonnes</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>(10.1%)</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>5.13%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>0.62 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Price range</td>
<td>0.56-0.70 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>50%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>15-20</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*
Market Forecasts

Figure 9-3 and Chart 9.2 illustrate the market volume and revenue forecasts for the European fish protein market for the period 2001 to 2011.

**Figure 9-3**
Fish Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>580.3</td>
<td>---</td>
<td>1000.0</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>549.5</td>
<td>(5.3)</td>
<td>930.0</td>
<td>(7.0)</td>
</tr>
<tr>
<td>2003</td>
<td>510.2</td>
<td>(7.2)</td>
<td>850.0</td>
<td>(8.6)</td>
</tr>
<tr>
<td>2004</td>
<td>458.6</td>
<td>(10.1)</td>
<td>740.0</td>
<td>(12.9)</td>
</tr>
<tr>
<td>2005</td>
<td>447.2</td>
<td>(2.5)</td>
<td>710.0</td>
<td>(4.1)</td>
</tr>
<tr>
<td>2006</td>
<td>486.5</td>
<td>8.8</td>
<td>760.0</td>
<td>7.0</td>
</tr>
<tr>
<td>2007</td>
<td>520.2</td>
<td>6.9</td>
<td>800.0</td>
<td>5.3</td>
</tr>
<tr>
<td>2008</td>
<td>548.6</td>
<td>5.5</td>
<td>830.0</td>
<td>3.8</td>
</tr>
<tr>
<td>2009</td>
<td>576.3</td>
<td>5.0</td>
<td>860.0</td>
<td>3.6</td>
</tr>
<tr>
<td>2010</td>
<td>612.3</td>
<td>6.2</td>
<td>900.0</td>
<td>4.7</td>
</tr>
<tr>
<td>2011</td>
<td>650.8</td>
<td>6.3</td>
<td>950.0</td>
<td>5.6</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 9.2**
Fish Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Between 2001 and 2004, volumes declined by over 30 per cent as a result of EU ban on the use of fish protein in ruminant feed. Fortunately steady growth in the aquaculture market has counteracted this.

In 2004, the European fish protein market generated revenues of 458.6 million Euros, corresponding to volumes of 740,000 tonnes. Fish protein concentrates represent over 95 per cent of the market volumes. There is expected to be continued growth in the demand for fish protein of 5-8 per cent. This growth is mainly from the aquaculture industry. Demand from the animal feed segment is likely to remain stable until the ruminant feed ban is lifted, following which demand is expected to increase.

By 2011, the European fish protein market is forecasted to be valued at 650.8 million Euros, which represents 950,000 tonnes.

The compound annual growth rate (CAGR) for the period 2004 to 2011 is estimated to be 5.13 per cent.

Pricing Analysis

The supply of fish meal is likely to continue to decline and global demand is expected to increase at almost 10 per cent.

In 2004, the average price of fish protein was 0.62 Euros per kilo, with the price of concentrates ranging between 0.55 and 0.75 Euros per kilo. The price of isolates is typically three times higher than concentrate prices.

Prices are influenced by buffer stock holdings and by trading policies. Since 2001, prices have risen by 50 per cent in U.S. dollars, but have been relatively stable in Euros and only increased slightly. The increase in freight costs resulted in a price increase in 2004. Throughout the forecast period, prices are likely to increase slightly.

End-user Analysis

Figure 9-4 and Chart 9.3 illustrates the end-user value analysis for the European fish protein market in 2004.

**Figure 9-4**

Fish Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture</td>
<td>80</td>
<td>Stable</td>
</tr>
<tr>
<td>Animal feed and Pet food</td>
<td>15</td>
<td>Increasing</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>Decreasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Aquaculture

Farmed fish is the largest market for fish protein and accounted for almost 80 per cent of the total fish protein use in 2004. The aquaculture industry is expected to continue to grow, as wild fish stocks come under increasing pressure. Although some fish can be fed other protein sources, fish protein is essential for carnivorous fish. The demand for fish protein in aquaculture applications is expected to increase steadily throughout the forecast period (2005-2011).

Animal Feed and Pet Food

In 2000, the animal feed segment accounted for 60 per cent of total fish protein use, a share that has declined to about 15 per cent in 2004. Fish protein concentrates were used in the diets of poultry and pigs and in the past in ruminants feed. Some of these animal feed sectors have now switched to vegetable proteins, and although demand is expected to increase when the ruminant feed ban is lifted, demand is not expected to get back to previous levels.

Fish protein concentrates are used as a balanced source of protein in the pet food industry. They can represent up to 10 per cent of the total ingredients.

Other Applications

Mixed with eggs and flavour, fish protein isolates are used to manufacture surimi. European surimi consumption is only 2 to 3 per cent of the total fish protein market. The demand for surimi is expected to increase during the forecast period, but is likely to remain a small market.

Fish protein hydrolysates is a developing market with specialist applications.
Competitive Environment

Competitive Structure

Figure 9-5 illustrates the competitive structure for the European fish protein market in 2004.

**Figure 9-5**

Fish Protein Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>15-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Fish meal producers</td>
</tr>
<tr>
<td></td>
<td>Blenders</td>
</tr>
<tr>
<td></td>
<td>Distributors and Importers</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fishing companies and fish meal producers</td>
</tr>
<tr>
<td></td>
<td>Ingredient blenders</td>
</tr>
<tr>
<td></td>
<td>Fish protein distributors and importers</td>
</tr>
<tr>
<td>Notable Acquisitions, Mergers</td>
<td>2003-TripleNine purchased Boras, increasing its market share</td>
</tr>
<tr>
<td></td>
<td>2001-2003 Closure of several Norwegian fishmeal producers in response to declining sales</td>
</tr>
<tr>
<td></td>
<td>2001-Merger of two Trade Associations to form the International Fishmeal and Fish Oil Organisation (IFFO)</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Production efficiency</td>
</tr>
<tr>
<td></td>
<td>Raw material sourcing</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Aquaculture industry, animal feed industry</td>
</tr>
</tbody>
</table>

There are three tiers of competition:

- Fish meal producers processing a catch
- Processors and ingredient manufacturers
- Distributors

Europe supplies about 65 per cent of its own fish protein and imports the remainder from South America.

There were 15 to 20 manufacturers in the European fish protein market in 2004. This number has reduced over the past since 2000 as a result of the declining market.
Norway is the largest participant in the aquaculture market, and many of the larger importers and traders are based here, including Knudsen Trading and Norsea Food.

The largest European producer is Triple Nine Fish Protein of Denmark. Triple Nine Fish Protein is a cooperative that is the world’s second largest fish protein manufacturer (200,000 tonnes per year) and has plants at two Danish fishing ports. The company has successfully expanded over the past few years.

Other major producers include FF of Skagen (Denmark), NorSild Mills (Norway) and Seagarden (Norway). Smaller suppliers include Sildarvinnslan (Iceland), Laxa Feedmill (Iceland), CTTP of France and United Fish Protein (the United Kingdom).

Of the major product blenders, DMV and SPI use fish protein in their products.

The animal feed market is dominated by distributors and blenders.

**Market Share Analysis**

Figure 9-6 and Chart 9.4 illustrate the market share for major market participants active in the European fish protein market in 2004.

**Figure 9-6**

Fish Protein Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple Nine</td>
<td>25</td>
</tr>
<tr>
<td>FF Denmark</td>
<td>15</td>
</tr>
<tr>
<td>Norsild</td>
<td>10</td>
</tr>
<tr>
<td>Others</td>
<td>15</td>
</tr>
<tr>
<td>Imports</td>
<td>35</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Chart 9.4

Fish Protein Market: Market Share Analysis (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Strategic Analysis of the European Meat Protein Market

Introduction to the Market

Market Overview and Definitions

Blood proteins constitute the largest part of the market by volume. Products are supplied mainly as powders and in their frozen form. Blood products typically contain 70 per cent protein content. For food applications, blood is broken-down into its components: plasma, haemoglobin, immunoglobulin and globin. Plasma is often used in sausages to help bind and emulsify the meat. Haemoglobin is used in pet food and to colour black pudding. Immunoglobulin is a protein found in body fluids and is responsible for neutralising antigens. It is often used as an emulsifier in meat products. Globin is used in mincemeat and hamburgers, where it improves the texture of the product and to some extent helps bind the ingredients together. Blood proteins are also used in the pharmaceutical industry during the preparation of antibodies.

Meat protein isolates are sold only as powders. Refined meat protein isolates are produced from non-blood sources such as pig rind, which is a source of collagen. Most meat protein isolates contain over 90 per cent protein and are used for specific applications such as hot dogs, for which their emulsifying properties are suitable, typically replacing carrageenan. Most products are derived from pork, with smaller amounts derived from chickens. The use of beef derived products declined sharply after the BSE crisis and has not recovered.

In 2004, the European market for meat proteins generated revenues of 73.5 million Euros, of which almost 80 per cent was for powdered products, and the remainder was for frozen and liquid blood products. The market is mature and was severely affected by the BSE crisis, although it is slowly recovering. The main suppliers of powdered blood proteins are Proliant, Sonac and Vapran. BHJ is the main supplier of refined isolates. Meat proteins are used as low-cost and functional ingredients in meat products and in pet food. Europe is a net exporter of meat proteins.
Market Drivers

Figure 10-1 lists the drivers ranked in the order of impact for the European meat protein market from 2005 to 2011.

**Figure 10-1**

Meat Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GI Issues</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Good functionalities</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Cost-savings</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>EU allowing the use of meat protein in animal feed</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Improved labelling</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Consumer trends</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**GM Issue**

Meat protein competes directly with soya protein in the marketplace. As a result of soya GM concerns, some users have switched from using soya protein to meat protein. This factor is expected to remain an important driver in the short term, but is likely to decline in importance in the long term.

**Good Functionality**

Meat protein ingredients exhibit excellent functionality properties such as water binding and emulsification capabilities. Meat proteins also form strong, elastic gels. Companies such as BHJ and Scanflavour to supply protein isolates to meet the precise functional requirements of meat producers. Their excellent functional properties are extensively used throughout the meat industry and for this reason direct substitution is often difficult. This factor will continue to drive growth of the European meat protein market during the forecast period.

**Cost Savings**

The use of meat proteins in the meat industry helps to reduce the overall cost of production. Meat proteins act as texturing agents and also as low cost meat extenders. The use of meat proteins also reduce the cost by reducing the amount of meat required to provide flavour. Cost savings as a result of using meat proteins are likely to continue to drive growth in the market, especially in Eastern Europe where blood products are widely used as a meat extender. Countries in Eastern Europe are less likely to be concerned with the labelling issues associated with the use of meat proteins.
EU ALLOWING USE OF MEAT PROTEIN IN ANIMAL FEED

The BSE crisis led to the EU effectively banning the use of meat proteins in specific animal feed applications. This restriction is expected to be lifted by 2007 and this is likely to lead to an increase in the use of meat proteins in these application sectors in the long term.

IMPROVED LABELLING

Proposed EU legislation on labelling is likely to require more information on food product packaging. However, as meat is not classified as an allergen, the labelling requirements are likely to be less stringent when compared to all other products classified as allergens (including gluten, milk and soya products). The overall impact of this driver is negligible.

Market Restraints

Figure 10-2 lists the restraints, ranked in order of impact, for the European meat protein market for the period 2005-2011.

FIGURE 10-2

Meat Protein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Health and Safety Issues</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Price</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Consumer perception of inappropriate use</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Slow growth of end-user markets</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Product labelling</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

HEALTH AND SAFETY ISSUES

The BSE crisis had a major effect on the European meat protein market. The foot-and-mouth disease outbreaks have aggravated the situation further. Meat proteins were banned from animal feed and consumer confidence in meat products decreased heavily. While confidence has recovered to some extent, these health and safety concerns still impact the market.

PRICE

In some applications it is believed that meat proteins are losing market share due to increased product substitution by alternative proteins sources. Meat proteins are typically more expen-
sive than soya proteins. During the period 2005-2011, prices are expected to be a restraint to the growth of the European meat protein market.

**Consumer Perception of Inappropriate Use**

Since 2000 there has been negative publicity regarding the use of meat protein in animal feeds. The general consumer perception is that this is not an appropriate use of animal proteins, especially following the BSE crisis.

**Slow Growth of End-user Markets**

The market for meat products in Europe is mature, growing overall at 1-2 per cent per annum. There is also an overall trend towards the use of fewer additives and growth in the number of vegetarian consumers in most Northern countries. All these factors are likely to restrain growth in the European meat protein market throughout the forecast period (2005-2011).

**Product Labelling**

Increased EU labelling requirements are expected to have an adverse effect on the use of meat proteins in much of the Western Europe. Producers of higher quality products are likely to avoid using low quality protein, especially isolates with high collagen content. It is possible that the blenders will become more important users of meat proteins, as they will be using lower proportions of the products and their labelling requirements are expected to be less onerous. This factor is expected to restrain growth in Western Europe in the early part of the forecast period.

**Market Quantification**

**Market Engineering Measurements**

Chart 10.1 illustrates the Market Engineering measurements for the European meat protein market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>73.5 million euros</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>74,000 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>5.8%</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>3.07%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>1.1 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>60%</td>
<td>Increasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>20-30</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 10-3 and Chart 10.2 illustrate the volume and revenue forecasts for the European meat protein market for the period 2001 to 2011.
**Figure 10-3**

Meat Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>64.2</td>
<td>---</td>
<td>68.0</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>65.7</td>
<td>2.3</td>
<td>69.0</td>
<td>1.5</td>
</tr>
<tr>
<td>2003</td>
<td>69.5</td>
<td>5.8</td>
<td>71.0</td>
<td>2.9</td>
</tr>
<tr>
<td>2004</td>
<td>73.5</td>
<td>5.8</td>
<td>74.0</td>
<td>4.2</td>
</tr>
<tr>
<td>2005</td>
<td>75.2</td>
<td>2.3</td>
<td>76.0</td>
<td>2.7</td>
</tr>
<tr>
<td>2006</td>
<td>79.1</td>
<td>5.2</td>
<td>78.0</td>
<td>2.6</td>
</tr>
<tr>
<td>2007</td>
<td>82.6</td>
<td>4.4</td>
<td>80.0</td>
<td>2.6</td>
</tr>
<tr>
<td>2008</td>
<td>84.8</td>
<td>2.7</td>
<td>82.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2009</td>
<td>86.2</td>
<td>1.7</td>
<td>83.0</td>
<td>1.2</td>
</tr>
<tr>
<td>2010</td>
<td>87.0</td>
<td>0.9</td>
<td>83.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2011</td>
<td>90.8</td>
<td>4.4</td>
<td>84.0</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 10.2**

Meat Protein Market: Volume and Revenue Forecast (Europe), 2001-2011

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
In 2004, the European market for meat protein was 73.5 million Euros representing a volume of 74,000 tonnes (80 per cent liquid and frozen product). Blood products account for 40-45 per cent of the market by value.

The market declined sharply in the late 1990s following the BSE crisis. The market is slowly recovering. Continued growth is forecast throughout the 2005-2011 period, and is mainly driven by demand for cheap blood products for Eastern Europe and for specialist protein isolates.

In 2011, the European market for meat protein is estimated at 90.8 million Euros, representing a volume of 84,000 tonnes.

The compound annual growth rate (CAGR) for the 2004-2011 period is 3.0 per cent.

Pricing Analysis

In 2004, the average price for European meat proteins was 1.1 Euros per kilo. Prices of powdered blood proteins average 1.7 Euros per kilo, varying from 0.5 Euros for some haemoglobin products to over 4.0 Euros per kilo for plasma products. Prices of protein isolates and flavourings range from 2.2 to 7.0 Euros per kilo, with an average price of 4.80 Euros per kilo.

During the 1997-2001 period, prices fell by 10 per cent, following a slow fall in demand from the BSE crisis and foot and mouth epizootic diseases. Since 2001, prices have been stable. In future average prices are expected to increase slightly due to the increasing demand for the high value isolates and to a stronger market for blood proteins, especially from Eastern Europe.

Usage Analysis

Figure 10-4 and Chart 10.3 illustrates the proportion of meat protein used in nutritional applications and functional applications in 2004.

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>44</td>
</tr>
<tr>
<td>Functional</td>
<td>56</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
**Nutritional Demand**

The nutritional demand for meat protein comes essentially from the pet food industry. The nutritional quality of meat proteins is excellent because they contribute all the essential amino acids as well as minerals such as calcium, sodium, potassium and phosphorous. Meat proteins are also a good source of iron. The protein content of most blood proteins is over 70 per cent. However, meat proteins are incorporated into human food mainly for the functional properties they provide. The nutritional demand for meat proteins is expected to increase during the 2005-2011 period, sustained by the growth in the pet food industry.

**Functional Demand**

The functional demand for meat proteins comes from the meat industry and the flavouring industry. The meat industry uses blood proteins and protein isolates derived from rind for their good binding and emulsifying properties. Meat proteins are used to bind ingredients in minced meat and hamburgers and to emulsify patés for example. To a lesser extent, haemoglobin is also used for its colour in delicatessen products. Plasma protein ingredients provide excellent water binding and emulsification properties and form strong, elastic gels. These protein products are ideal for use in hot dogs, bologna, beef patties, hams, poultry products for example. The market for meat proteins as a texturer is becoming more competitive due to the possible substitution from other protein sources such as soya or whey proteins.

The functional demand also includes demand from the flavouring industry. Dehydrated meat, also known as bouillon, is used in a wide range of preparations ranging from baked goods to snacks.
End-user Analysis

Figure 10-5 and Chart 10.4 illustrates the end-user value analysis for the European meat protein market in 2004.

**Figure 10-5**

Meat Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—in revenues</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat industry</td>
<td>46</td>
<td>Increasing</td>
</tr>
<tr>
<td>Pet food</td>
<td>44</td>
<td>Increasing</td>
</tr>
<tr>
<td>Other applications</td>
<td>10</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 10.4**

Meat Protein Market: End-user Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Meat Products**

Meat proteins are used in the meat industry as meat extenders in hamburgers and as a binder/emulsifier in delicatessen products. The meat industry uses plasma and immunoglobulin in sausages and globin in hamburgers and minced meat. Protein isolates are used as binding agents in products such as hot dogs. Within the meat industry, meat proteins are at risk from substitution from whey and soya proteins. The demand for meat proteins in this industry has partly recovered following the BSE crisis. In addition GM concerns have impacted the demand for soya protein, and the meat protein market has benefited from this.
Pet Food

The pet food industry used blood proteins as a protein source. Meat proteins contain the amino acids needed for a carnivorous pet diet. The pet food industry is a fast growing market in Europe and the demand from the pet food industry for blood proteins is expected to increase during the 2005-2011 period.

Other Applications

There are a number of specialist applications for meat proteins. Collagen based isolates are used in sports products, where they are believed to help in joint flexibility and injury recovery. The pharmaceutical industry uses blood proteins such as immunoglobulin, which can be modified to produce antibodies and other immunoassay products. The demand from the pharmaceutical industry is increasing but it is unlikely that it will be a high volume application sector.

Competitive Environment

Competitive Structure

Figure 10-6 illustrates the competitive structure for the European meat protein market in 2004.

Figure 10-6

Meat Protein Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of companies in the market</th>
<th>20-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Specialist meat product producers</td>
</tr>
<tr>
<td></td>
<td>Ingredient blenders</td>
</tr>
<tr>
<td></td>
<td>Distributors</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>3</td>
</tr>
<tr>
<td>Notable Acquisitions, Mergers</td>
<td>Sonac formed by merger of Smits Vuren, Sonac and Harimex</td>
</tr>
<tr>
<td></td>
<td>Chr. Hansen exits food ingredient market, focuses on pharmaceuticals</td>
</tr>
<tr>
<td></td>
<td>Scanflavour management buyout</td>
</tr>
<tr>
<td></td>
<td>Proliant buys BHJ</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Price and low production costs</td>
</tr>
<tr>
<td></td>
<td>Customisation, formulation</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Meat industry, petfood, pharmaceuticals</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

There are two tiers of competition between ingredient manufacturers and distributors.

Meat proteins are produced by specialist companies that buy their raw materials from abattoirs. The main suppliers of blood products are Proliant, Sonac and Veos. BHJ and Disex supply protein isolates mainly from pig rind products.
There has been some consolidation in the market with Proliant (USA) acquiring BHJ (Denmark). However, BHL is considered to operate independent of Proliant’s Spanish subsidiary.

Sonac was formed after the merger of three smaller suppliers: Smits Vuren, Sonac and Harimex.

Distributors are important in this market, which is characterised by low tonnages and a wide end-user application base. In some regions, most of the products are supplied by distributors.

