Size, Share, Sources and Segments: Analysis and Forecasts for Value-added Protein Ingredient

Christopher Shanahan, Global Program Manager, Food Ingredients & Feed
Frost & Sullivan

2014 Protein Trends & Technologies Seminar
April 8, 2014
Arlington Heights, IL, USA
Today’s Agenda

• Market Overview of the Global Protein and Amino Acid Ingredients Market
• Mega Trends and Opportunity Identification in the Protein and Amino Acid Ingredients Market
• Final Remarks and a Look into the Crystal Ball
Market Overview of the Global Protein and Amino Acid Ingredients Market
Market Segmentation of the Global Protein and Amino Acid Ingredients Market

The protein ingredients product space is highly fragmented, where there is a lot of competition for a limited number of end applications. This makes the importance of quickly identifying and addressing opportunities and threats critical.

Protein Ingredients

Animal Protein Ingredients
- Milk Protein Concentrate (MPC)
- Whey Protein Isolate (WPI)
- Whey Protein Concentrates (WPC35 and WPC80)
- Whey Protein Hydrolysate (WPH)
- Casein/Caseinates

Plant Protein Ingredients
- Soy Protein
  - Soy Protein Isolate (SPI)
- Wheat Protein
- Pea Protein
- Other Protein
  - Rice Protein
  - Potato Protein
  - Canola Protein

Amino Acid Ingredients

Animal and Plant Source which includes
- L-glutamate
- D, L-Methionine
- L-Lysine HCL
- Glycine
- L-Phenylalanine
- L-Aspartic acid
- L-Threonine
- L-Cysteine
- D, L –Alanine
- L-Glutamine
- L-Arginine
- L-Tryptophan
- L –Valine
- L –Leucine
- L –Alanine
- L –Isoleucine
- L –Histidine
- L –Proline
- L –Serine
- L - Tyrosine
Steady demand from nutritional applications such as nutritional formulas, infant formulas, milk-based nutritional drinks, sports nutrition, and weight management products drives the demand for a wide range of protein and amino acid ingredient solutions.

**Steady** demand for protein and amino acid ingredients is driven by:

1. **Market Size (Revenue)**
   - **Market Size (Revenue)**: $46.83 billion (2013)
   - **Market Revenue Size CAGR (2013-2020)**: 7.0%

2. **Market Size (Unit Shipment)**
   - **Market Size (Unit Shipment)**: 7,834,000 MT (2013)
   - **Unit Shipment CAGR (2013-2020)**: 5.7%

**Top Three Growth Factors**

1. **The food industry is looking for improved functionality from its specialist protein ingredients. The demand for such products will continue to drive demand.**
2. **Emerging regions are creating new opportunities for all protein and amino acid suppliers.**
3. **The industry’s drive to promote the potential health benefits of protein and amino acids spurs demand.**

Note: All figures are rounded. The base year is 2013. Source: Frost & Sullivan analysis.
Proteins and Amino Acids—Market Size By Region

Proteins and Amino Acids: Unit Shipment by Region, Global (2013)

Europe
2013 Market Size: 2,547 ('000 MT)
A mature market, Europe represents 33% of the global consumption.

United States
2013 Market Size: 2,633 ('000 MT)
Contributes 34% of global consumption and is approaching market maturity.

Asia-Pacific
2013 Market Size: 1,689 ('000 MT)
Fastest growing region due to growth in infant formulas.

Rest of the World
2013 Market Size: 965 ('000 MT)
Rest of World is also fast growing sector due to general and infant nutrition growth

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan
Total Proteins and Amino Acid Ingredients—% of Sales by Chemistry/Source

Animal-based proteins is the largest segment in the total market for proteins and amino acids. The advantages that animal-based proteins offers include convenience and ease of formulation, consistent performance, and better product stability and functionality.

Source: Frost & Sullivan analysis.
Specifically in the protein