The major blending companies such as Hahn and Kerry play an important role.

Market Share Analysis

Figure 10-7 and Chart 10.5 illustrate the market share represented by each of the major participants active in the total European meat protein market in 2004.

**Figure 10-7**

Meat Protein Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proliant inc. BHJ</td>
<td>35</td>
</tr>
<tr>
<td>Sonac</td>
<td>15</td>
</tr>
<tr>
<td>Veos</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>30</td>
</tr>
<tr>
<td>Imports</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 10.5**

Meat Protein Market: Market Share Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Proliant Meat Ingredients is a division of the Proliant Inc., based in the United States. The company produces proteins and other meat products at its plant in Spain. Proliant manufactures and markets protein products for the food, nutrition, human health, nutraceutical, diagnostic, life science research, biopharmaceutical and veterinary vaccine industries. It has four plants in the United States and is the market leader in the European meat protein market with 35 per cent of market share. In 2003, Proliant acquired BHJ (formerly Danexport) and are now the largest producers of meat protein isolates.

Veos has production facilities in Belgium (Veos), France (Vapran) and also Brazil. The company sells under the Veos name.

Sonac is owned by Sobel (who also owns Rousselot, one of the largest gelatine producers). Sonac was formed by the merger of Smits Vuren, Sonac and Harimex and has production plants in Netherlands and Belgium.

Other companies active in this market include:

- Prowico (Germany) - produce isolates from bone sources
- Disex (Spain) - the second largest supplier of isolates from pig rind and sell under the Royal Protein brand.
- Protein S.A. (Spain) - make protein from bone sources
- Scanflavour - a small supplier of isolates.

Examples of distributors include Acatris (Belgium), Benson (U.K.) Camida and SPI.
Strategic Analysis of the European Single Cell Market

Introduction to the Inactive and Autolysed Yeasts Market

Market Overview and Definitions

Single cell proteins are refined from unicellular organisms (mainly yeast) or simple multicellular organisms (mainly mycoprotein).

In this research service, two products were included:

- Yeast extract and autolysed yeasts - products that typically contain 50 per cent protein content
- Mycoprotein

These two products are distinct markets and are covered separately in this section. Active yeasts are excluded.

These products are used mainly in bakery and in brewing applications - as a processing aid and not as an ingredient. Although their protein content is high, this is not why they are used.
**Inactive and Autolysed Yeasts**

Inactive and autolysed yeasts are used as flavourings and seasonings in a range of food such as snacks, sauces and meat products. They also have a nutritional value, containing calcium, vitamin B and iron, and can be used in dietary supplements or in animal feed. These products are available as liquids, pastes or powders. Autolysed yeasts contain about 50 per cent protein. The main suppliers are BioSpringer and DSM.

**Mycoprotein**

Mycoprotein is extracted from fungal mycelium and has a typical protein content of around 12 per cent. It is used in vegetarian products as a meat analogue. Marlow Foods is the only manufacturer of this product.

The European market for single cell proteins was worth 149.0 million Euros in 2004, of which mycoprotein accounted for 40 per cent. The market in Europe is mature and little growth is forecast.

**Market Drivers**

Figure 11-1 lists the drivers, ranked in order of impact, for the European inactive and autolysed yeast market, from 2005 to 2011.

**Figure 11-1**

Inactive and Autolysed Yeasts Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Health concerns over food</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Reliable raw material source</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Flavouring properties</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Demand for nutraceutical ingredients</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Sugar deregulation</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Health Concerns Over Food**

The demand for inactive yeasts has benefited from consumer concerns over the safety or desirability of other protein sources. Due to various health issues and concerns, some food manufacturers prefer to use yeasts, which enable them to provide a 'cleaner' label for their products. This is likely to remain a driver throughout the forecast period 2005-2011.
RELIABLE RAW MATERIAL SOURCE

Single cell protein sources are grown under the cover of nutritional substrates. Their rapid reproduction provides fast growth. The supply of yeasts is more reliable when compared to some other proteins that are more likely to be affected by external factors such as poor weather or disease. The reliability of supply is expected to continue to be a driver in the European single cell protein market.

FLAVOURING PROPERTIES

Yeast extracts are used to impart meaty flavours to many food items, such as snack foods, ready meals, sauces, soups and spreads. Many of these markets, are growing at fast rates, which will lead to modest increases in single cell protein use.

DEMAND FOR NUTRACEUTICAL INGREDIENTS

Yeast-based single cell proteins have specific health benefits associated with their use. This has led to increased demand for yeast products in pet food and health supplements applications. This is likely to be a medium driver throughout the forecast period 2005-2011.

SUGAR Deregulation

Yeasts are grown on molasses, and derived from sugar. The planned deregulation of the European sugar industry in 2006 may lead to lower prices of molasses and yeasts in Europe, which may drive further growth in this market.

Market Restraints

Figure 11-2 lists the restraints, ranked in order of impact for the European inactive yeast and autolysed market from 2005 to 2011.

Figure 11-2

Inactive and Autolysed Yeasts Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of functional properties</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Organoleptic properties of yeast</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Amino Acids Deficiency</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Lack of Functional Properties

Single cell proteins lack the functional properties that are associated with other protein sources, such as binding and emulsifying. This means that in most applications they are not practical alternatives to other proteins that are primarily used for functional properties they provide. The use of yeast-based proteins is likely to be confined to flavour applications, nutritional supplements and beverages. This is believed to be a substantial restraint on the market over the forecast period 2005-2011. Conversely, single cell proteins have only limited competition when compared to other proteins in their main market sectors.

Organoleptic Properties of Yeast

The powerful smell of yeast indicates that it is generally unsuitable as a protein source in human food (with the exception of Marmite), and its use is restricted to a flavouring. This is expected to be a major restraint on the market throughout the forecast period (2005-2011).

Amino Acid Deficiency

The deficiency in lysine and methionine (as contained in other plant proteins) is expected to continue as a minor restraint on the market.

Market Quantification - Inactive and Autolysed Yeasts

Market Engineering Measurements

Chart 11.1 illustrates the Market Engineering measurements for the European inactive single cell yeasts market for 2004.
Chart 11.1

Inactive Single Cell Yeasts Market: Market Engineering Measurements (Europe), 2004

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>89.0 million euros</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>41,400 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>2.2%</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>2.28%</td>
<td></td>
</tr>
<tr>
<td>Average price</td>
<td>2.15 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Price range</td>
<td>1.8 - 2.6 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Market concentration (percent of base year market controlled by top three competitors)</td>
<td>Over 70%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>5-10 companies</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 11-3 and Chart 11.2 illustrate the volume and revenue forecasts for the European inactive and autolysed yeast market for the period 2001 to 2011.
### Figure 11-3

Inactive and Autolysed Single Cell Yeasts Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (Tonnes)</th>
<th>Unit Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>84.1</td>
<td>---</td>
<td>39,500</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>86.5</td>
<td>2.9</td>
<td>40,300</td>
<td>2.0</td>
</tr>
<tr>
<td>2003</td>
<td>87.1</td>
<td>0.7</td>
<td>40,900</td>
<td>1.5</td>
</tr>
<tr>
<td>2004</td>
<td>89</td>
<td>2.2</td>
<td>41,400</td>
<td>1.2</td>
</tr>
<tr>
<td>2005</td>
<td>90.7</td>
<td>1.9</td>
<td>42,200</td>
<td>1.9</td>
</tr>
<tr>
<td>2006</td>
<td>92.7</td>
<td>2.2</td>
<td>43,100</td>
<td>2.1</td>
</tr>
<tr>
<td>2007</td>
<td>93.1</td>
<td>0.4</td>
<td>43,900</td>
<td>1.9</td>
</tr>
<tr>
<td>2008</td>
<td>94.2</td>
<td>1.2</td>
<td>45,100</td>
<td>2.7</td>
</tr>
<tr>
<td>2009</td>
<td>96.6</td>
<td>2.5</td>
<td>46,200</td>
<td>2.4</td>
</tr>
<tr>
<td>2010</td>
<td>100.1</td>
<td>3.6</td>
<td>47,200</td>
<td>2.2</td>
</tr>
<tr>
<td>2011</td>
<td>104.2</td>
<td>4.1</td>
<td>48,500</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

### Chart 11.2

Inactive and Autolysed Single Cell Yeasts Market: Unit Shipment and Revenue Forecast (Europe), 2001-2011

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
In 2004, the European inactive and autolysed yeast market generated revenues of 89.0 million Euros, corresponding to volumes of 41,400 tonnes.

Market volumes are expected to increase broadly in line with the output of the main user industries, with a growth of 2 per cent. There is a slight downward pressure on prices expected as a result of deregulation sugar industry in Europe.

By 2011, the European inactive and autolysed yeast market is forecast to be valued at 104.2 million Euros, which represents 48,500 tonnes.

The compound annual growth rate (CAGR) for the period 2004 to 2011 is estimated to be 2.3 per cent.

Pricing Analysis

The average price of inactive single cell yeast proteins in 2004 was 2.15 Euros per kilo, with yeast extracts typically priced than autolysed yeasts. Since 2001, there have only been slight price variations.

The price is affected by the cost of molasses. With the deregulation of the sugar industry in 2006, there may be some downward pressure on single cell protein prices, although it is also possible there may be a shortage of supply which may keep prices high.

Product Analysis

Active yeasts (not covered in this study) are also referred to as live yeasts, or baker's yeast. They are grown on a sugar beet molasses and are used mainly in the bakery and brewing industries.

**Yeast Extracts**

Yeast extracts are obtained from baker's yeast, and autolysed into peptides and amino acids. The cell walls are removed, allowing the extracts to be fully soluble. Yeast extracts are used mainly for their taste and flavour in products, such as soups, sauces, and snacks.

**Autolysed Yeasts**

These are partially autolysed yeast cells, produced as a powder, and are used as flavourings in a wide range of food products.
Usage Analysis

Figure 11-4 and Chart 11.3 illustrates the proportion of egg protein used in nutritional applications and functional applications in 2004.

**Figure 11-4**
Inactive and Autolysed Single Cell Yeasts Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>30</td>
</tr>
<tr>
<td>Functional</td>
<td>70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 11.3**
Inactive and Autolysed Single Cell Yeasts Market: Usage Analysis (Europe), 2004

Most yeast proteins used in human food have a functional (for example flavouring) rather than a nutritional use. However, in animal feed applications they are used primarily for the protein content they provide.

End-user Analysis

Figure 11-5 and Chart 11.4 illustrates the end-user value analysis by application for the European inactive and autolysed yeast single cell market for 2004.
Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

**Processed Food**

Yeast extracts are used as flavourings in applications such as snack foods, meat products and soups. Only small amounts are required to achieve the desired effect. Most of the end-user markets are quite stable, and this application is expected to show only modest growth during the forecast period (2005-2011).

**Animal Feed and Pet Food**

Yeast hydrolysates are used in animal feed and in pet food as flavour enhancers and as an nutritional ingredient in pet food. Usage in the pet food market is expected to increase during the forecast period (2005-2011).
Vegetarian Dishes

Yeast extracts can be used as protein sources and as flavours in some vegetarian dishes. They provide a 'clean label' alternative to gluten and soya protein, and have an established use in these products.

Competitive Environment - Inactive and Autolysed Yeasts

Competitive Structure

Figure 11-6 illustrates the competitive structure for the European market for Inactive and Autolysed Yeast market.

Figure 11-6
Inactive and Autolysed Single Cell Yeasts Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>5-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td></td>
</tr>
<tr>
<td>General food ingredient suppliers for whom yeast proteins are minor part of their product range</td>
<td></td>
</tr>
<tr>
<td>Specialist suppliers of yeast products</td>
<td></td>
</tr>
<tr>
<td>Notable Acquisitions, Mergers</td>
<td></td>
</tr>
<tr>
<td>LeSaffre, the world market leader, acquired Red Star Yeast (USA)</td>
<td></td>
</tr>
<tr>
<td>Kerry Ingredients have purchased a production facility from Quest</td>
<td></td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Price, product range</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Producers of soups, snacks, meat products</td>
</tr>
<tr>
<td></td>
<td>Animal feed and pet food suppliers</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Since 2000 the industry has consolidated, and is now dominated by a few suppliers. Distributors such as ACP Ingredients are also active in this market.

Market Share Analysis

Figure 11-7 and Chart 11.5 illustrate the market share represented by each of the major participants active in the European inactive and autolysed yeast markets in 2004.
Lesaffre, the world’s largest yeast supplier, is also the largest supplier of inactive yeast proteins in Europe with 40-50 per cent market share in 2004. The company has production facilities in Europe and in the United States, and has a very wide range of products. Yeast extracts and autolysed yeasts are supplied by their subsidiary company, BioSpringer.

DSM

DSM produces yeast extracts for food flavourings, and is the second largest supplier to the European inactive and autolysed yeast market.
Others

Other suppliers include Mauri (part of Associated British Foods), and Deutsche Hefewerke (Ohly). Major ingredient suppliers such as Puratos and Kerry Ingredients buy yeasts to further refine and to use in ingredient blends. Kerry has purchased a production facility from Quest International as a source of supply for their own needs. Puratos has recently started production.

Introduction to the Mycoprotein Market

Market Overview and Definitions

Single cell proteins are refined from unicellular organisms (mainly yeast) or simple multicellular organisms (mainly mycoprotein).

In this research service, two products were included:

- Yeast extract and autolysed yeasts - products that typically contain 50 per cent protein content
- Mycoprotein

These two products are distinct markets and are covered separately in this section. Active yeasts are excluded.

These products are used mainly in bakery and in brewing applications, but as a processing aid and not as an ingredient. Although their protein content is high, this is not why they are used.

Inactive and Autolysed Yeasts

Inactive and autolysed yeasts are used as flavourings and seasonings in a range of food such as snacks, sauces and meat products. They also have a nutritional value, containing calcium, vitamin B and iron, and can be used in dietary supplements or in animal feed. These products are available in liquids, pastes or powders. Autolysed yeasts contain about 50 per cent protein. The main suppliers are BioSpringer and DSM.

Mycoprotein

Mycoprotein is extracted from fungal mycelium and has a protein content of about 12 per cent. It is used in vegetarian products as a meat analogue, where it provides good nutritional value.
Mycoprotein was developed by AstraZeneca, and is supplied under the 'Quorn' brand name. The main user was its subsidiary company Marlow Foods.

In 2003, AstraZeneca sold the Quorn business and Marlow Foods to Montague Venture Capital. Marlow Foods produces the mycoproteins, and also vegetarian ready meals in which the mycoprotein is used. The company also sells mycoprotein to ready meal producers in Scandinavia, Holland, Belgium and the United States.

The European market for single cell proteins was worth 149 million Euros in 2004, of which mycoprotein accounted for some 40 per cent.

Market Drivers

Figure 11-8 lists the market drivers ranked in order of impact for the European mycoprotein market, from 2005 to 2011.

**Figure 11-8**

Mycoprotein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vegetarian demand</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Consumer obesity issues</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Reliable raw material source</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Vegetarian Demand

Mycoprotein is a vegetarian protein source and is used to replace meat protein. The increased demand for vegetarian products has been the main driver to growth in the European mycoprotein market. This product has fully exploited its home market (UK), and hence export markets are growing rapidly. Export markets are undeveloped. The market for vegetarian products in other European countries is notably smaller. However there is still untapped potential, and the factor is considered to drive growth in the market throughout the forecast period (2005 - 2011).

Consumer Obesity Concerns

The obesity issue is a major concern in much of Europe. The low carb trend may lead to consumers favouring proteins over carbohydrates. The calorie content of mycoprotein is lower than any other protein ingredients and this is likely to drive growth in the European mycoprotein market.
Reliable Raw Material Source

As with yeast single cell protein sources, supply is more reliable than for some other protein sources, which are more likely to be affected by external factors such as poor weather or disease. The reliability of supply is expected to continue to be a key driver in the European mycoprotein market.

Market Restraints

Figure 11-9 lists the key market restraints in the order of impact for the European mycoprotein market, from 2005 to 2011.

Figure 11-9

Mycoprotein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of functional properties</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Price</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Consumer perception of source material</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Competition from other proteins</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Lack of competition</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Lack of Functional Properties

As with other single cell proteins, mycoproteins lack functional properties typically associated with other protein types such as binding and emulsifying. This means that in most applications they are not practical alternatives to other protein sources. The application of mycoprotein is confined to meat substitutes, and this factor will continue to restrain growth in the market.

Price

Mycoprotein is expensive to produce and has a typical market price of 7.50 Euros per kilo in 2004. This price is much higher than any other protein source. This is likely to remain a restraint on market development throughout the forecast period (2005-2011).
Consumer Perception of Source Material

Increased consumer awareness of food sources indicates that it is expected to become more difficult to promote mycoproteins, especially in new markets. In the United States, there has already been adverse consumer reaction on the fungal source materials used for mycoproteins. Negative consumer reactions will continue to restrain growth in the market.

Competition from other Proteins

While mycoproteins have established a niche market in vegetarian meals, there are alternatives including soya protein and pulse proteins, which can also provide a textured product. The high price of mycoprotein makes the product vulnerable to substitution from other protein sources in particular applications.

Lack of Competition

Marlow Foods is the sole supplier of mycoproteins. Lack of competition means that prices are expected to remain high. The lack of competition in the market may restrain growth in the market.

Market Quantification - Mycoprotein

Market Engineering Measurements

Chart 11.6 illustrates the Market Engineering measurements for the European mycoprotein market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>60 million euros</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market size (tonnes)</td>
<td>8,400</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>2.0%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Average price</td>
<td>7-50 Euros /kg</td>
<td></td>
</tr>
<tr>
<td>Price range</td>
<td>7-50 Euros /kg</td>
<td></td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>1</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 11-10 and Chart 11.7 illustrate the market volume and revenue forecasts for the European mycoprotein market between 2001 and 2011.
In 2004, the European mycoprotein market generated revenues of 60.0 million Euros, corresponding to volumes of 8,400 tonnes.
The European mycoprotein market is in decline as the restraints are expected to continue to outweigh the drivers. Most export markets are developing slower than expected. Marlow Foods may look at lowering prices in an effort to expand its client or application base. Total volumes may decline slightly over the forecast period (2005-2011). Entry of another competitor appears unlikely.

By 2011, the European mycoprotein market is forecast to be valued at 60.0 million Euros, which represents 8,450 tonnes.

The compound annual growth rate (CAGR) for the period 2004 to 2011 is estimated to be 0 per cent.

Pricing Analysis

In 2004, the price range of mycoproteins was 7.50 Euros per kilo. Since 2001, the price has declined as part of an effort by Marlow Foods to develop export markets. In the future, prices are dependant on the strategy of the sole supplier.

Usage Analysis

Figure 11-11 and Chart 11.8 illustrates proportion of mycoprotein used in nutritional applications and functional applications in 2004.

Figure 11-11

Mycoprotein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>30</td>
</tr>
<tr>
<td>Functional</td>
<td>70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Mycoprotein is used essentially for one application - as a meat substitute in vegetarian meals. It is used for the nutritional benefits it provides and also for its specific functional properties - it is similar in texture to meat.

**Competitive Environment - Mycoprotein**

**Competitive Structure**

Mycoprotein was developed in the 1980s and patent protection has expired. However, the manufacturing process is complex and there has been no indication of any other company entering this market. There is a risk of substitution from other protein sources such as soya and pulse protein products.

Marlow Foods is the only producer of mycoprotein in Europe. The company sells mycoprotein to selected ready meal producers outside the United Kingdom. The 'Quorn' product is a relatively new concept, and the company works with its chosen manufacturers on marketing campaigns to establish demand in new markets.
Strategic Analysis of the European Soya Protein Market

Introduction to the Market

Market Overview and Definitions

Soya is typically made up of:

- 30 per cent carbohydrate,
- 38 per cent protein
- 14 per cent moisture.

Containing all the essential amino acids, soya protein is the largest plant-based protein market in Europe. This market includes soya flour and grits, soya concentrates, soya isolates and textured soya proteins.

Soya flour and grits are produced by grinding and sieving soya flakes to give a protein content of 40 per cent, which may be increased to 50 per cent by removal of fat content. The main end-user markets is the bakery and the animal feed industry.

Soya protein concentrates have a minimum protein content of 65 per cent and are made by removing a proportion of the carbohydrate from soya flour. Traditional concentrates are used mainly in animal feed, but there are also a wide range of functional concentrates designed for specific human food applications. Soy protein concentrates are used in the dairy, meat bakery and other industries.

Soya isolates have a minimum 90 per cent protein content and are used in meat, bakery and dairy products. They are made by removing nearly all carbohydrate and fat.

Textured soya proteins are defatted soya flour or concentrates that are textured to resemble meat products.
In 2004, the total market was estimated to be valued at 363.6 million Euros, representing 269,000 MT in volumes.

The European soya protein market has been more affected by the GM issue than any other protein source, as a high percentage of world soya production is made from GM material.

The supply of soya protein is dominated by three companies - ADM, Cargill and Solae.

European Legislation and Labelling Requirements

GM and Non-GM Soya

The European soya protein market has been affected by consumer preference in Europe for non-GM products.

European Legislation on GM Products

The production of GM (genetically modified) food involves altering the genetic structure of plants to modify their characteristics. Genes may be deleted, changed, or created. Plants' resistance to disease, insects or fungi can be improved, leading to increasing yields and a reduction in the use of pesticides. The United States is the largest producer of GM food, and there has been an increase in production in Eastern Europe and other developing countries. In the United States, 70 per cent of soya bean, 50 per cent of rape and 25 per cent of maize is GM.

In Western Europe, the consumer reaction to GM food has been largely negative, with concerns that the new structures could have an impact on human health or could cross-pollinate with wild plants to irreversibly change the natural environment.

Consumer opinion in Europe has led the EU and various national governments to impose severe restrictions on the production and use of GM foods. It has also led most major food producers and supermarkets to implement policies whereby every effort is made to source GM free products wherever possible.

Types of GM Food

GM foods are classified as follows for the purpose of legislation and control:

- Food or ingredients produced directly from GM crops e.g. soya and maize, in which GM can be detected
- Food or ingredients produced from GM crops, which have been highly refined so that no trace of GM can be detected
Foods manufactured using GM ingredients (which are used primarily for processing e.g. usually enzymes), and are not detectable in the final product

- Animal feed made from GM crops - not detected in the meat products

**EU Directives**

Directive 90/219, replaced by 98/81 and 2001/18, harmonised EU laws on GM products. The directives cover field trials, commercial production and marketing of GM crops. They allow restricted use of GM in a controlled environment such as in the laboratory and in field trials, subject to government approval of individual cases.

In 1998, several EU countries imposed an unofficial ban on the approval of new varieties of GM products, until effective traceability and labelling was in place. The EU considered this action illegal, and it led to US complaints to the World Trade Organisation (WTO).

**Labelling of Novel Foods**

The use of GM products is also to some extent influenced by the Novel Foods Regulation (NFR) (258/97). This affects not only GM products, but also products containing new molecules or using new processing methods. Companies wanting to market a Novel Food have to apply to the relevant national government agency for approval. The product has to be:

- Safe
- Presented in a way that is not misleading
- Not nutritionally disadvantageous in comparison to alternative products

**New Labelling Regulations**

In 2001, the EU introduced draft regulations for traceability and labelling of GM foods (11496/01, amending Directive 2001/18) and on the authorisation of GM foods (11576/01). The new regulations came into place on April 18th 2004.

The introduction of the legislation is expected to encourage national governments to stop blocking the licensing of new GM products, and defuse the trade dispute with the USA by allowing the use of some GM products in Europe.

Under the new legislation all products with ingredients (soya or maize) derived from GM crops have to be labelled as GM even if after processing there is no trace of GM in the final product. All products containing more than 0.9 per cent of GM material are expected to be labelled. The 0.9 per cent limit is used because it is often not possible to detect a lower content.
The broad consensus among industry participants is that GM products are safe for humans. The labelling rules are likely to be a concession for general consumer concerns. However, they do not address the concerns about the impact of GM crops in other plants.

**Traceability**

The labelling proposals cover all GM products, whether detectable or not. The exception is GM ingredient used for processing (mainly enzymes), which are exempt. Laboratory tests are no longer sufficient alone and a paper audit covering for each stage of the supply chain is required. The U.S. soya industry and parts of the European processing industry are unhappy with the proposals, seeing them as impractical to enforce. Supporters of the proposals quote acceptance of similar audit trails for meat and organic products.

Most large European food companies and supermarkets specify non-GM material. Brazil is the main source of non-GM material and certification schemes have been set up to enable full traceability of non-GM material. However, Brazil has now permitted the planting of GM material, putting further pressure on sources of non-GM material.

The new EU legislation on labelling of GM products came into effect in April 2004. Most European food companies have reacted by purchasing fully traceable ingredients. As a result, there have been supply shortages and prices have risen in specific ingredient sectors.

Possible scenarios for the forecast period include:

All European food uses fully traceable non-GM material. Prices rise initially, but the supply situation improves with time and prices fall.

Some smaller companies, especially those supplying the foodservice sector, are expected to use material that is not fully traceable and cannot be labelled as non-GM. If this is acceptable to end-users, the use of this material is expected to gradually increase, extending to minor brand owners and own label products in the retail sector. However, most large food companies have committed to a 'GM-free' position and are unlikely to change unless there is a big shift in consumer opinion. The speed at which this develops is expected to depend on consumer reaction.

It is likely that even if there is no shortage of fully traceable non-GM material, some small companies are expected to use material that cannot be labelled as GM-free for cost reasons. There is a fine balance between adverse consumer reactions and product economics which will need to be tested.

By 2011 there are a number of possible scenarios that are possible. Examples include:

The European industry is expected to be entirely non-GM. This is following the industries' prior attempts to use GM material, but due to consumer reaction this has not been successful and the market is effectively non-GM.
GM material has become established in specific markets. Non-GM is used by major brands and companies. A proportion of non-GM is expected to be use for the 'green' market. GM ingredients are expected to be used mainly by low-cost producers.

Developments are expected to depend on consumer reactions and the time at which, if at all, the big companies start to use GM material.

The most likely scenario is that by 2011 non-GM is expected to be restricted to a niche 'green' market. Supply problems and food safety audits in 2005 and 2006 are likely to result in GM products becoming more established in the European soya protein market.

In 2004, revenues have risen, but volumes have fallen, as the European soya protein market has switched to fully traceable products in response to the new EU labelling regulations. In early 2005, there were still supply problems and prices were still high. There are, however, indications that the GM issue may become less of an issue in the short term and the market may recover.

Market Drivers

Figure 12-1 lists the drivers, ranked in order of impact, for the European soya protein market from 2005 to 2011.

**Figure 12-1**

Soya Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increased demand for cheap functional proteins</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Increased demand for meat protein alternatives</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand for dairy alternatives</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Soya health benefits</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Soya protein-GM issues</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Increased Demand for Cheap Functional Proteins**

Food preparations are becoming more complex and the demand for functional ingredients is increasing. Soya proteins have a good price/function ratio. They are a good choice for low-cost food manufacturers and demand is expected to drive growth in this market throughout the forecasts period (2005 - 2011).
I n c r e a s e d D e m a n d f o r M e a t P r o t e i n A l t e r n a t i v e s

There are two major reasons for food manufacturers’ increased substitution of animal proteins with plant proteins. 1) high price 2) consumer attitudes towards animal products. As a result of these factors there is a growing demand for textured soya proteins as a meat alternative. ADM launched the NutriSoy range, a high moisture textured soya based protein (combined with other proteins) into this market.

The trend for substitution of animal proteins with plant proteins is expected to be a key driver in the European soya proteins market throughout the forecast period (2005-2011).

I n c r e a s e d D e m a n d f o r D a i r y A l t e r n a t i v e s

In 2002 and 2003, the demand for soya-based products including drinks, desserts and tofu products increased by over ten per cent in 2002 and 2003 in Europe. Continued strong growth is expected during the forecast period (2005-2011), which is likely to drive the demand for soya proteins.

S o y a H e a l t h B e n e f i t s

Soya proteins contain fibres and important minerals such as calcium, magnesium, phosphorous and potassium. Many health benefits have been linked to the consumption of soy protein e.g. reducing the amount of cholesterol in the body, lowering the occurrence of breast cancer, helping to prevent osteoporosis. The FDA may authorise claims that soya may reduce risk of heart disease - free of cholesterol, low in saturated fats. The importance of health benefits is expected to be boosted, if formal health claims are allowed. These associated health benefits are of particular interest to those end-users active in the functional food and speciality food market. However, some of the soya proteins health benefits remain controversial and this factor is expected to only constitute a medium driver to the growth of the European soya protein market during the forecast period (2005-2011).

S o y P r o t e i n - G M I s s u e s

In the late 1990s, some food companies removed soya ingredients from their product specifications following adverse consumer GM concerns. Often soya proteins were replaced with milk proteins. If the GM concern become less of an issues in future, companies may start to reintroduce soya back into the products - the impact of this driver is likely to occur in the long term.
Market Restraints

Figure 12-2 lists the restraints, in order of impact for the European soy protein market from 2005 to 2011.

**Figure 12-2**
Soya Protein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High raw material cost</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Raw material supply</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Impact of GM Product Issues</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Limited functionality</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Soya allergy issues</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>Labelling and product quality</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>7</td>
<td>Competition from other plant proteins</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

**High Raw Material Cost**

Since April 2004, European based end-users have had to comply with the new labelling requirements for GM products. This has led to a sharp increase in demand for fully traceable non-GM soya, which can be double the price of the standard non-GM product. In 2004, low stock levels have made prices volatile. Price increases has made soya uncompetitive as a protein source compared to other sources such as gluten. The price of fully traceable non-GM soya is expected to remain high for the next two years. Subsequently, future trends are expected to depend on the supply situation and on any change in consumer acceptance of GM products. However, soya protein accounts for only a very small percentage of the total product cost in most cases, and these increases are often absorbed in the supply chain.

**Raw Material Supply**

Brazil has been the main source of non-GM soya. Brazil has now relaxed its restrictions on planting GM material. If this leads to less production of non-GM product, this is expected to lead to further increase in prices of non-GM soya protein in Europe.

**Impact of GM Product Issues**

Soya has always been linked to adverse consumer concerns, and this is likely to be an ongoing restraint on its use. GM concerns may decline later in the forecast period (2005-2011).
LIMITED FUNCTIONALITY

Although highly functional, soya proteins do not have the same versatility as the animal proteins they are supposed to replace. One example is within the dairy industry, where the substitution of milk proteins with a soya equivalent had to be limited after a new lower pH yoghurt was developed, because the lower pH rendered the soya protein unusable. This restraint is not of major importance but it is expected to have an impact on particular application sectors in the European soya proteins market.

SOYA Allergy Issues

Allergies to soya products have been reported, especially in northern Europe. Although this only affects a small percentage of the population, it has resulted in some Scandinavian food producers replacing soya proteins with pulse proteins. Although a minor restraint, it may become more important by the end of the forecast period (2005-2011). The University of Illinois has found a soya seed that does not contain the protein that is thought to cause most allergic reactions but this is expected to take five to ten years to commercialise.

LABELLING AND PRODUCT QUALITY

New product labelling requirements are expected to make consumers more aware of the presence of soya as an ingredient, and its link to GE. This will continue to restrain growth in the market in future.

COMPETITION FROM OTHER PLANT PROTEINS

The research for alternatives to animal proteins has looked into the use of a number of different plant protein sources, in addition to soya. To date, these have had limited impact on the European soya protein market. However it is likely that new vegetable protein sources, such as canola or rice, are likely to be more widely used and are expected to compete in some application sectors with soya. These new developments may restrain growth in the soya protein market in the long term.

MARKET QUANTIFICATION

Market Engineering Research Measurement System

Chart 12.1 illustrates the Market Engineering measurements for the European soya protein market in 2004.
Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>363.6 million euros</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>269,000 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>3.0%</td>
<td>Please fill</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>1.46%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Various</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>1.4 Euros/kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Price range</td>
<td>0.7 Euros - 10 Euros/kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>65%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>20-30</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*

Market Forecasts

Figure 12-3 and Chart 12.2 illustrate volumes and revenue forecasts for the European soya protein market for the period 2001-2011.
The soya protein market was 363.6 million Euros in 2004, representing a volume of 269,000 tonnes.
During the late 1990s, volumes fell and prices increased mainly on account of the GM related issues. During the 2001 to 2004 period, average prices increased slightly and volumes were stable.

In the forecast period, volumes are expected to increase at 1 - 2 per cent per annum. Prices are likely to increase in the early part of the forecast period because of pressure on GM supply, but may decline later in the period.

By 2011, the European soya protein market is forecast to be valued at 402.5 million Euros, which represents 306,400 tonnes.

The compound annual growth rate (CAGR) for the period 2004-2011 is 1.5 per cent.

Product Analysis

Soya proteins come in five different forms:

- flours and grits,
- defatted flour and grits,
- concentrates, isolates
- textured proteins
- isoflavones

**Soya Flour and Grits**

Soya flour and grits are obtained by milling and sieving soya beans. The calibre of the sieve determines the flour or grit denomination. They are supplied as full fat or defatted products, and typically contain 40-50 per cent protein content. Soya flour and grits also contain oligosaccharides, fibres and soya oil. Full fat products contain about 12 per cent oil while defatted products contain only one per cent. In Europe, most products are full fat. They are used mainly in the bakery industry, for products such as biscuits and cakes, and in animal feed applications.

**Soya Protein Concentrates**

Soya protein concentrates are manufactured using a defatted soya bean and the manufacturing process involves alcohol extraction. The protein content of soya protein concentrates is typically around 70 per cent. Concentrates benefit from a number of different functional properties. They are mainly used as protein supplement in meat products and in animal feed applications.
Soya Protein Isolates

Soya protein isolates are obtained by chemical extraction. Soya protein isolates typically contain 90 per cent protein, no fibre and a significant quantity of sodium. They are used in high value applications such as infant nutrition, sports nutrition products and also in meat products.

Textured Soya Proteins

Textured soya proteins are made from soya flour and concentrates, which are mechanically textured into a fibre-like resistant form. They have good water retention properties and good nutritional value. They are used in the meat industry as a substitute for meat in order to decrease production costs. They are also used to give texture and as a protein source in vegetarian dishes.

Isoflavones

Isoflavones are a component of soya beans that offer a health benefits for the heart and circulation. Isoflavones are supplied by ADM, Cargill and others as an integral part of concentrates and isolate portfolio.

Pricing Analysis

The European soya protein market is to some extent a world market with prices influenced by worldwide trends. Several of the largest suppliers have production facilities in other regions as well as in Europe, and are able to supply to Europe, from elsewhere, or to other markets from their European facilities.

In 2000, the BSE crisis and the European ban on meat and bone meal in animal feed increased demand for soya meal with prices increasing 20 per cent. The switch to non-GM soya in Europe also increased prices, although the overall price trend of soya has been stable in since 2002.

In 2004, the new EU regulations have led to an increase in the demand for 'hard' IP non-GM soya protein. This product can be traced back through the complete supply chain to the soya beans and seeds. The production of hard IP product involves additional costs - the cost of the Audit system, the costs involved in keeping the products separate in the distribution and processing stages for example. Due to the supply situation, producers can command a price premium. There is also a price premium associated with further refined products such as soya isolates and concentrates.

In 2004, the prices increased after a poor harvest in the previous year (2003). In early 2005, the average price of soya proteins was 1.4 Euros per kilo with a range from 0.7 - 3.0 Euros
per kilo for some soya isolates. The price of isolates has fallen, which is against the general trend. This has been a result of increased competition with both Cargill and Solbar (Israel) entering European soya protein isolate market and more imports from China (mainly to Eastern Europe).

Prices of soya are considered to be stable over the medium term, but are expected to fluctuate by at least ten per cent in the short term due to the supply situation. The major soya processing companies, such as Cargill and ADM, have long-term supply contracts with soya producers, which are expected to ‘smooth’ out any major short-term price fluctuations. Further minor price increases are likely in 2005. Trends from 2006 - 2011 are expected to depend on the level of acceptance of GM products in the market.

**Price Trends**

The major recent development has been the price premium demanded for ‘hard IP’ soya protein. The new EU food labelling requirements have increased demand for this product, and prices have increased by 20 per cent in 2004. The situation has been exacerbated by Brazilian suppliers starting to produce GM crops. Possible developments are:

- Market Non-GM: The supply situation for fully traceable material is likely to improve and even if the market remains wholly or mainly non-GM, prices are expected to fall for standard hard IP product. While volumes are expected to increase, total revenues are likely to decline between 2006 and 2011.

- Market Mainly GM: If the market switches to mainly GM material, the price of non-GM is expected to fall more sharply because of oversupply. While volumes are slightly higher, total revenues are likely to fall more sharply.

**Usage Analysis**

Figure 12-4 and Chart 12.3 illustrates proportion of soy proteins used in nutritional applications and functional applications in 2004.

**Figure 12-4**

Soya Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>60</td>
</tr>
<tr>
<td>Functional</td>
<td>40</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Nutritional Demand

Soya proteins constitute a cheap source of protein. Soya proteins also have associated health benefits such as cholesterol reduction and alleged cancer reduction capability. With the exception of isolates, they also contain vitamins, minerals and fibres. Nutritional demand represents a high proportion of the total market because it includes many meat applications as well as animal feed, and a large proportion of bakery products. It also includes infant food, vegetarian meat analogues, energy drinks and snacks. The perceived health benefits associated with soya protein drive nutritional usage, and this market is expected to be further boosted, if and when suppliers are allowed to make specific health claims.

Functional Demand

Soya proteins have good functional properties. They are a good fat binder used in meat products. Furthermore, concentrates do not release fat during cooking. They have excellent water retention abilities, a property that is useful in baked food and meat products. Moreover, concentrates, isolates and textured soya proteins have emulsifying and gelification properties, and are used to improve food texture, especially in meat, dairy and fish products.

Competitive Environment

Competitive Structure

Figure 12-5 illustrates the competitive structure for the European soya protein market in 2004.
The European soya protein market is dominated by less than ten companies, and this includes major soya processors and a few large distributors. There are also a number of small distributors and importers supplying to the European soya protein market from sources outside Europe.

The main tiers in the European soya protein market are:

- Companies that process natural raw materials. The European soya protein market is now dominated by three companies: Solae, Cargill and ADM. These companies produce, refine and supply soya protein as part of their soya processing business. The main soya products are meal and oil. European demand for oil is decreasing and exports also fell as production capacity has increased in overseas markets. This has led to a reduction in European production of soya products in the food and animal feed industry. Some processors have been researching new markets for soya, such as the use of soya as a biodiesel ingredient. Competition comes mainly from outside Europe. Distributors are often able to offer a non-GM products from Asian suppliers at a competitive price.

- Companies such as Hamlet and Loders Croklaan are not involved in soya processing, but are active in soya flours and involved in further processing and refining to produce protein grits, concentrates and isolates. Degussa, previously one of the largest suppliers, withdrew from the soya protein at the end of 2004, and closed a large production facility.

- Distributors and traders such as Soya International and Helm, buy and may repackage or reformulate, and distribute the products, typically to end-users specifications. The majority of these companies offer products specific to niche application sectors. There are also specialist food ingredient distributors and formulators, such as Kerry, DSM, Univar and Brenntag, who may have soya proteins as part of their product portfolio. Solbar of Israel is an important supplier of high value soya proteins to Europe.
Food processors who use soya proteins in their final products.

Most tiers of the industry have relatively few participants. There are substantial barriers to entry, including the economies achieved in large scale soya processing. The requirement for full traceability of source material is likely to strengthen the position of soya processing companies who have strong contacts and relationships in place with producers, compared with companies that buy semi-refined material.

The production of soya protein is relatively capital intensive and the industry in Europe has consolidated in recent years. Many of the major suppliers have facilities in Europe and elsewhere, and may supply to Europe from their sites in other regions. Europe has no significant soya bean crops, partly due to the fact of the costs involved in Europe. The supply of soya and other raw materials is from outside Western Europe, giving traders and distributors the opportunity to source materials in South America and Asia for direct supply to European food companies.

While there are a very large number of raw material suppliers, the European demand for 'Hard IP' fully traceable non-GM soya has changed the competitive environment. Soya processors have had to set up new supply arrangements with individual soya or other raw material suppliers. There are still only a small number of such suppliers and the supply situation has been part of the reason for the price premium for 'Hard IP' soya.

The soya protein industry is dominated by a small number of large companies. A problem for suppliers is the lack of product differentiation at the lower cost end of the market, and has driven the trend for product customisation.

Market Share Analysis

Figure 12-6 and Chart 12.4 illustrates the market share represented by each of the major participants active in the European soy protein market in 2004.

Figure 12-6

Soya Protein Market: Market Share Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solae</td>
<td>30</td>
</tr>
<tr>
<td>ADM</td>
<td>20</td>
</tr>
<tr>
<td>Cargill</td>
<td>15</td>
</tr>
<tr>
<td>Others</td>
<td>10</td>
</tr>
<tr>
<td>Imports</td>
<td>25</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
The European soya protein market is dominated by three major producers - Solae Group, ADM and Cargill. These leading participants are soya processing companies with international operations. All the companies have production both in Europe and elsewhere, and trade internationally between their various operations.

Solae Group and Central Cereol is now part of the Solae Group, which is a joint venture set up by DuPont Inc. and Bunge Ltd. Central Cereol was purchased by Bunge from the former French state owned by food company EBF. The company is the largest supplier of soya protein in Europe, specialising only in soya products (unlike its two main competitors, that have a much wider product base). The company is the main supplier of protein isolates in Europe.

Cargill is one of the world’s largest processors of soya and other food commodities. The company processes soya at plants in Belgium and the United Kingdom, as well as Brazil. The company expanded its European business by the purchase of Vamo Mills (Belgium). Cargill has a large share of the European textured protein market and has increased its activity in the European isolates protein market, using a new membrane production technology to gives a less denatured product. The company is the only European supplier of defatted soya flour.

Archer Daniels Midland (ADM) is a major worldwide processor of agricultural commodities, and a major soya supplier in Europe, the United States and in other regions. ADM has recently introduced the Nutrisoy range of products for the meat alternative market with improved texture and taste. The company is also a major supplier of specialist soya protein concentrates for animal feed applications.

Other recent suppliers include Degussa, which is a major world supplier of speciality chemicals to a wide range of industries, including the food industry. In 1999, Degussa acquired the Lucas Meyer Group that is a major soya processor. The company withdraw from the European soya protein market at the end of 2004.
Loders Croklaan, based in the Netherlands, was formerly part of Unilever. The company buys in processed soya and refines it for high-value applications. Lasenor (Norte), based in Spain, has a similar operation and mainly supplies to the Spanish market. Hamlet, based in Denmark, supplies soya flour protein for specialist animal feed applications, using a patented production process. Soya flour protein has replaced concentrates for some applications in this market. Acatris, of Belgium, supplies isolates and isoflavones.

Soya protein is also supplied to the European market by a number of importers and distributors, such as Soya International and Helm International, some of whom refined products before re-selling. These small operations account for a significant proportion of the European market and have increased their market share since 2000, partly due to their ability to source non-GM material.

Since 2001 there have been substantial imports of protein isolates from China, which are typically sold at low prices and have lead to claims of 'dumping' in the European market.

**Forecasts for Soya Grits and Flour Protein Market**

**Market Overview and Definitions**

Soya beans contain 36 per cent of proteins and 18 per cent oil. Soya flour and grits are the least processed and least expensive of the soya proteins. They typically contain around 50 per cent protein and also contain fibre and glucides. Soya flour and grits include both defatted and full fat products. This category excludes soya meal, of which over 10 million tonnes per annum is used for animal feed in Europe.

Soya flour and grits are primarily used in the bakery industry as a protein source or as a water retention agent, and in pet food where they are used primarily for their nutritional value.

In 2004, the soya flour and grits market was valued at 68.6 million Euros representing 95,000 tonnes. 70 per cent of this amount was accounted for by full fat products. The market is highly concentrated - ADM, Cargill, Solae are the main suppliers, and Cargill is the only supplier of defatted products. Degussa withdrew from the full fat market in 2004.

**Market Engineering Measurements**

Chart 12.5 illustrates the Market Engineering measurements for the soya protein and grit market for 2004.
Soya Protein and Grit Market: Market Engineering Measurements (Europe), 2004

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>68.6 million euros</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>95,000 Tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>5.2%</td>
<td>Stable</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>0.59%</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>0.7 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Price range</td>
<td>Euros 0.5 - Euros 0.85 Euros/kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>Over 60%</td>
<td></td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>10-20</td>
<td></td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*

Market Drivers

Figure 12-7 lists the drivers, ranked in order of impact, for the European soya protein and grit market from 2005 to 2011.
Cheap Source of Protein

Soya flour and grits are the cheapest source of protein ingredients available after wheat gluten. They contain essential amino acids, vitamins and minerals as well as, in some cases, soya oil. Demand from the pet food and low cost meat segments is expected to drive growth in the market throughout the forecast period.

Cheap Functional Protein Source

Soya flour and grits have water retention and fat binding properties. Although functionality is limited, they are well suited for use in the bakery industry. The flour and grits are incorporated into the flour. The demand from the bakery market is likely to be maintained throughout the forecast period (2005-2011).

Source of Fibre

Soya flour and grits are a good source of fibre. The rise in demand for fibre sources, especially by the functional food, cereals and energy snack manufacturers is expected to sustain the growth of soya flour and grits market. It should be noted that there is competition from soya protein concentrates in this application sector.

Improved Functionality

Full fat flours have taken some market share from soya concentrates as a result of development work that has resulted in improved functionality. Hamlet supplies products to this market.
Market Restraints

Figure 12-8 lists the restraints, ranked in order of impact, for the European soya protein and grit market from 2005 to 2011.

Figure 12-8
Soya Protein and Grits Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Noticeable smell and taste</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Low functionality</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Variable quality</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Noticeable Smell and Taste

The main restraint for food manufacturers using soya flour and grits, even though GM free, there is a noticeable smell and the taste of beans associated with the product. The bakery and animal feed sectors are the two markets where the taste and smell can be ignored or is not considered to be an issue. Other market segments are reluctant to use soya flour and grits due the noticeable smell and taste associated with such products. The situation has been and is expected to remain the major restraint to the use of soya flour and grits throughout the 2005-2011 forecast period.

Low Functionality

Soya flour and grits have no gelification nor emulsion properties and their water retention capacity is only twice their weight. Soya protein concentrates can retain seven times their weight, have gelification and emulsion capacities and are only slightly more expensive. Soya protein concentrates still remain the key ingredient of choice for food manufacturers. The lack of functionality of soya flour and grits is expected to constitute a restraint to further growth.

Variable Quality

Soya flour and grits are basic products, which come directly from grinding soya beans. In some cases they may be defatted. Quality is often dependent on the quality of the soya beans used, and soya flour and grit manufacturers cannot guarantee the protein level of their product from one batch to another. Food manufacturers often prefer to use a protein source whose composition is reliable and guaranteed. These variations in quality are expected to remain as a restraint to the use of soya flour and grits in specific applications.
Market Forecasts

Figure 12-9 and Chart 12.6 illustrate the volume and revenue forecasts for the European soya grits and flour proteins market from 2001-2011

**Figure 12-9**

Soya Grits and Flour Proteins Market: Volumes and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>64.6</td>
<td>---</td>
<td>95.0</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>65.5</td>
<td>1.4</td>
<td>95.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2003</td>
<td>65.2</td>
<td>(0.5)</td>
<td>95.9</td>
<td>0.9</td>
</tr>
<tr>
<td>2004</td>
<td>68.6</td>
<td>5.2</td>
<td>95.0</td>
<td>(0.9)</td>
</tr>
<tr>
<td>2005</td>
<td>68.1</td>
<td>(0.7)</td>
<td>95.9</td>
<td>0.9</td>
</tr>
<tr>
<td>2006</td>
<td>68.8</td>
<td>1.0</td>
<td>96.9</td>
<td>1.0</td>
</tr>
<tr>
<td>2007</td>
<td>70.1</td>
<td>1.9</td>
<td>98.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2008</td>
<td>69.9</td>
<td>(0.3)</td>
<td>99.8</td>
<td>1.0</td>
</tr>
<tr>
<td>2009</td>
<td>70.6</td>
<td>1.0</td>
<td>100.8</td>
<td>1.0</td>
</tr>
<tr>
<td>2010</td>
<td>70.9</td>
<td>0.4</td>
<td>102.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2011</td>
<td>71.5</td>
<td>0.8</td>
<td>105.0</td>
<td>2.1</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 12.6**

Soya Grits and Flour Proteins Market: Volumes and Revenue Forecasts (Europe) 2001-2011

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
The soya flour and grits market was valued at 64.6 million Euros in 2001 representing a volume of 95,000 tonnes.

The GM issue, lack of growth in the main markets and competition from other protein sources has added to the complexity of this market. Average prices have been higher due to the increase in soya prices generally. Market volumes have declined slightly.

The soya flour and grits market was valued at 68.6 million Euros in 2004 with a representing a volume of 95,000 tonnes.

Prices are expected to remain high in 2005-2006, with a possible fall in 2007, if the non-GM supply problems are resolved. Market volumes are expected to increase at 1-2 per cent per annum.

The compound annual growth rate (CAGR) in revenues for the period 2004 to 2011 is 0.6 per cent.

Usage Analysis

Figure 12-10 and Chart 12.7 illustrates proportion soya protein and grits used in nutritional applications and functional applications in 2004.

**Figure 12-10**

Soya Grits and Flour Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Applications</th>
<th>Market Share–by revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>90</td>
</tr>
<tr>
<td>Functional</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 12.7**

Soya Grits and Flour Protein Market: Usage Analysis (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Nutritional Demand

Soya proteins constitute a cheap source of protein. They are also rich in vitamins, minerals and fibres. Nutritional applications represent most of the soya flour and grits market, with the majority of the demand coming from animal feed, pet food and bakery sectors.

Functional Demand

Soya flour and grits do not have very good functionality. They retain a small amount of water and fat, but release them during heating. The functional demand for soya flour and grits is relatively minor and comes from pharmaceutical, low-cost meat, chocolate, and bakery industry.

End-user Analysis

Figure 12.11 and Chart 12.8 illustrates the end-user analysis for soya protein by application in 2004.

Figure 12.11
Soya Grits and Flour Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)–by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakery</td>
<td>60</td>
<td>Stable</td>
</tr>
<tr>
<td>Animal feed and pet food</td>
<td>20</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 12.8
Soya Grits and Flour Protein Market: End-user Analysis (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Bakery

Bakery is the largest market segment for soya flours and grits, which are used as a source of protein as well as for their water and oil retention properties. Soya proteins are used widely in the industry, especially in biscuits and snacks. The demand for soya proteins from the bakery industry is stable, with little increase expected during the forecast period.

Animal Feed and Pet Food

Soya proteins are primarily used as they are one of the lowest priced protein sources. The new GM labelling requirements are not expected to have an adverse affect on the animal feed market, because although GM animal feed has to be labelled, the products derived from animals that have used the feed do not have to be labelled as such.

Forecasts of the Soya Protein Concentrates Market

Market Overview and Definitions

Soya protein concentrates were developed in the 1960s as an improvement to the relatively poor flavour of soya flours. Soya grits are the main raw material for manufacturing traditional soya concentrates, which typically contain around 70 per cent protein and are used mainly for animal feed. Functional protein concentrates have also been developed. They have low flavour, are high in protein and fibre and low in sodium. Furthermore, they have good emulsifying, water retention and fat binding and gelification properties.

Functional soya protein concentrates are primarily used in the meat industry, but also in dairy products, fish products, cereals, energy snacks, beverages, sauces and meat substitutes.

In 2004, the soya concentrates market was worth 88.4 million Euros.

The market is dominated by Solae, Cargill and ADM, but with a high level of imports. Notably, the Israeli company Solbar is a large supplier.

Market Engineering Measurement

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>88.4 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>68,000 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>5.0%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2005-2011)</td>
<td>0.96%</td>
<td>n/a</td>
</tr>
<tr>
<td>Average price</td>
<td>1.3 Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Price range</td>
<td>Euros/kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>50%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>20-30</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Drivers

Figure 12-12 lists the drivers, ranked in order of impact for the European soya protein concentrates market from 2005 to 2011.
Product Development and Improved Functionality

Suppliers, in collaboration with the food industry, have developed concentrates with specific properties to target niche and new markets. These applications utilise the various properties of soya concentrates. The gelification properties of soy protein concentrates are used in the meat and in the dairy industries. The emulsification properties are used in confectionery and the meat industry. A high capacity to retain water (up to seven times their weight) makes them an ideal protein source to use in ready meals, TV snacks and delicatessen. They also have the ability to bind fat in meat preparations. The demand for cost effective functional proteins is expected to be a continued driver in this market throughout the forecast period (2005-2011).

Good Nutritional Value

Soya protein concentrate contains essential amino acids, vitamin, fibres and their taste and odour are neutral. They constitute an inexpensive source of protein for meat substitutes, energy snacks and beverage and dietary supplements. The excellent nutritional properties of soy protein concentrates is expected to drive the growth in the market throughout the forecast period.

Growing Market in Eastern Europe

Eastern Europe is an important market for soya concentrates in the meat industry. This region is expected to remain as a strong market for soya concentrates throughout the forecast period.
MARKET POTENTIAL

Soya protein concentrates are used in some functional foods and in various sports products, where they sometimes replace isolates as they are cheaper. There are many health benefits associated with soya protein, such as reduction in cholesterol level and prevention of the formation of hormonal cancers. If the European Union eventually allows such claims to be made on food products, the market is expected to grow significantly. This may become a major driver for growth in the soya concentrate market in future.

COST

While the price of soya proteins have increased due to the GM issue, soya products are still considered a cost effective protein solution in many application sectors. The GM issue is expected to develop in such a way that soya prices are likely to fall with time which will drive further growth in the market.

Market Restraints

Figure 12-13 lists the restraints ranked in order of impact for the European soya protein concentrates market, from 2005 to 2011.

FIGURE 12-13

Soya Protein Concentrates Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soya products and GM issue</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Increased competition</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

SOYA PRODUCTS AND GM ISSUE

The image of soya products was seriously affected by GM issues, which has inhibited growth of the European soya protein concentrates market. Prices of soya proteins have increased because of the cost of non-GM material. Shortage of non-GM soya may accentuate this problem in 2005-2006, although in the following years the situation may improve as the supply situation adjusts and consumers attitude to GM products change.
Increased Competition

While continuous product development has found new applications for soya concentrates, business has also been lost in the animal feed market to wheat proteins and to other substitutes, such as defatted grits. In the food market, some market share has been lost to milk proteins. Although soya has also gained back some market share as a result of the BSE crisis, it is likely that the market will become increasingly more competitive amongst the various protein sources.

Market Forecasts

Figure 12-14 and Chart 12.10 illustrate the volume and revenue forecasts for the European soya concentrates market for the period 2001-2011.

Figure 12-14
Soya Protein Concentrates Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volume (Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>85.3</td>
<td>---</td>
<td>65,100</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>85.4</td>
<td>0.1</td>
<td>66,200</td>
<td>1.7</td>
</tr>
<tr>
<td>2003</td>
<td>84.2</td>
<td>-1.4</td>
<td>66,800</td>
<td>0.9</td>
</tr>
<tr>
<td>2004</td>
<td>88.4</td>
<td>5.0</td>
<td>68,000</td>
<td>1.8</td>
</tr>
<tr>
<td>2005</td>
<td>93.4</td>
<td>5.7</td>
<td>69,200</td>
<td>1.8</td>
</tr>
<tr>
<td>2006</td>
<td>92.8</td>
<td>-0.6</td>
<td>70,300</td>
<td>1.6</td>
</tr>
<tr>
<td>2007</td>
<td>92.9</td>
<td>0.1</td>
<td>70,900</td>
<td>0.9</td>
</tr>
<tr>
<td>2008</td>
<td>92.4</td>
<td>-0.5</td>
<td>72,200</td>
<td>1.8</td>
</tr>
<tr>
<td>2009</td>
<td>92.5</td>
<td>0.1</td>
<td>73,400</td>
<td>1.7</td>
</tr>
<tr>
<td>2010</td>
<td>93.4</td>
<td>1.0</td>
<td>74,700</td>
<td>1.8</td>
</tr>
<tr>
<td>2011</td>
<td>94.5</td>
<td>1.2</td>
<td>75,400</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
The soya proteins concentrates market was 88.4 million Euros in 2004 representing a volume of 68,000 tonnes.

Market volumes grew slightly in the period 2001-2004, as better functional products were developed and new applications in entered. However, volumes accounted for by animal feed applications declined in the light of intense price competition and there was some loss of market share to special soya flour products. Throughout the forecast period 2005-2011, volumes are expected to increase, as they are driven by demand from the meat industry from Eastern Europe, and by specific functional applications in other food markets. Prices are likely to fall slightly in the later part of the forecast period, as non-GM soya supply problems ease. There is expected to be little growth in total revenues.

By 2011, the European soya proteins concentrates market is estimated to be valued at 94.5 million Euros, which represents 75,400 tonnes.

The compound annual growth rate (CAGR) in revenues for the period 2004 to 2011 is expected to be 1.0 per cent.

Pricing Analysis

In early 2005, the average price of soya protein concentrates was 1.3 Euros per kilo. Prices range from under 1 Euro per kilo, for most animal feed applications, to 2.5 Euros per kilo.
Prices increased in 2004, due to higher soya prices, caused by the poor harvest in the 2003 and by the impact of the new EU regulations. One of the most recent developments has been the price premium commanded for ‘hard IP’ soya products. The new EU food labelling requirements have increased demand for this product and hence prices increased by 20 percent in 2004. This price was exacerbated by Brazilian suppliers starting to produce GM crops - they have been traditionally a major supplier of non-GM soya.

In 2004, the soya harvest was good and new production capacity for soya protein concentrates was opened in Israel. These factors are expected to reduce prices, reducing price pressure from the continuing shortage of non-GM material. Trends from 2006 to 2010 are expected to depend on the level of acceptance of GM products in the market and on the supply situation for non-GM soya.

Usage Analysis

Figure 12-15 and Chart 12.11 illustrates the proportion of soy protein concentrates used in nutritional applications and functional applications in 2004.

F i g u r e 1 2 - 1 5
Soya Concentrates Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>30</td>
</tr>
<tr>
<td>Functional</td>
<td>70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

C h a r t 1 2 . 1 1
Soya Concentrates Market: Usage Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Nutritional Demand

Soya protein concentrates constitute a cheap source of protein. They are also rich in vitamins, minerals and fibres. The demand is from various sectors of the meat industry such as burger and pizza topping manufacturers, and from various applications in the energy, sport and diet supplement, and infant nutrition markets. There is also a significant demand from the animal feed industry.

Functional Demand

Soya protein concentrates have excellent functional properties. They retain water up to seven times their weight and bind fat. Furthermore, they do not release the water or fat during the heating process. These qualities are useful for ready meal, delicatessen and fish product manufacturers. Soya protein concentrates also act as emulsifying and gelating agents, and are used in the dairy and confectionery industries. The functional properties of soya protein concentrates benefit from development work, and most of the market growth is likely to come from an increase in demand for functional proteins.

End-user Analysis

Figure 12-16 and Chart 12.12 illustrates the end-user analysis for soya protein concentrate by application in 2004.

Figure 12-16

Soya Concentrates Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)–by Value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat industry</td>
<td>45</td>
<td>Increasing</td>
</tr>
<tr>
<td>Animal feed and pet food</td>
<td>40</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Other food</td>
<td>15</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
### Meat Industry

The meat industry is the largest user of soya protein concentrates. It uses soya proteins as a fat and water binder and a texturing agent in delicatessen, burgers, kebabs and other meat preparations, but also to a lesser extent to increase the protein content. Soya proteins have enabled the meat industry to reduce production costs while still maintaining the texture of its preparations. The development of meat products suitable for use in microwave ovens has increased the demand for soya proteins, especially concentrates, because unlike other functional proteins, they do not release water and fat during the microwave heating process.

### Animal Feed and Pet Food

This market mainly uses soya flour and grits as a source of protein, although there is some use of concentrates and even isolates in special preparations. The use of soya concentrates has declined slightly due to price competition from wheat and other vegetable proteins.

### Other Foods

Other applications include fish products, confectionery, infant food, energy snacks/drinks, dairy, sports/diet supplements, cereals, vegetarian meals and pharmaceuticals. Many of these markets are supplied by blenders and soya proteins are integrated with other ingredients.
Forecasts of the Soy Protein Isolates Market

Market Overview and Definitions

Soya protein isolates are manufactured by chemical isolation - they have a high percentage of soluble protein and a very low flavour profile. The protein content is 90 per cent minimum. Protein isolates are manufactured for specific functional purposes, such as whipping, aerating, gelling, foaming, emulsification, thickening and binding.

They are tasteless and can be used in a wide variety of application areas. Soya protein isolates are used mainly in the meat industry as a meat extender and also in high value products, such as infant food, milk replacements, and sports / energy products.

In 2004, the European soya protein isolates market was estimated at 75.6 million Euros. The market is concentrated and dominated by the leading soya processor, Solae. Imports are also significant, including cheap imports from China. The main product blenders such as Kerry also use these products.

Market Engineering Measurements

Market Engineering Drives Market Strategy and Planning

### Market Engineering Drives Market Strategy and Planning

#### Measurement Name | Measurement | Trend
--- | --- | ---
Revenues | 75.6 million euros | Increasing
Market size (Tonnes) | 28,000 tonnes | Increasing
Base year market growth rate | (4.9%) | N/A
Compound annual growth rate (2004-2011) | 1.08% | Decreasing
Average price | 2.7 Euros/kg | Decreasing
Price range | 2-3.5 Euros/kg | Decreasing
Market concentration (per cent of base year market controlled by top three competitors) | 60% | Decreasing
Competitors (active market competitors in base year) | 10-20 | Increasing

*Note: All figures are rounded. Source: Frost & Sullivan*

### Market Drivers

Figure 12-17 lists the drivers, ranked in order of impact, for the European soya protein isolates market from 2005 to 2011.
Soya protein isolates have excellent functionality. Often their functional properties are designed for specific applications. Functional properties include whipping, aerating, gelification, foaming, emulsification, thickening and binding. The trend towards increased functionality should drive the growth of the European soya protein isolates market in the forecast period.

Nutritional and Organoleptic Qualities

Soya protein isolates benefit from the same properties as other soya proteins. However, they are devoid of fibre. Their nutritional usage is mainly in the preparation of baby and infant food and milk replacements. They are also used in some sport and dietary supplements, although their high price limits usage.

Soya protein isolates have the best organoleptic properties among soya proteins, as they are neutral in both taste and odour. This quality, allied with soya protein's ability to retain flavour, give them a competitive advantage in segments such as sauces and confectionery. Their use in these markets is considered to be a key driver for further growth throughout the forecast period (2005 to 2011).

Increased Competition

The European soya proteins isolates market has been dominated by Protein Technologies International (Solae). Cargill and Solbar (Israel) have now entered the market. Since 2001, imports from China have increased. These products have been slightly lower in quality than European isolates, but have been available at very competitive prices. The increased competition has already led to price reductions and this is likely to drive further growth in the market, especially in the earlier part of the forecast period.
**Improved Perception of Soya**

Soya has suffered from its association with GE. However, there is strong demand in the market for soya milk and other soya products. This is expected to improve the perception of soya, and may lead some food companies to consider reinstating soya in their product formulations.

**Market Restraints**

Figure 12-18 lists the restraints, ranked in order of impact, for the European soya protein isolates market from 2005 to 2011.

**Figure 12-18**

Soya Protein Isolates Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price quality ratio</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Functionality deteriorates under harsh conditions</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>High sodium content</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Price-quality Ratio**

Soya protein isolates are the most expensive of the soya proteins. They compete against functional soya protein concentrates, which often have the similar functionality but cost less. They do not benefit from a strong price / efficiency ratio, which is a key consideration for most food manufacturers. This situation is likely to be the major restraint for the European soya protein isolates market throughout the forecast period.

**Functionality Deteriorates Under Harsh Conditions**

Soya protein isolates release fat and water under heat, and the gel they form hardens after reheating. These functional limitations exclude soya protein isolates from use in ready meals and similar food preparations. This factor will restrain growth of the European soya protein isolate market throughout the forecast period (2005-2011).
High Sodium Content

The high sodium content of soya protein isolates in specific applications sectors such as delicatessen and some fish preparations. This situation constitutes a minor restraint to growth, but is expected to increase in importance during the forecast period.

Market Forecasts

Figure 12-19 and Chart 12.14 illustrates the volume and revenue forecasts for the European soya protein isolate market for the period 2001-2011.

Figure 12-19

Soya Protein Isolates Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>78.9</td>
<td>---</td>
<td>27.7</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>78.9</td>
<td>0.0</td>
<td>27.7</td>
<td>0.0</td>
</tr>
<tr>
<td>2003</td>
<td>79.5</td>
<td>0.8</td>
<td>27.4</td>
<td>(1.1)</td>
</tr>
<tr>
<td>2004</td>
<td>75.6</td>
<td>(4.9)</td>
<td>28</td>
<td>2.2</td>
</tr>
<tr>
<td>2005</td>
<td>75.8</td>
<td>0.3</td>
<td>28.6</td>
<td>2.1</td>
</tr>
<tr>
<td>2006</td>
<td>78.6</td>
<td>3.7</td>
<td>29.1</td>
<td>1.7</td>
</tr>
<tr>
<td>2007</td>
<td>81</td>
<td>3.1</td>
<td>30</td>
<td>3.1</td>
</tr>
<tr>
<td>2008</td>
<td>81.1</td>
<td>0.1</td>
<td>30.6</td>
<td>2.0</td>
</tr>
<tr>
<td>2009</td>
<td>81.9</td>
<td>1.0</td>
<td>31.5</td>
<td>2.9</td>
</tr>
<tr>
<td>2010</td>
<td>80.2</td>
<td>(2.1)</td>
<td>32.1</td>
<td>1.9</td>
</tr>
<tr>
<td>2011</td>
<td>81.5</td>
<td>1.6</td>
<td>33</td>
<td>2.8</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Since 2001, sales volumes have been stable. Isolates have lost market share to soya concentrates with improved functionality, although cheap Chinese imports have gained some business back from concentrates. The continued high price of non-GM soya has hindered growth in particular application sectors especially in the meat industry.

The European soya protein isolate market was valued at 75.6 million Euros in 2004, representing a volume of 28,000 tonnes.

In 2005 and 2006, the shortage of non-GM soya supplies is expected to put further upward pressure on prices, but this is likely to be balanced by low cost Chinese imports. Solae has announced a price increase for 2005.

By 2011, the European soya protein isolate market is forecasted to be valued at 81.5 million Euros, which represents 33,000 tonnes.

The compound annual growth rate (CAGR) in revenues for the period 2004 to 2011 is 1.1 per cent.

Pricing Analysis

In early 2005, the average price of soya protein isolates was 2.7 Euros per kilo. Prices ranged from 3.5 Euros for products used in high value meal replacement products and energy products to around 2 Euros per kilo for products used in animal feed.
Prices for isolates used in the high value energy and nutraceutical markets increased from 2000 to 2003 and average prices were over 3.50 Euros per kilo. Prices in the meat industry, and for other food markets - meat, soups and sauces among others, are generally 10-20 per cent lower. Increased competition, including Chinese imports, has reduced prices. GM products, used in animal feed applications, are 10-20 per cent lower in price than non-GM products.

Increased competition in the market, including Chinese imports (many to Eastern Europe), has reduced prices. Competitive pressure is likely to continue, but there is expected to be continued pressure from the continuing shortage of GM material. Further increases are likely in 2005. Trends from 2006 to 2011 are expected to depend on the level of acceptance of GM products in the market.

Usage Analysis

Figure 12-20 and Chart 12.15 illustrates proportion of Soy protein isolates used in nutritional applications and functional applications in 2004.

**Figure 12-20**

Soya Protein Isolates Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%) - by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>25</td>
</tr>
<tr>
<td>Functional</td>
<td>75</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 12.15**

Soya Protein Isolates Market: Usage Analysis (Europe), 2004

![Soya Protein Isolates Market: Usage Analysis (Europe), 2004](chart)

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Nutritional Demand

The nutritional demand for soya protein isolates is in milk replacement, baby and infant food and, to a lesser extent, in speciality foods. Soya protein isolates are a good concentrated source of essential amino acid with a neutral taste, but have little mineral or vitamin content and no fibre.

Functional Demand

The functional demand for soya protein isolates comes mainly from the meat industry, but also from dairy products, where they are used for whipping, aerating, gelling, foaming, emulsification, thickening and binding. They compete with animal proteins and soya concentrates and high prices are likely to restrain growth in this market.

End-user Analysis

Figure 12.21 and Chart 12.16 illustrates the end-user value analysis for soya protein by application in 2004.

Figure 12.21

Soya Protein Isolates Market: End-user Analysis in Volumes (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)—by Value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat industry</td>
<td>55</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Functional foods and sports products</td>
<td>15</td>
<td>Increasing</td>
</tr>
<tr>
<td>Animal feed</td>
<td>10</td>
<td>Stable</td>
</tr>
<tr>
<td>Other foods</td>
<td>20</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 12.16

Soya Protein Isolates Market: End-user Analysis in Volumes (Europe), 2004

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Meat Industry

The meat industry is the largest market for soya protein isolates, where they are used for both nutritional and functional reasons. Most applications are quite price sensitive and some business has been lost to soya concentrates.

Nutraceuticals and Energy Products

Soya protein isolates are used in high value specialist foods. A restraint in this market is consumer preference for other ingredients, in particular milk protein. New labelling requirements may accentuate this problem for soya.

Animal Feed

This market uses mainly soya flour and grits as a source of protein, although there is some use of isolates in special preparations. The isolates used are generally lower in price than those used in human food application sectors. Soya proteins are used for their price efficiency in providing protein sources.

Other Foods

Other uses include a wide range of food including fish products, confectionery, sauces, soups and vegetarian meals. Price is important in most of these markets and the use of soya isolates is restrained by high price.

Forecasts of the Textured Soy Proteins Market

Market Overview and Definitions

Textured soya proteins are defined as soya-based proteins that have been textured to resemble meat products. They are made from both soya flour and concentrates. In contrast to soya protein concentrates, they have fewer unwanted flavours as they are free from carbohydrates.

They are used mainly in two applications:

- as meat extenders to increase cooking yield and help in the emulsifying and binding of meat products
- as meat analogues and a protein source in vegetarian dishes
Market Engineering Measurements


**Chart 12.17**

Textured Soya Proteins Market: Market Engineering Measurements (Europe) 2004

---

**Market Engineering Drives Market Strategy and Planning**

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>131.0 million euros</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>78,000 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>5.6%</td>
<td>Stable</td>
</tr>
<tr>
<td>Compound annual growth rate (2004 - 2011)</td>
<td>2.43%</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>1.7 Euros / kg</td>
<td>Stable</td>
</tr>
<tr>
<td>Price range</td>
<td>1.3 euros - 2.5 euros / kg</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>60%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>10-20</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*

---

**Market Drivers**

Figure 12-22 lists the drivers, ranked in order of impact for the European textured soya proteins market from 2005 to 2011.
Unique Texturing Abilities

The main advantage of textured soya proteins is the wide range of shapes and textures available in the market, which allows their easy inclusion into meat and fish products. Textured soya proteins also come in other shapes so that they can be integrated in other products, such as snack bars and muesli, yielding possible applications in other markets.

Growth of Fast Food and Vegetarian Markets

The main use of textured soya proteins is in meat products for the fast food market. The proteins are integrated into burgers and other products, allowing them to reduce production cost without losing the fibre texture typically associated with the products. The continued growth of the fast food market is expected to drive the European textured soya protein market throughout the forecast period. However, trends within the market may reflect concerns about healthy eating and product quality, and reduce the size of particular segments of the fast food market in the long term. The other main use is in vegetarian products, which is a growing market in Europe.

Lack of Competition

Competition for textured soya protein market is minor. Other fibrous proteins, such as pea proteins, are also used as meat extenders and as a vegetarian dish textural, but are higher priced.

Demand from Eastern Europe

The new EU members are demanding low-cost meat products. This is expected to be a driver in this market throughout the forecast period.
Market Restraints

Figure 12-23 lists the restraints, ranked in order of impact, for the European textured soya proteins market, from 2005 to 2011.

Figure 12-23

Textured Soya Protein Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM and Labelling issues</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Cost pressures</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

GM and Labelling Issues

An important market for textured soya protein is the manufacture of meat substitutes and vegetarian dishes. This market is very sensitive to consumer GM concerns. The consumer association of soya with GM is a disincentive for vegetarian dish manufacturers, who are actively researching the use of alternatives such as mycoproteins. New labelling requirements may accentuate this problem. This is likely to be a restraint to the growth of the European textured soya proteins market throughout the forecast period (2005-2011).

Cost Pressures

Textured soya proteins are used mainly in low quality meat product applications. This market is very price sensitive and prices have been under pressure by shortages of non-GM material. This is expected to be a restraint on the growth of the market, especially in the early stages of the forecast period.

Market Forecasts

Figure 12-24 and Chart 12.18 illustrate the volumes and revenue forecasts for the European textured soya protein market for the period 2001-2011.
Figure 12-24
Textured Soya Protein Market: Volume and Revenues Forecasts (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>119.0</td>
<td>---</td>
<td>71.9</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>123.0</td>
<td>3.4</td>
<td>74.1</td>
<td>3.1</td>
</tr>
<tr>
<td>2003</td>
<td>124.0</td>
<td>0.8</td>
<td>75.7</td>
<td>2.2</td>
</tr>
<tr>
<td>2004</td>
<td>131.0</td>
<td>5.6</td>
<td>78</td>
<td>3.0</td>
</tr>
<tr>
<td>2005</td>
<td>136.0</td>
<td>3.8</td>
<td>80.3</td>
<td>2.9</td>
</tr>
<tr>
<td>2006</td>
<td>142.0</td>
<td>4.4</td>
<td>81.9</td>
<td>2.0</td>
</tr>
<tr>
<td>2007</td>
<td>143.0</td>
<td>0.7</td>
<td>83.6</td>
<td>2.1</td>
</tr>
<tr>
<td>2008</td>
<td>145.0</td>
<td>1.4</td>
<td>86.1</td>
<td>3.0</td>
</tr>
<tr>
<td>2009</td>
<td>147.0</td>
<td>1.4</td>
<td>87.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2010</td>
<td>150.0</td>
<td>2.0</td>
<td>89.6</td>
<td>2.1</td>
</tr>
<tr>
<td>2011</td>
<td>155.0</td>
<td>3.3</td>
<td>93</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 12.18
Textured Soya Protein Market: Volume and Revenues Forecasts (Europe), 2005 - 2011

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Volumes fell in the late 1990s due to GM concerns and there was an increased demand for non-GM material. The market has since recovered, driven by the growth in Eastern Europe and demand from vegetarian applications.

Prices range from 1.30 Euros per kilo to 2.50 Euros per kilo and have risen slightly over the past four years.

The European textured soya protein market was 131.0 million Euros in 2004, representing a volume of 78,000 tonnes.

Volumes are forecast to grow and demand from Eastern Europe should balance the volumes lost to alternative protein products in some Western European markets.

By 2011, the European textured soya protein market is forecasted to be valued at 155.0 million Euros, which represents 93,000 tonnes.

The compound annual growth rate (CAGR) in revenues for the period 2004 to 2011 is 2.4 per cent.

Usage Analysis

Figure 12-25 and Chart 12.19 illustrates the proportion of Soy protein isolates used in nutritional applications and functional applications in 2004.

**Figure 12-25**

Textured Soya Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)—by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>0</td>
</tr>
<tr>
<td>Functional</td>
<td>100</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Textured soya protein has functional uses in virtually all applications - the texture being the main functional benefit. It is also used as a meat and fish extender.

End-user Analysis

Figure 12-26 and Chart 12.20 illustrates the end-user value analysis for textured soy protein by application in 2004.

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)–by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat products</td>
<td>75</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Vegetarian products</td>
<td>20</td>
<td>Increasing</td>
</tr>
<tr>
<td>Other foods</td>
<td>5</td>
<td>Stable</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
**Meat Products**

Textured soya proteins are widely used as meat extenders for low-value meat products and for their functional binding properties in burgers.

**Vegetarian Products**

This market uses textured soya proteins as a meat alternatives. While the European market for vegetarian products is growing, soya products suffered from concerns surrounding GM, and hence manufacturers have since looked at using other plant proteins and single cell proteins as alternatives.

**Other Food**

Textured soya protein has found a few niche applications in other food products such as cereal bars.
Strategic Analysis of the European Gluten Market

Introduction to the Wheat Gluten Market

Market Overview and Definitions

Gluten is the term used to describe the mixture of proteins found in the seeds of cereal crops. Gluten is essentially produced from wheat and corn, but other crops such as barley or rice gluten are also used as a source. Wheat gluten also exists in a concentrated version called vital wheat gluten.

Gluten is a sticky, paste-like substance, of which approximately 40 per cent is protein. Vital wheat gluten contains approximately 75 per cent protein. Gluten is extracted by a wet milling process, which fully separates the starch and gluten. It is then dried and powdered.

Wheat and corn gluten are used for different applications. The primary use of wheat gluten is in bakery products, and for corn gluten it is in animal feed.

In 2004, the total market was valued at 283.8 million Euros.

- Wheat gluten: 194,000 tonnes, 153.6 million Euros
- Corn gluten: 290,000 tonnes, 130.2 million Euros

Both markets are mature, influenced by raw material supply and rely heavily on their key end-user markets. The demand for wheat gluten is affected by the quality of the wheat crop.

The supply of gluten in Europe is dominated by three companies: Amylum, Cerestar, and Roquette.
Market Drivers

Figure 13-1 lists the drivers, ranked in order of impact, for the European wheat gluten market, from 2005 to 2011.

**Figure 13-1**

Wheat Gluten Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Established demand from bakery industry</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Improved functionality</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Price</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Growing demand as alternative to fish protein</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Abolition of US import barriers</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Established Demand from Bakery Industry**

Gluten is used in the bakery industry for its protein content but also for its functional properties. For example, its thermoforming abilities help bread retain its shape. Gluten is often used in high value products, especially breads which are growing faster than the overall industry. The bakery industry accounts for over 50 per cent of the total use of gluten. Demand from the bakery industry will continue to drive growth in the market.

**Improved Functionality**

Food companies are increasingly requiring products that meet precise specifications. The development of hydrolysates and soluble glutens with improved functional properties may open up new markets for gluten. Gluten also has a flavour profile that is considered to be more favourable than other protein sources such as soya.

**Price**

While substitution of one protein source for another is quite limited, high or unstable prices may encourage this to happen. The price of gluten has fallen over the past decade, and remains price competitive when compared to most other protein sources.
Growing Demand as Alternative to Fish Protein

The demand for proteins in the aquaculture industry is increasing at 10 per cent per annum. Fish protein is in short supply and the industry is seeking alternative protein sources. This could be an important growing market for gluten in the forecast period (2005-2011).

Abolition of U.S. Import Barriers

Historically, Europe has exported gluten to the United States. In 1998, quotas were introduced, limiting imports to 40,000 tonnes per annum. In 2002, these quotas were lifted resulting in a sharp increase in European exports, which have approximately doubled. This has helped to maintain price levels in Europe.

Market Restraints

Figure 13-2 lists the restraints, ranked in order of impact, for the European wheat gluten market, from 2005 to 2011.

**Figure 13-2**

Wheat Gluten Protein Ingredients Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gluten intolerance</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Unpredictable nature of the industry</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Low nutritional value and functional limitations</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Deregulation of sugar industry</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Gluten Intolerance

In response to growing awareness of food intolerances, gluten free food is becoming an established niche market in the food industry. While the actual market for gluten free products is expected to remain small, growing awareness of the problem is likely to lead more food manufacturers to use alternatives protein sources in their product ranges. This factor is likely to remain a restraint in the market throughout the forecast period.
Unpredictable nature of the Industry - Supply and Price

The bakery industry is the main user of gluten. However, the demand from the bakery industry is dependent on the quality of the wheat crop and the percentage of gluten in the wheat. In a good crop, as in the hot summer of 2003, gluten content can be up to 10 per cent higher, which reduces demand for gluten as an additive to improve protein content.

When the wheat crop is good, there is less demand and prices will drop. When there is a poor wheat crop, demand from the bakery industry will increase and so prices will be higher. The unpredictable nature of the industry may restrain growth in the market.

Low Nutritional Value and Functional Limitations

Gluten is low in essential amino acids and is less digestible than several alternative proteins. In many end-user markets, there is increased demand for specific functional properties and this is expected to favour alternative plant proteins. This factor is expected to restrain growth in the market.

Deregulation of the Sugar Industry

Plans to deregulate the sugar industry in 2005 or 2006 are likely to make the industry more competitive. As wheat and corn are also raw materials used a lot in the food industry, this is likely to put pressure on prices, including protein prices. Alternatively, deregulation may lead to less sugar molasses in Europe, increasing demand for wheat-based products.

Market Quantification - Wheat Gluten Market

Market Engineering Measurements

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>153.6 million euros</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>194,000 tonnes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>(9.6%)</td>
<td>Increasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>0.8%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>0.9 Euros / kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Price range</td>
<td>0.65 - 1.2 Euros / kg</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>75%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>10-15</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 13.3 and Chart 13.2 illustrates the volume and revenue forecasts for the European wheat gluten protein market for the period 2001-2011.
**Figure 13.3**

Wheat Gluten Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>157.5</td>
<td>---</td>
<td>196.0</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>165.2</td>
<td>4.9</td>
<td>201.0</td>
<td>2.6</td>
</tr>
<tr>
<td>2003</td>
<td>170.0</td>
<td>2.9</td>
<td>200.0</td>
<td>-0.5</td>
</tr>
<tr>
<td>2004</td>
<td>153.6</td>
<td>-9.6</td>
<td>194.0</td>
<td>-3.0</td>
</tr>
<tr>
<td>2005</td>
<td>165.9</td>
<td>8.0</td>
<td>202.0</td>
<td>4.1</td>
</tr>
<tr>
<td>2006</td>
<td>169.1</td>
<td>1.9</td>
<td>206.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2007</td>
<td>166.5</td>
<td>-1.5</td>
<td>208.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2008</td>
<td>166.3</td>
<td>-0.1</td>
<td>210.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2009</td>
<td>167.4</td>
<td>0.7</td>
<td>212.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2010</td>
<td>170.2</td>
<td>1.7</td>
<td>215.0</td>
<td>1.4</td>
</tr>
<tr>
<td>2011</td>
<td>175.5</td>
<td>3.1</td>
<td>222.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

**Chart 13.2**

Wheat Gluten Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
In 2004, the European wheat gluten protein market was valued at 153.6 million Euros, with volumes of 194,000 tonnes. In 2002, there was a shortage of supply in Europe after a poor harvest, which led to a higher demand from the bakery industry in 2003. In 2003 there was a good harvest, and the situation was reversed. Prices decreased in 2004, and demand from the bakery industry decreased.

European market volumes are forecast to continue to increase at one to two per cent per annum, mainly driven by increased demand from the bakery market. Poor harvests are expected to create higher prices and volume demand in specific years. This factor is impossible to predict, and is not reflected in the forecasting table. Furthermore, quotas from the United States would also have an impact.

By 2011, the European wheat gluten market is forecasted to be valued at 175.5 million Euros, which represents 222,000 tonnes.

The compound annual growth rate (CAGR) of revenues for 2004-2011 is estimated at 0.8 per cent.

Pricing Analysis

By the end of 2004, the average price of gluten was 0.9 Euros per kilo, having fallen after the very good harvest of 2003, which followed a price increase in 2002.

The price of gluten is affected by the levels of supply, and prices fell during the 1990s, due to persistent overproduction in Europe.

Given stable supply, prices are expected to remain stable. If the use of alternative sources of material such as barley increase, average prices are expected to increase. However, the deregulation of the sugar industry is likely to increase competition. This is expected to reduce the price of wheat products including gluten.

There will, however, be annual price fluctuations of up to 10 per cent which are very dependent on the quality of the harvest.

Product Analysis

Gluten is typically made from wheat and corn.

VITAL WHEAT GLUTEN

Vital wheat gluten is a powder containing 75 per cent protein. It is extracted by a wet milling process, which separates it from starch. It is used mainly in bakery for its functional properties to improve texture and elasticity of the dough.
Wheat Gluten Hydrolysates

Wheat gluten hydrolysates are obtained by the hydrolysis of vital wheat gluten. Wheat gluten hydrolysates contain 80 per cent protein and have good emulsifying and gelling properties, making them suitable for use in the meat industry and for the production of snacks and cereals.

Soluble glutens are produced by deamidation and offer specific functional properties such as emulsifying, binding and gelling, not available in other gluten products. Soluble gluten products are used in niche food markets such as sauces and soups.

Usage Analysis

Figure 13.4 and Chart 13.3 illustrates proportion of wheat gluten protein ingredients used in nutritional applications and functional applications in 2004.

Figure 13.4
Wheat Gluten Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)–by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>15</td>
</tr>
<tr>
<td>Functional</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan

Chart 13.3
Wheat Gluten Protein Market: Usage Analysis (Europe), 2004

Nutritional demand is limited to a few specialist products and animal feed applications.
End-user Analysis

Figure 13-5 and Chart 13.4 illustrates the end-user value analysis for wheat gluten protein by application in 2004.

**Figure 13-5**
Wheat Gluten Protein Ingredients Market: End-user analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)–by value</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakery</td>
<td>60</td>
<td>Increasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>15</td>
<td>Increasing</td>
</tr>
<tr>
<td>Animal feed</td>
<td>5</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Other Market</td>
<td>20</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 13.4**
Wheat Gluten Protein Ingredients Market: End-user analysis (Europe), 2004

- Bakery: 60%
- Meat products: 15%
- Animal feed: 5%
- Other Market: 20%

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Bakery**

The bakery industry is the main end-user market for gluten products. Gluten has both nutritional and functional uses in the bakery industry. The addition of gluten increases the protein level in the dough, thereby adding the strength and elasticity needed to endure the commercial mixing and kneading processes. Gluten, therefore, allows manufacturers of pan breads to manage the consistency of their products. This is especially important when wheat protein levels are low, within crops, or variable across production regions. While the overall bakery
market has a low growth rate in Europe, the increased demand for speciality breads has increased the use of gluten. There is some competition from other proteins - soya and pulse. As a result, demand from the bakery industry for gluten is expected to increase at one to two percent in the forecast period. However, the annual demand is expected to vary according to the quality of the harvest, which is likely to result in fluctuations in demand of up to five to ten percent.

Animal Feed

Corn gluten is used in animal feed applications to increase protein content. There is some use of wheat gluten as a nutritional supplement.

Meat Products

Gluten is used in the meat industry mainly for the functional properties associated with its use. For example, it is utilised for its water retention properties in delicatessen meats, as an emulsifier in sausages and pates, and as an emulsion stabiliser in hams and chickens. This is a market where new applications have been developed by improving the functionality of specific products.

Other Markets

Gluten is used in a wide range of markets including pasta, energy snacks and dietary supplements. Gluten has advantages - in some cases it is the lower-price option which are matched with specific functional features such as solubility. A major new potential market is in aquaculture, where it can be used as a protein source for fish meal. The aquaculture business is growing at ten per cent per annum and alternative protein sources are chosen mainly on price, which places gluten in a favourable position.

Competitive Environment - Wheat Gluten Market

Competitive Structure

Figure 13-6 illustrates the competitive structure for the European wheat gluten market in 2004.
The major suppliers each have a different approach to marketing their products in the industry. Gluten is perceived by some companies as a by-product of their main starch production business, and gluten is sold as a commodity, largely to the bakery industry. Other suppliers, such as Amylum, regard gluten as a value-added product and they spend a lot of time researching new applications.

Important blending companies, such as Puratos and Kerry Ingredients, also use gluten as an ingredient in highly specified functional products for high-value applications.

Most gluten is sold directly to end-users, and thus distributors do not have a major role in this market.

Market Share Analysis

Figure 13.7 and Chart 13.5 illustrate the European gluten market share analysis represented by each of the major participants active in 2004.
Amylum is a subsidiary of Tate and Lyle. It is a major agricultural product processor whose core business is sugar and wheat production. As a leading sugar producer, Tate and Lyle is focusing more on its efforts on value-added food ingredients, in order to reduce its reliance on sugar. In the European gluten market, it was the leading developer of hydrolysates. Furthermore, it has developed soluble wheat proteins by a process of deamidation, and consequently overcome one of the major restrictions traditionally associated with gluten in various applications.

Cerestar was purchased by Cargill in 2002. The company is a major producer of starches, dextrose, gluten and other products derived from cereals. The company has production facilities in Germany, Italy, France, Netherlands and the United Kingdom. In 2004, the company started to market soya proteins produced by another Cargill owned company.
Roquette is a French company and is one of the largest European processors of wheat, maize and potatoes. It has processing plants in France, U.K., Spain and outside Europe. The company employs 600 staff and has turnover of 2 billion Euros. Gluten is a minor part of its total product range.

Other suppliers include Pfeiffer and Langen (a major German processor of sugar and cereals), Frank (Netherlands), and Reppe (Sweden). Other minor companies include Puratos and Kerry Ingredients.

Traditionally, investment decisions have been made with regard to the starch market rather than the European gluten market. However the leading suppliers have all made an effort to their presence in the market over recent years.

**Introduction to the Corn Gluten Market**

**Market Overview and Definitions**

Gluten is the term used to describe the mixture of proteins found in the seeds of cereal crops. Gluten is essentially produced from wheat and corn, but other crops such as barley or rice gluten are also used as a source. Wheat gluten also exists in a concentrated version called vital wheat gluten.

Gluten is a sticky, paste-like substance, of which approximately 40 per cent is protein. Vital wheat gluten contains approximately 75 per cent protein. Gluten is extracted by a wet milling process, which fully separates the starch and gluten. It is then dried and powdered.

Wheat and corn gluten are used for different applications. The primary use of wheat gluten is in bakery products, and for corn gluten it is in animal feed.

In 2004, the total market was valued at 283.8 million Euros.

- Wheat gluten: 194,000 tonnes, 153.6 million Euros
- Corn gluten: 290,000 tonnes, 130.2 million Euros

Both markets are mature, influenced by raw material supply and rely heavily on their key end-user markets. The demand for wheat gluten is affected by the quality of the wheat crop.

The supply of gluten in Europe is dominated by three companies: Amylum, Cerestar, and Roquette.

Corn gluten is a by-product of corn (maize) processing and starch production. It contains 40 per cent protein and constitutes some 5 per cent of the total processed tonnage. Volumes are dependant upon the maize crop and the predominant application is in animal feed or in pet food.
Market Drivers

Figure 13-8 lists the drivers, ranked in order of impact, for the European corn gluten market, from 2005 to 2011.

**Figure 13-8**

Corn Gluten Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Established demand from animal feed</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Price</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Raw material supply</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Alternative to fish protein</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Established Demand from Animal Feed**

Corn gluten is used mainly as a nutrient source in animal feed and pet food. These markets are growing at two per cent in Europe, and this steady demand is expected to be a key factor to continued growth in the European corn gluten market in the period 2005-2011.

**Price**

Corn gluten is considered to be a low priced protein source and it competes with other low price products, such as soya grits, in the animal feed market. Substitution of one for another is quite limited. When it does occur, price is often plays a key role. The price of corn gluten has fallen over the past decade and continues to be price competitive especially when compared to other protein sources. The entry of several new countries to the EU is expected to increase corn supply, which is likely to keep prices competitive.

**Raw Material Supply**

Gluten is produced as a by-product of starch produced from corn. The total processed corn crop in Europe has remained stable at 6 million tonnes over recent years. New EU members, in particular Hungary, are expected to be additional sources of supply. This additional supply is expected to drive growth in the market.
Alternative to Fish Protein

Demand for proteins in the aquaculture industry is increasing at ten per cent. Fish protein is in short supply and the industry is seeking alternative protein sources. This could be a potential market for corn gluten in future.

Market Restraints

Figure 13-9 lists the restraints, ranked in order of impact, for the European corn gluten market, from 2005 to 2011.

Figure 13-9

Corn Gluten Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 yrs</th>
<th>3-4 yrs</th>
<th>5-7 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low nutritional value and functional limitations</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Deregulation of sugar industry</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>GM Ingredients for animal feed</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Low Nutritional Value and Functionality Limitations

Corn gluten has found few applications in human food because it is low in essential amino acids and is less digestible than several alternative proteins. Suppliers have put most investments into developing and researching new applications for wheat gluten. It is unlikely that much R&D effort will be done to find new food ingredient applications for corn gluten and this will limit growth in the market.

Deregulation of the Sugar Industry

Plans to deregulate the sugar industry in 2005 or 2006 are likely to make the industry more competitive. As wheat and corn are also raw materials used a lot in the food industry, this is likely to put pressure on prices, including protein prices. Alternatively, deregulation may lead to less sugar molasses in Europe, increasing demand for wheat-based products.

GM Ingredients for Animal Feed

New GM regulations were introduced in April 2004. This means all products derived from a GM source, which comprises at least 0.9 per cent of total content have to be labelled. This labelling is necessary even if the final product does not contain identifiable GM material. These regulations are expected to have an impact on the use of maize as a source of gluten for animal feed applications, as some maize sourced outside of Europe is derived from GM material.
**Market Quantification - Corn Gluten Market**

Market Engineering Measurements

Chart 13.6 illustrates the Market Engineering measurements for the European corn gluten market in 2004.

**Chart 13.6**
Corn Gluten Market: Market Engineering Measurements (Europe), 2004

---

**Market Engineering Drives Market Strategy and Planning**

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>130.2 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>290,000 tonnes</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>1.6 %</td>
<td>Pls fill</td>
</tr>
<tr>
<td>Compound annual growth rate (2004-2011)</td>
<td>0.25%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Mature</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>0.45 euros per kilo</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Price range</td>
<td>0.39 - 0.52 euros per kilo</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>75%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>10-15</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded. Source: Frost & Sullivan*
Market Forecasts

Figure 13.10 and Chart 13.7 illustrates the volume and revenue forecasts for the European corn gluten market for the period 2001-2011.

**Figure 13.10**

Corn Gluten Market: Volumes and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volume (Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>131.5</td>
<td>---</td>
<td>285.0</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>128.1</td>
<td>(2.6)</td>
<td>285.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2003</td>
<td>128.2</td>
<td>0.1</td>
<td>285.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2004</td>
<td>130.2</td>
<td>1.6</td>
<td>290.0</td>
<td>1.8</td>
</tr>
<tr>
<td>2005</td>
<td>129.2</td>
<td>(0.8)</td>
<td>294.0</td>
<td>1.4</td>
</tr>
<tr>
<td>2006</td>
<td>133.1</td>
<td>3.0</td>
<td>304.0</td>
<td>3.4</td>
</tr>
<tr>
<td>2007</td>
<td>132.2</td>
<td>(0.7)</td>
<td>308.0</td>
<td>1.3</td>
</tr>
<tr>
<td>2008</td>
<td>131.5</td>
<td>(0.5)</td>
<td>306.0</td>
<td>(0.6)</td>
</tr>
<tr>
<td>2009</td>
<td>131.1</td>
<td>(0.3)</td>
<td>305.0</td>
<td>(0.3)</td>
</tr>
<tr>
<td>2010</td>
<td>130.9</td>
<td>(0.2)</td>
<td>305.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2011</td>
<td>131.5</td>
<td>0.5</td>
<td>305.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 13.7**

Corn Gluten Market: Volumes and Revenue Forecast (Europe), 2001-2011

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Volumes have remained relatively stable since 2000, following a steady growth of one to two per cent during the 1990s. The enlargement of the EU will drive growth in the market. Growth in the corn gluten market is likely to be impacted by increase substitution from products such as soya meal which are expected to become more price competitive in future.

In 2004, the European corn gluten protein market generated revenues of 130.2 million Euros, corresponding to volumes of 290,000 tonnes.

By 2011, the European corn gluten market is forecasted to be valued at 131.5 million Euros, which represents 305,000 tonnes.

The compound annual growth rate (CAGR) of revenues for 2004-2011 is 0.3 per cent.

### Pricing Analysis

The average price for corn gluten in 2004 was 0.45 Euros per kilo. Prices are stable with fluctuations of usually less than 10 per cent. Prices are stable, and are expected to decline slightly in the forecast period.

Although demand is expected to increase over the forecast period, there is likely to be increasing price pressure, as a result of increased supply, the impact of sugar deregulation and increased competition from substitute products.

### Usage Analysis

Figure 13-11 and Chart 13.8 illustrates the proportion of gluten protein ingredients used in nutritional applications and functional applications in 2004.

#### Figure 13-11

Corn Gluten Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%)--by value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>85</td>
</tr>
<tr>
<td>Functional</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
85 per cent of corn gluten is used for nutritional based applications.

End-user Analysis

Figure 13-12 and Chart 13.9 illustrates the end-user value analysis for corn gluten by application in 2004.

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal feed</td>
<td>40</td>
<td>Increasing</td>
</tr>
<tr>
<td>Petfood</td>
<td>35</td>
<td>Increasing</td>
</tr>
<tr>
<td>Aquaculture</td>
<td>10</td>
<td>Increasing</td>
</tr>
<tr>
<td>Other food</td>
<td>15</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan
Animal Feed

Corn gluten is used in animal feed to increase protein content. Despite the fact that the growth in animal feed consumption has slowed down, the market is expected to increase at 1-2 percent over the forecast period (2005-2011).

Pet Food

Corn gluten is also used in pet food to increase protein content. Pet food companies tend to use a higher graded product than animal feed companies. Pet food companies tend to have more concerns about colour and stability. The use of corn gluten in this market is expected to increase during the forecast period (2005-2011).

Aquaculture

The use of protein by aquaculture industry is growing at 10 percent and it is seeking additional protein sources for fish meal. Various vegetable proteins have been utilised as possible substitutes including corn gluten. However, colour and texture issues with the use of corn gluten in aquaculture applications have restricted its use. To date, the European aquaculture industry has made little use of non-fish meal sources on account of EU regulations, governing the use of fishmeal. It is possible that these restrictions are likely to be relaxed in 2005, which is expected to lead to a gradual increase in demand for non-fishmeal protein during the forecast period (2005-2011).
Ot her Food

Corn gluten has very few other applications. An examples is hydrolysates which are used in blended protein mixes.

Competitive Environment - Corn Gluten Market

Competitive Structure

Figure 13-13 illustrates the competitive structure for the European corn gluten market in 2004.

Figure 13-13
Corn Gluten Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>10-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td></td>
</tr>
<tr>
<td>Starch and corn product suppliers</td>
<td></td>
</tr>
<tr>
<td>Application and development cost</td>
<td></td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td></td>
</tr>
<tr>
<td>2 Tiers</td>
<td></td>
</tr>
<tr>
<td>Producers of gluten from starch</td>
<td></td>
</tr>
<tr>
<td>Acquisitions Mergers</td>
<td></td>
</tr>
<tr>
<td>Purchase of Cerestar by Cargill</td>
<td></td>
</tr>
<tr>
<td>Competitive Factors</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td></td>
</tr>
<tr>
<td>Product availability</td>
<td></td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td></td>
</tr>
<tr>
<td>Animal feed, pet food companies</td>
<td></td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Corn gluten is seen as a by-product of starch production and is perceived essentially as a commodity product, which is sold to the animal feed industry largely based on price.

Market Share Analysis

Figure 13-14 and Chart 13.10 illustrate the European corn gluten market share analysis in 2004.
The European corn gluten market is dominated by Cerestar and Roquette.

Other suppliers of corn gluten include Agrana (Austria), Jackering (Germany) and Syral (France).
Strategic Analysis of the European Pulse Protein Market

Introduction to the Market

Market Overview and Definitions

The main source of pulse protein is yellow peas (pisum sativum). Yellow peas represent more than 90 per cent of the market. The other ten per cent comprises of lupin protein, with some supply of protein from mung beans. There is some research being carried out on the use of other proteins such as lucerne and canola beans.

Pea proteins typically come in the form of protein concentrates or pea protein isolates. Pea protein concentrates have a protein content of approximately 50 per cent, and are used mainly as a protein supplement in animal feeds or bread flour. Pea protein isolates have a protein content of over 75 per cent and often used as a stabiliser for water-in-oil emulsions. They are employed in the meat industry and in other food applications such as mayonnaise. The separation of pea components (proteins, fibres and starch) is based on an aqueous separation process. The use of organic solvents is not required.

Pulse proteins are composed of two families of proteins: globulins and albumins. Pulse proteins have been available for a relatively short time, thus the market is still quite low volume and less established than alternative proteins. High manufacturing costs and prices are the main limitations associated with their use. The main European supplier includes Cosucra SA of Belgium. Imports from the North American supplier Parrheim Foods (Canada) are also considerable.

In 2004, the European market for pulse proteins generated revenues of 16.4 million Euros.
Market Drivers

Figure 14-1 lists the drivers, ranked in order of impact, for the European pulse protein market, from 2005 to 2011.

**Figure 14-1**

Pulse Protein Market: Market Drivers Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Driver</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Awareness of gluten intolerance</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>Increased demand for proteins</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Increased demand for dietetic foods</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Good functionality</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Research into new protein sources</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

**Awareness of Gluten Intolerance**

Consumer awareness of gluten intolerance has increased and there is a growing market for gluten free products. This has helped drive growth in the European pea protein market.

**Increased Demand for Proteins**

Trends in North America, and to a lesser extent Europe, are tending to favour protein over carbohydrate and fat. This factor is increasing the demand for several proteins, especially proteins such as pulses, which have a high protein content. However, the effect of the Atkins diet and similar low-carb diets is expected to decline over the forecast period (2005-2011).

**Increased Demand for Dietetic Foods**

Pulse proteins are suitable for many applications sectors as they are rich in amino acids and fibre, and low in cholesterol and lactose. The demand for dietetic foods in Europe is growing (especially in France), which is yielding an opportunity for pulse proteins as long as they can be formulated to meet precise specifications. Growth in this market is expected to remain steady during the forecast period (2005-2011).

**Good Functionality**

The food industry is using more highly specified proteins in order to obtain precise product characteristics. Even though pulse proteins are used primarily for their protein content, they do have good functionality. For instance, pulse proteins have strong emulsifying, stabilising
and water binding properties, and there is likely to be an increasing awareness of these advantages over the forecast period (2005-2011).

Research into New Protein Sources

There is little research being conducted in other protein sources such as canola beans and lucerne. Although Europe may not be a large user of these products, this may change. It is possible that these new protein sources will be available during the forecast period (2005-2011). For example, Burcon of Canada is developing proteins from canola and is expected to have a product on the market (through ADM) from 2006.

Market Restraints

Figure 14-2 lists the restraints, ranked in order of impact, for the European pulse protein market, from 2005 to 2011.

Figure 14-2

Pulse Protein Ingredients Market: Market Restraints Ranked in Order of Impact (Europe), 2005-2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Restraint</th>
<th>1-2 Years</th>
<th>3-4 Years</th>
<th>5-7 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Supply of materials</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Users lack of familiarity</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Lack of market power</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Lupin-allergy concerns</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Price

Pulse proteins are more expensive than any other vegetable proteins. In 2004, the average price was 3.70 Euros per kilo. Thus, pulse proteins are typically used when their protein content or functionality outweighs the higher price.

Supply of Materials

Pulse proteins can be derived mainly from yellow peas. In Europe, the products are grown only in a few sites in northern France. Although Cosucra have opened a new plant in northern France, a limited processing capacity is expected to continue to be a restraint on growth. This limited supply has affected the market twice in the past five years, once during
the 1999 GM crisis and then again during the meat protein shortage during 2001, when there was a physical shortage of pulse protein. The small size of the market makes it more susceptible to supply variations than for other protein markets.

A related issue is the lack of applications for the starch and fibre that are produced as a by-product of protein production. There has been some research and development into the use of these by-products in non-food applications.

Australia is a major producer of lupins and a possible source of protein imports, though it is worth noting that it is a different type of lupin that is grown.

**Users Lack of Familiarity**

Many food companies are not likely to be that receptive to the use of pulse proteins in formulations, despite the European food industry's growing awareness of its potential. The leading producers are currently promoting their product actively. However, this lack of familiarity is expected to remain as a restraint in the market in the earlier part of the forecast period.

**Lack of Market Power**

The European pulse protein market has been developed by specialist producers and not by the major food ingredient processors or blenders. These specialist suppliers had less access and influence on the major food producers. This is believed to restrain growth in the market.

**Lupin Protein - Allergy Concerns**

The demand for lupin protein has been affected by concerns over lupin allergies and the possible link to anaphylactic shock. This factor will continue to restrain growth in the lupin protein market throughout the forecast period of the report.

**Market Quantification**

**Market Engineering Measurements**

Market Engineering Drives Market Strategy and Planning

<table>
<thead>
<tr>
<th>Measurement Name</th>
<th>Measurement</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>16.4 million euros</td>
<td>Stable</td>
</tr>
<tr>
<td>Market size (Tonnes)</td>
<td>4,700 tonnes</td>
<td>Stable</td>
</tr>
<tr>
<td>Base year market growth rate</td>
<td>15.5%</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Compound annual growth rate (2004 - 2011)</td>
<td>8.59%</td>
<td>N/A</td>
</tr>
<tr>
<td>Market age</td>
<td>Developing</td>
<td>N/A</td>
</tr>
<tr>
<td>Average price</td>
<td>3.7 Euros per kilo</td>
<td>Increasing</td>
</tr>
<tr>
<td>Price range</td>
<td>3.2 - 5.1 Euros per kilo</td>
<td>Increasing</td>
</tr>
<tr>
<td>Market concentration (per cent of base year market controlled by top three competitors)</td>
<td>Over 80%</td>
<td>Decrease</td>
</tr>
<tr>
<td>Competitors (active market competitors in base year)</td>
<td>5 - 10</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Note: All figures are rounded. Source: Frost & Sullivan

Market Forecasts

Figure 14.3 and Chart 14.2 illustrate the volume and revenue forecasts for the total European pulse protein market between 2001 and 2011.
**Figure 14.3**

Pulse Protein Market: Volume and Revenue Forecasts (Europe), 2001-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Million Euros)</th>
<th>Revenue Growth Rate (%)</th>
<th>Volumes (000 Tonnes)</th>
<th>Volume Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>13.5</td>
<td>---</td>
<td>3.8</td>
<td>---</td>
</tr>
<tr>
<td>2002</td>
<td>13.7</td>
<td>1.5</td>
<td>4.2</td>
<td>10.5</td>
</tr>
<tr>
<td>2003</td>
<td>14.2</td>
<td>3.6</td>
<td>4.5</td>
<td>7.1</td>
</tr>
<tr>
<td>2004</td>
<td>16.4</td>
<td>15.5</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>2005</td>
<td>17.8</td>
<td>8.5</td>
<td>5.0</td>
<td>6.4</td>
</tr>
<tr>
<td>2006</td>
<td>18.2</td>
<td>2.2</td>
<td>5.2</td>
<td>4.0</td>
</tr>
<tr>
<td>2007</td>
<td>19.5</td>
<td>7.1</td>
<td>5.3</td>
<td>1.9</td>
</tr>
<tr>
<td>2008</td>
<td>21.4</td>
<td>9.7</td>
<td>5.6</td>
<td>5.7</td>
</tr>
<tr>
<td>2009</td>
<td>23.1</td>
<td>7.9</td>
<td>5.8</td>
<td>3.6</td>
</tr>
<tr>
<td>2010</td>
<td>26.0</td>
<td>12.6</td>
<td>6.0</td>
<td>3.4</td>
</tr>
<tr>
<td>2011</td>
<td>29.2</td>
<td>12.3</td>
<td>6.3</td>
<td>5.0</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 14.2**

Pulse Protein Market: Volume and Revenue Forecasts (Europe) 2001-2011

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
In 2004, the European pulse protein market was valued at 16.4 million Euros, corresponding to a volume of 4,700 tonnes. Approximately 90 per cent of the market represents pea protein and the remaining lupin and bean protein.

The market volumes grew rapidly from 1997 to 2000, on account of increased demand from the animal feed sector as an alternative to GM-soya. In 2001, the market for pea protein was boosted by the shortage in meat protein, but the market for lupin protein fell.

Since 2002, revenues have increased at 3-16 per cent per annum, which is lower than anticipated because the products have not found new markets as quickly as expected.

Sales growth is expected to depend on raw material supply and on demand from new markets. Growth from 2005-2007 is likely to be steady. There should be a stronger growth towards the end of the forecast period, as long as there is necessary investment in supply. However, the market is expected not to grow substantially unless a strong new supplier enters the market.

By 2011, the European pulse protein market is forecast to be valued at 29.2 million Euros, which represents 6,300 tonnes.

The compound annual growth rate (CAGR) of revenues for 2004-2011 is estimated at 8.6 per cent.

Pricing Analysis

In late 2004, the average price for pulse proteins in Europe was 3.70 Euros per kilo. Pea protein prices were slightly lower and lupin prices were slightly higher.

Production costs are high and production capacity has been limited. Unless new participants in the market provide a substantial capacity increase, prices are likely to rise above current levels. Moreover, increasing use of protein isolates should increase the average price.

Product Analysis

The two main pulse proteins in the market are pea protein concentrates and pea protein isolates:

**Pea Protein Concentrates**

Pea protein concentrates have a protein content of approximately 50 per cent. The separation of the pea components - proteins, fibres and starch - is based on an aqueous separation process, and does not use any organic solvents. Pea protein concentrates have a low level of
denaturation and high solubility. They have excellent nutritional value and functionality properties.

**Pea Protein Isolates**

Pea protein isolates typically have a protein content of over 75 per cent. The amino acid composition of pea proteins isolates shows high lysine content and lack of sulphurous amino acids. Furthermore, they do not contain any cholesterol, lactose or fibre and have high emulsification properties, as well as good stability in terms of shearing, heating and retorting. They are also an excellent stabiliser for water-in-oil emulsions.

**Usage Analysis**

Figure 14.4 and Chart 14.3 illustrates the proportion of pulse protein ingredients used in nutritional applications and functional applications in 2004.

**Figure 14.4**

Pulse Protein Market: Usage Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Share (%) - by Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>60</td>
</tr>
<tr>
<td>Functional</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*

**Chart 14.3**

Pulse Protein Market: Usage Analysis (Europe), 2004

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
**Nutritional Demand**

Pulse proteins are rich in amino acids and fibre. The main demand for pulse proteins as a nutritional source is within the animal feed industry. Pulse proteins are blended in with compounded livestock feed in order to increase protein content. Additional nutritional demand for pulse proteins comes from functional food manufacturers such as the baby food industry, vegetarian dish producers, bakery and pasta manufacturers.

**Functional Demand**

Pulse proteins have good emulsification and stabilisation properties in water-oil emulsions and good stability to shearing, heating and retorting. The functional demand for pulse proteins comes from:

- The meat industry as a meat extender, where the proteins are used for the texturing properties they provide
- The bakery industry, which has started using pulse proteins as a replacement for soya proteins, gluten and eggs.

In addition, they are suitable for applications in the fish industry as well as in dressings, sauces, vegetarian dishes, dairy, fat and oils, bakery, beverages and confectionery. The functional demand for pulse proteins is expected to increase in Europe, as the benefits associated with pulse proteins is promoted by the industry.

**End-user Analysis**

Figure 14-5 and Chart 14.4 illustrates the end-user value analysis for pulse protein by application in 2004.

**Figure 14-5**

Pulse Protein Market: End-user Analysis (Europe), 2004

<table>
<thead>
<tr>
<th>Market Sector</th>
<th>Market Share (%)</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal feed</td>
<td>15</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Meat products</td>
<td>45</td>
<td>Stable</td>
</tr>
<tr>
<td>Bakery products</td>
<td>20</td>
<td>Stable</td>
</tr>
<tr>
<td>Other food</td>
<td>20</td>
<td>Increasing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>---</td>
</tr>
</tbody>
</table>

*Note: All figures are rounded; the base year is 2004. Source: Frost & Sullivan*
Animal Feed

The animal feed market in Europe is the main consumer of pulse proteins and its products are used in compound feed as a nutritional supplement for young animals. Pulse proteins increase the amino acid content of cheaper protein sources such as gluten. However, the high price of pulse proteins when compared to other vegetable proteins restricts their use to a limited number of applications.

Meat Products

The meat industry is the second largest market for pulse proteins, where they are used for their texturing properties as a meat extender. The market is stable and little growth is expected during the forecast period (2005-2011).

Bakery Products

This sector is the main user of lupin proteins and also uses a limited amount of pea proteins. Pulses are used in the bakery sector to increase protein content as well as to add strength and elasticity to the product. Lupin flours can be used to replace egg proteins. Another use for pulse proteins is in GM gluten free products, where they are used as a soya substitute in bakery products. Cost reduction trends, GMO and gluten intolerance awareness are expected to drive growth in this market between 2005 and 2011.
Other Markets

Other markets include vegetarian dishes, dairy, mayonnaise, dietetic and functional food products. Pulse proteins are more widely used in these markets throughout North America. However, the demand in most European markets is increasing. Growth is expected to largely depend on the ability of suppliers to sell to food producers. The position of pulse proteins in terms of supply and awareness is likely to grow stronger in the later stages of the forecast period.

Competitive Environment

Competitive Structure

Figure 14.6 illustrates the competitive structure for the European pulse protein market in 2004.

Figure 14.6
Pulse Protein Market: Competitive Structure (Europe), 2004

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Specialist pulse protein producers</td>
</tr>
<tr>
<td></td>
<td>Ingredient blenders</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>2 Tiers</td>
</tr>
<tr>
<td></td>
<td>Protein Manufacturers</td>
</tr>
<tr>
<td></td>
<td>Importers, distributors</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Service, customisation, formulation</td>
</tr>
<tr>
<td></td>
<td>Ability to source materials</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Animal feed producers, meat industry, high value food producers</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

The market has been developed by specialist producers - Parrheim Foods in Canada and Cosucra in Belgium. Kerry Ingredients, a major blender, has recently closed a small processing facility. The major companies such as ADM and Cargill have not entered this market. However, Roquette has started to supply pea proteins.

Market Share Analysis

Figure 14.7 and Chart 14.5 illustrate the European pulse protein market share represented by each of the major participants active in the European Pulse Protein Market in 2004.
Pea Protein

Cosucra is the only significant producer of pea protein in Europe. Sotexpro of France produce pea protein, but it has temporarily ceased manufacturing during 2004. The other major supplier is Parrheim Foods of Canada, which exports to Europe.

Cosucra S.A. is the marketing and sales support wing of a group of independent Belgian companies that produce natural ingredients including pulse proteins. Cosucra is the largest European producer with around 50 per cent market share. It opened a new production facility in France in 2004.

Parrheim Foods is a division of Parrish and Heimbecker whose head office is in Winnipeg, Canada. Parrheim Foods is a market leader for pea protein in Europe and it has over 40 per cent market share.
LUPIN PROTEIN

The suppliers of Lupin protein are:

- The Terrena Group (Cana cooperative) in France
- Swiss Milk Company that supply 'Lupidor' brand lupin proteins distributed through Natpro Foods of Germany
Strategic Recommendations

INTRODUCTION

For all suppliers, product development, price/cost and quality control will continue to be factors that will continue to impact the competitive environment of this market.

Customer/End user

At a customer level, protein ingredient manufacturers must survey and watch food production trends. Protein suppliers should conduct an annual survey to monitor the satisfaction of their customers and their needs, attitudes, budgets and new product development. A systematic customer survey system and a media watch across market sub-segments will reveal unmet customer needs, which the protein supplier can meet. By defining product specifications required in each potential market, protein producers can then concentrate their activities on the most promising markets for their products.

Consumer

At the consumer level, protein ingredient producers must survey and monitor public trends on food issues. Understanding public opinion trends on subjects such as allergies or healthy eating will allow protein producers to develop suitable ingredients. Regular European consumer surveys, and a monitoring of the media, who often influence trends in public opinion, should be considered.

Competitor

Protein ingredient producers must watch the key developments of competitors. R&D departments intent on staying on the cutting edge of development must monitor their competition very closely. New developments in protein ingredients as well as new market success by competitors need to be monitored in order to define an appropriate competitive strategy.
systematic competitor benchmarking and analysis system can also provide a wealth of new ideas for a company.

**Raw Material Supplier**

In some instances, protein ingredient manufacturers should consider becoming involved in raw material supply. Successful nutritional improvements in both milk and egg proteins have been made by controlling the animal feed of cows and hens. Other actions on raw material supply such as introduction of an Identity Preservation (IP) program for non-GM soya products, helps to provide 'clean' labelling for products.

**Strategic Opportunities - by Market Sector**

**Milk Protein Suppliers**

Milk protein suppliers can continue to benefit from the trend towards more functional products, and increased consumer interest in the nutritional value of products. Companies can also benefit from anticipating and planning for supply side changes - whether availability, EU subsidy rates, or changes to the CAP.

**Soya Protein Suppliers**

Soya protein suppliers can benefit from additional focus on the real and perceived health benefits of soya, and demand for meat-free alternatives. Opportunities will also come from an accurate on-going assessment of likely developments in the demand for GM and non-GM products, and the related sourcing of raw material supplies.

**Egg Protein Suppliers**

While egg proteins have strong functional and nutritional properties, the industry is probably still over-supplied. The main opportunities may lie in re-organisation and consolidation of the industry.

**Meat Protein Suppliers**

The meat protein industry has been restructured, and if there are no further health scares, it should be able to continue its recovery. The main opportunities are for low cost products in Eastern Europe and high value isolates for specialist applications.
Fish Protein Suppliers

The fish protein industry is well placed from a market viewpoint. It has a rapidly growing main market - aquaculture - and may recover some of its former market in ruminant feeds. From the supply side, the position is less certain, with possible restrictions on fish catches.

Gelatine Suppliers

Gelatine's main markets in confectionery and specialist food applications are well established. However, the European market is unlikely to improve its current position and there are potential consumer health concerns or supply difficulties. The main opportunities for the industry are likely to be in growth markets in other regions such as China. Key to success in the market is being able to manage raw material supply and processing capabilities.

Gluten Suppliers

The prospects for gluten are heavily influenced by cereal yields, and demand from the bakery industry. To reduce its dependence on these factors, the industry has to put systematic development and marketing efforts into finding new applications.

Pulse Protein Suppliers

Pulse proteins have made little impact in Europe. Supply restraints and a lack of awareness from the food industry means this is unlikely to change. However, in a market dominated by long established products, pulse proteins such as lucerne, do provide a possible opportunity to develop a new sector in the industry.

Recommendations for the Marketing Department

The following recommendations can be made for Marketing Department

Creative Market Segmentation Analysis

While much of the food industry is low growth, there are numerous high growth niche markets. A creative market segmentation analysis can identify opportunities for future growth. The research involves segmenting the protein ingredients market in various ways, for instance by functional properties or nutraceutical content, geography or user market. Analysing each segment individually should reveal areas with fewer competitors, and high market potential for growth. Thorough analysis of competitors and customers, along with other key players in the market, should be performed in order to provide a comprehensive overview of the market segment's dynamics.
An example of this practice has been the approach of ADM to the various markets for soya proteins.

In the meat protein market, Proliant Inc. has taken a similar approach to segmenting their market by product type and application.

END-USER DEMAND ANALYSIS

As the protein ingredients market grows increasingly competitive and with limited growth, future sales and profit gains will be derived only by gaining a thorough understanding of the needs of end-users but also of their attitude and budget. To make continuous improvements and adjustments, companies must be prepared to measure and monitor their customer bases constantly. Companies should design a regular customer survey to make specific customer measurements that relate to their protein ingredient products; this has the potential to reveal unmet customer needs. These measurements must be monitored over time to track the movement and trends of customer attitudes and behaviour.

PRODUCT RANGE

Users have varying price points, quality requirements and technical specifications. Suppliers should consider how they can segment their own products to meet the range of market needs.

INFLUENCE ON CONSUMER ATTITUDES

The food industry is often ineffective in promoting positive images associated with the use of specific food ingredients. While individual companies can do little on their own, protein suppliers should aim to improve the industry response to when these issues are raised. This can involve having the information and the right people available to respond along with the data and understanding to rebut inaccuracies.

Companies, and the industry, should also plan responses to new `health` issues, such as allergies or obesity. If the industry has a prepared response it will have a better chance of influencing future developments and consumer perceptions.

Recommendations for the Product Development Department

The following recommendations can be made for Product Development Department

ANALYSIS OF NEW PRODUCT POTENTIAL

Before a company makes the decision to invest in new product development, it should undertake a comprehensive analysis of both the competition and the end-user base to ensure that
the project is indeed bringing a product to the market that the competition does not already offer and that the customers want.

This approach has been particularly important in developing new products for proteins for nutraceutical and energy products, where the proteins have to be carefully specified to meet precise functional requirements. Such an approach was used in the development of a new range of milk-based proteins for fruit juices by Glanbia.

In the gluten market, Amylum has used a similar approach to identify possible high value new applications outside the bakery industry. This has led to the successful introduction of new products such as hydrolysed proteins for sauces and low calorie drinks.

**Monitoring of Competitor Research and Development**

R&D departments intent on staying on the cutting edge of development must monitor their competition very closely. A quarterly competitive monitoring programme should be set up to analyse and measure systematically competitors’ activities across all strategic areas. This could reveal new product development plans, new technology evaluation, strategic partnership arrangements for example.

**Focus on Broad Trends**

While much development work is for individual customers, companies should focus their general innovation work towards food industry trends. There include more short life products, pro-biotic/healthy/nutritional products and anti-obesity products (low fat etc).

**Recommendations for Corporate Management and Business Development**

The following recommendations can be made for Corporate Management and Business Development Department.

**Competitive Benchmarking**

It is important to monitor the leaders in the industry on a continuous basis in order to be prepared for changes they could bring to the market. If a competitor monitoring programme is not continuous, the chances of being caught off guard by competitive strategy increase significantly. A systematic competitor benchmarking and analysis system can also provide a wealth of new ideas to improve a company.
**Acquisition Analysis**

In a market with often low growth and with price pressures, mergers and acquisitions provide companies with a way to increase market share, access low cost supplies and widen their technical knowledge.

An acquisition could be the most cost-effective way of meeting growth objectives in this market. The analysis would include a review of all companies by category, a screening system based on market measurements and a SWOT analysis of the way each company would potentially fit into the overall strategy.

Conversely, companies should consider whether the return on their protein business is adequate, and if not, should consider divesting it. In particular, a protein business should not be maintained just because it ‘fits’ other parts of the business.

Gelita Group has strengthened its competitive position in the gelatine market by acquisition. The company has purchased Extraco, Kind & Knox and Dynagel providing a wider range of specifications and production facilities. This move will help the group avoid market growth restraints caused by raw material shortages.

Eurovo of Italy strengthened its position in the European egg protein market by the acquisition of Aveve (Belgium) and Ovonor (France)

**Implementation of Continuous Improvement Programme**

Corporate management teams are engaged in a continuous struggle to find new ways to improve the efficiency and quality of their companies. A well-structured and well-managed market research programme is an effective way to generate a wealth of ideas for improvement and to identify areas that need improving. Ideas generated from inside the company eventually die out; the only source of never-ending feedback is the market place.

**Business Planning**

**Most Important Elements to Integrate into Business Planning**

Figure 15-1 details the key elements to integrate into the planning of a business.
FIGURE 15-1

Total Protein Ingredients Market: Key Elements to Incorporate into Business Planning (Europe), 2004

<table>
<thead>
<tr>
<th>Key Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the company’s current market position, and where does it aspire to be at the end of the forecast period?</td>
</tr>
<tr>
<td>2. What action will the company take to develop new products, and to find new applications for these products?</td>
</tr>
<tr>
<td>3. Can the company develop new products to meet specific end-user functionality requirements?</td>
</tr>
<tr>
<td>4. Can the company develop its own niche product range to reduce competition?</td>
</tr>
<tr>
<td>5. What actions can the company take to secure supply of suitable raw materials for its proteins?</td>
</tr>
<tr>
<td>6. How will company respond to the changing structure of end-user markets?</td>
</tr>
<tr>
<td>7. Can the company effectively exploit eastern Europe as a market or source of supply?</td>
</tr>
<tr>
<td>8. Does the company understand relevant consumer trends?</td>
</tr>
<tr>
<td>9. How will the company assess potential acquisitions or joint ventures?</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

CONSUMER TRENDS

Do you understand relevant consumer trends?

- Allergies
- Diets
- End user market growth

Regular consumer surveys, and media monitoring, should be considered, to enhance understanding of trends. While much development work is for individual customers, companies should focus their general innovation work towards food industry trends. These include more short life products, pro-biotic/healthy/nutritional products, anti-obesity products (low fat etc).

Product ranges and marketing effort should be developed to take account of trends

Influence on Consumer Attitudes

The food industry is often ineffective in promoting positive arguments about food ingredients. While individual companies can do little on their own, protein suppliers should aim to improve the industry response to media and Government when these issues are raised. This entails having readily available accurate responses to issues that are raised, and the right people to make the responses, with the data and understanding to rebut inaccuracies.
Companies, and the industry, should also plan responses to new ‘health’ issues, such as allergies or obesity. If the industry has a prepared response it will have a better chance of influencing developments.

**PRODUCT RANGE**

Do you understand your customers requirements and un-met needs, with regards to:

- Functional proteins
- Blended products

Can the company develop new products to meet food companies' functionality requirements?

Does your product range match the market profile? Users have varying price points, quality requirements and technical specifications. Suppliers should consider how they can segment their own products to meet the range of market needs.

Creative market segmentation analysis can identify opportunities for future growth.

An example of this practice has been the approach of ADM to the various markets for soya proteins. Such an approach was also used in the development of a new range of milk-based proteins for fruit juices by Glanbia. In the gluten market, Amylum has used a similar approach to identify possible high value new applications outside the bakery industry. This has led to the successful introduction of new products such as hydrolysed proteins for sauces and low calorie drinks.

**COMPETITIVE POSITION**

Is your competitive position in your market viable? Are you a (profitable) major player, or do have you have (profitable) niche markets? If not:

- Can you improve your position by acquisition or joint venture?
- Can the company develop its own niche speciality to reduce competition?
- Conversely, companies should consider whether the return on their protein business is adequate. If not, should it be held at current level with minimum necessary investment, or should it be divested? In particular, protein business should not be maintained because it ‘fits’ other parts of the business if it is not possible to give the protein business sufficient attention.

Are you aware of key developments from competitors? A systematic competitor benchmarking and analysis system will enable a company to develop an appropriate response. It can also provide a wealth of new ideas for a company.
RAW MATERIAL SUPPLY

Can you evaluate how developments in raw material supply will affect your business e.g.

- EU regulations and price support - relevant in particular for milk proteins, gluten
- World supply and demand - relevant for fish protein and soya
- Modification of raw materials to improve proteins
- GM issue - relevant for soya

Is your commercial position in relation to raw material suppliers satisfactory? If not, can it be improved by development work with suppliers? In some instances, protein ingredients manufacturers should consider becoming involved in raw material supply. Successful nutritional improvements in both milk and egg proteins have been made by controlling the animal feed of cows and hens. The major soya protein suppliers such as Solae and Cargill have increased their strength in the market by developing strong links to soya producers, while Degussa, who lacked these types of arrangements have exited the market.

Most Important Elements to Integrate into Business Monitoring

Figure 15-2 details the key elements to integrate into the monitoring of a business.

Figure 15-2

Total Protein Ingredients Market: Key Elements to Incorporate into an Engineering Monitoring Programme (Europe), 2004

<table>
<thead>
<tr>
<th>Key Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Monitor the competition throughout the forecast period</td>
</tr>
<tr>
<td>2 Monitor the impact of future legislation with regard to proteins</td>
</tr>
<tr>
<td>3 Monitor key industry trends within the protein market</td>
</tr>
<tr>
<td>4 Monitor changing consumer attitudes to ingredients</td>
</tr>
<tr>
<td>5 Monitor mergers and acquisitions within the industry</td>
</tr>
<tr>
<td>6 Monitor globalization and consolidation in end-user markets</td>
</tr>
<tr>
<td>7 Monitor raw materials development</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Frost & Sullivan Awards

Market Penetration Leadership Award

The 2005 Frost & Sullivan Market Penetration Leadership Award is presented to Solbar Industries Ltd. of Israel, for its continued focus on new technologies and product development that have helped in the development of its range of soy protein concentrates. These developments have successfully helped the company penetrate the European soy protein market in a number of end-user segments.

Solbar Industries Ltd. is the third largest supplier in the world of specialty soy proteins and isoflavones. This Israeli soy protein specialist has over 17 years of experience and its natural soy solutions have already been used in a number of applications. The company operates through its two production sites in Israel, and one in the United Kingdom.

Chart 16.1 illustrates the factors that have contributed to Solbar Industries Ltd.’s success in market penetration leadership.

Chart 16.1

Protein Ingredients Market: Market Penetration Leadership Award - Solbar Industries Ltd. (Europe), 2005

Source: Frost & Sullivan
Patented Breakthrough Technology

Solbar Industries Ltd. is a market leader in the development of soy proteins. The company’s soy protein concentrates, made by removing a portion of the carbohydrates (sugars) from dehulled and defatted soybeans, improve the functional properties of food. The company is well known for this pioneering technology, which was first patented in 1963. Following the tradition of innovation, Solbar continues to develop a wide range of soy concentrates specific to particular segments of the food and the feed industry.

New Product Innovations Ensures Competitive Edge

In addition to its new isolated soy protein Solpro 900, Solbar Industries manufactures:

- Solcon S: a multi-functional soy protein concentrates
- Bontex: a unique steam-textured soy protein for instant soups and convenience meals
- Solgen and Nutragen: textured soy concentrates and soy isoflavones with high levels of genistin and daidzin

Solbar has recently expanded its family of functional soy protein concentrates to include the non-GMO IP functional soy concentrate. Launched in January 2005, the Solcon S family is a welcome addition to flagship S-110 and S-200 proteins. Solcon S can be used in a wide variety of meat, poultry, fish and vegetarian applications. The company also launched ‘Solgen 3/S’, which contains 3 per cent total isoflavones. Sologen 3/S is highly soluble at a neutral pH.

Strategic Expansions Continue to Strengthen the Position of Solbar in the Market

Solbar has grown from a small Israeli company to a global participant in the soy proteins market. Some of the major strategic expansion undertaken by the company are discussed below:

- Solbar bought Bontrae™ (line of steam-textured soy proteins) from IFF in the 2001. The product has been renamed as ‘Bontex’.
- In the year 2004, Solbar established a company under the name of Nutricognia to market systems for sugar analysis. It is a joint venture between Solbar Industries Ltd. and Dr. Ofer Markman, a group headed by the inventor of the Procognition technology. Nuricognia is involved in the marketing of the systems used for the analysis of sugar to key market segments, such as baby food, dairy products and probiotic bacteria-enriched products.
Following its plan of globalisation Solbar has all set to explore new markets. The company has recently established a speciality proteins factory in Ningbo Free Trade Zone, China.

Competitive Market Penetration Strategies and Understanding the Market Requirements

In 2004, the European soy protein market was valued at 363.6 million Euros (Frost & Sullivan, 2005). Growth in the European soya protein market is still being restrained by genetically modified (GM) concerns. A lot of users prefer to use non-GM soya proteins in their product formulations. The changing market conditions have provided opportunities for companies to supply non-GM material to end-users. The Solcon S family of non-GMO IP functional soy concentrates, are welcome additions to Solbar’s product portfolio.

Taking advantage of the trend of more targeted application protein solutions, Solbar has invested heavily in production capacity and in new product development to increase its share of the European market. Investment in new production facilities has enabled the company to achieve low cost production, making it competitive against the relatively high cost European producers.

The company has focused on the end-users requirement for improved functionality in proteins of all types by investing in product development and technical support functions. Over the past 2 years it has expanded its product range to include flours, concentrates and isolates. Solbar also offers textured products and isoflavones as part of its ingredient portfolio. In 2005, the company launched a further range of functional concentrates designed for the meat and fish industries and containing reduced levels of carbohydrates.

Solbar’s sales organisations are prevalent in more than 45 countries. The company’s extensive network of exclusive distributors and shipping and warehousing facilities ensure that logistics run smoothly.

Conclusion

Solbar has expanded its soya protein business by continually focussing on product development and improved product functionality. It has successfully increased its share of the European soya protein market - a market which some of the established European suppliers have found difficult to penetrate. Commitment to research and development, improved technologies and customer service have resulted in Solbar’s leading position in the soy protein market. In recognition of its continued development of the soy protein market globally, Frost & Sullivan bestows the 2005 Market Penetration Leadership award to Solbar Inc for its contributions in the European soya protein market.
MARKET LEADERSHIP AWARD

The 2005 Frost & Sullivan Market Leadership Award is presented to U.S. based Proliant Inc. for systemically strengthening their leadership position in the European meat protein market.

Proliant Inc., formerly AMPC (American Meat Protein Corporation) was founded in 1981. Owned by the Lauridsen Group, Inc. (LGI, Inc.), the company is a leading innovator in applied protein sciences for food, health and nutrition.

Proliant's processes allows economical large-scale separation and purification of bioactive proteins present in complex biological fluids - particularly blood plasma and milk. The company's success can be attributed to its ability to convert research and development into high quality commercial products.

Proliant Inc has four divisions, each focusing on specific markets. These include:

- Proliant Dairy Ingredients
- Proliant Meat Ingredients
- Proliant Health
- Proliant Biologicals

Proliant's Dairy Ingredients division specialises in dairy proteins. The company supplies whey protein isolates, whey protein hydrolysates, whey protein concentrates, specialty proteins and lactose to a number of nutrition, dairy, bakery, confection, snack, meat and savory markets. These ingredients enhance the nutritional value of products, and provide particular functional properties and flavour to products.

Proliant Health Ingredients is a manufacturer and marketer of bioactive protein-based ingredients for use in nutrition products.

The company’s meat ingredients division produces proteins and other meat products at its plant in Spain and has four more plants in the USA. While the main market for these products is in the meat industry, the company has also developed products for specialist high value applications for the pharmaceutical and health and nutrition markets.

Proliant Biologicals is engaged in the manufacture of high-purity animal-derived biochemicals, such as Bovine Serum Albumin (BSA), used in diagnostics, research, biopharmaceutical and veterinary applications.

Chart 16.2 illustrates the factors that have contributed to Proliant Inc.'s success in market leadership.
Proliant Inc. - The Market Leader

In 2004, Proliant Inc was the market leader in the European meat protein market with a 35 per cent market share. In Europe, the company’s main business has been in blood proteins, a market that was adversely affected by the BSE (Bovine Spongiform Encephalopathy) crisis.

In 2003, Proliant entered the higher value market for meat proteins made from collagen, by acquiring BHJ of Denmark, the leading European supplier of these products. This decision has helped the company maintain a leading position in the blood protein and collagen protein segments of the meat protein market.

Proliant Inc. has further strengthened its position by careful market segmentation. Product functionality is often designed for a specific end-user application - whether pates, sausages, or cooked meats for example. Proliant is in an excellent position, and is able to offer products to meet the needs of particular application sectors. For example, Proliant Inc is able to offer blood proteins as functional meat extenders, for flavours and flavour enhancers, as a stock and as plasma.

Continued Focus on Research and Development

From the very beginning, the company put emphasis on product development and innovation, much of it in new higher value-added applications outside the traditional meat industry markets. These include development of bio-functional proteins - products that may aid the immune system.
A recent introduction is the Nutragammax range of proteins for health and nutritional applications. The product is available as a powder, and contains bioactive peptides that promote growth. An intense commitment to research and development has made Proliant a leader in protein ingredient technology.

**Conclusion**

The European meat protein market has started to recover from the impact of the BSE crisis. Proliant is well placed to exploit this recovery, having taken necessary steps to ensure a comprehensive product range, ensuring product development remains a key focus and that there is a solid distribution network in place.

Recognising the company’s efforts, Frost & Sullivan presents the 2005 Market Leadership Award to Proliant Inc., for its high quality protein products, outstanding service and innovative technology- 'the trademarks of a true leader'.

**Product Innovation Award**

The 2005 Frost & Sullivan Product Innovation Award is presented to Amylum UK Limited for its pioneering technology that has transformed wheat gluten protein from an industrial scale raw material to a product that has specific functional properties well suited to a wide range of end-user applications.

Amylum exhibits more than 125 years of experience in the production of starches and starch derivatives. It provides a comprehensive array of products with wide ranging applications in the food, beverage, industrial, and animal feed industries. The company emerged as UK’s largest processor of wheat for the production of glucose syrups and starches for the food, soft drink and brewing sectors. In 2004, the size of the European wheat gluten market is 153.6 million Euros, and Tate and Lyle are considered to be market leaders in this sector (Frost & Sullivan, 2005).

Chart 16.3 illustrates the factors that have contributed to Amylum UK Limited’s success in product innovation.
Pioneering Technology

Amylum achieved a major breakthrough in the year 1976, when the company was able to use wheat alongside the traditional raw material corn in the manufacture of starches and sugars.

The pioneering technology involved separating the wheat protein from wheat flour by washing out the starch fraction and recovering the gluten, an insoluble, native protein. This native protein is sold by the company as vital wheat gluten under its brand names Amygluten, Biogluten and Amytex.

Another major accomplishment by Amylum was the development of techniques that could convert the water-insoluble vital wheat gluten into soluble wheat proteins. The resulting product has unique functional characteristics with many highly nutritious and digestible characteristics making it ideal for use in various food and animal feed applications. Amylum SWP and Solpro series are excellent examples where developments in technology have resulted in products that meet the specific needs of end-users. In an increasingly competitive environment, the need to increase application and customer base is becoming key to survival.

Product Innovations - Major Breakthroughs

Traditionally wheat gluten was mainly used in the bakery industry to supplement the protein content of the wheat. Not many wheat gluten producers have focused on the further development or exploration of other potential applications for gluten.
On the contrary, Amylum has been a market leader in innovation in this sector, focusing on developing alternative uses particularly in the higher value added functional applications. It has invested heavily in the research and development of various new products.

Commitment to succeed and innovate has helped the company achieve some major breakthroughs. The development of hydrolysates for example, overcame one of the main challenges for use of wheat gluten in many applications.

The types of products developed and supplied by Amylum include:

- Vital wheat gluten binders - high protein content, a digestible product suitable for animal feed.
- Vital wheat glutens - used in processed meat for improved structure and in soya sauces.
- Hydrolysed wheat protein - can be used with soya protein to provide a base for soya sauce. It is also finding increasing use in other applications such as sauces and soups.

A Leading Edge

Frost and Sullivan research indicates that Amylum has attained leadership in the wheat gluten market by continually focusing on product innovation and technological developments.

The Amylum Group maintains a network of sales offices and distributors around the globe, which are supported by a dedicated technical support and marketing team. This guarantees effective cross functional communication relating to product capabilities, application solutions, and recent developments.

The company’s strict quality control of the total process - from order receipt through production to final delivery - is aimed at achieving total customer satisfaction. Its efficient R&D department focuses on customer requirements to provide new and improved solutions.

Conclusion

Amylum has played an instrumental role in developing innovative approaches that address some of the key challenges in the wheat gluten market. Its strategic focus on product innovation has revolutionized the market and further strengthened its position as market leader.

Frost & Sullivan recognises the company’s excellence and presents the 2005 Frost & Sullivan Product Innovation Award to Amylum for its commitment and efforts in developing the European wheat gluten market.
BUSINESS DEVELOPMENT STRATEGY LEADERSHIP AWARD

The 2005 Frost & Sullivan Business Development Strategy Leadership Award is presented to Volac International Limited, for its processing expertise, nutritional knowledge, continual investment in Research & Development and commitment to innovation in the European whey protein market. In 2004, the European whey protein market was valued at 837.7 million Euros (Frost & Sullivan, 2005).

Volac International Limited is a private independent company, headquartered in Orwell, Hertfordshire. The company has two manufacturing sites in the UK and the third one in Liverpool. Established in 1970, the company manufactures a wide range of milk replacers and animal feeds for calves, lambs and piglets. It is also heavily involved in the exploration of opportunities in the functional food sector, where whey protein can play a key ingredient.

Chart 16.4 illustrates the factors that have contributed Volac International Limited’s success in business development strategy leadership.

Chart 16.4
Protein Ingredients Market: Business Development Strategy Leadership Award - Volac International Limited (Europe), 2005

Innovative Technology and Development of Products

Over the years, Volac has expanded its business by investing in product development processes and technology that are highly flexible. This in turn has helped the company to stay responsive to the specific needs of the end-user sectors. For example, it can manufacture
whey protein concentrates for food applications as well as lactose-based products for animal feed.

Volac has been instrumental in the development of innovative technologies that have helped drive the industry to healthy livestock nutrition production solutions. It has discovered a unique process to manufacture nutritionally superior milk replacers with the help of high value globular proteins. The company’s production facility in Felinfa ch now produces thousands of tonnes of a high quality milk replacer, colostrum substitute and whey protein ingredients every year.

Volac’s pioneering achievements include:

■ Introduction of the first instantised milk replacers
■ Development of the big bale silage wrapping system
■ Development of Megalac protected fat, the natural alternative to feed antibiotics Gardion
■ The alkaline whole crop preservation system

Market Significance

The whey products industry has been traditionally dominated by large companies, who are also active in other sectors of milk production, such as cream and cheese production. Whey products represent a relatively small part of their business and often decisions need to take into account a number of different factors.

In contrast, Volac is a specialist producer of whey products, for animal feed and for high value human foods applications. Given its size, it can remain responsive to the changing needs of the market. The company has carved a niche for itself in the European whey protein market by implementing a number of market penetration and business development strategies.

Major Strategic Moves for Business Development

The whey protein market is vulnerable to a number of external factors such as raw material supply, changing EU subsidies and regulations. Volac International has taken into consideration these factors when it was developing its strategies.

In a strategic move to strengthen its position in the European market, the company formed a joint venture with Kass, Netherlands to build a new whey products plant in Holland. This would be among the largest and most efficient facility in Europe with a production capacity approaching 50,000 tonnes of dried products per year. Kass is currently one of the largest cheese producers in Netherlands, and this new operation gives Volac improved access to raw material supplies from the cheese industry.
Volac has invested £2m to increase the production capacity of its Felinfach facility. The investment was jointly funded by the Welsh Assembly and the Welsh Development Agency. This strategic move would enable Volac to increase its presence in specific industry sectors, which will in the long term lead to a greater share of the market.

**Conclusion**

As a specialist whey products producer, Volac has successfully grown its business by its high production performance, strategic decisions and careful attention to product development and specification. The company is a deserving recipient of the 2005 Frost & Sullivan Business Development Strategy Award in the European Whey Protein Market.
### Database of Key Industry Participants

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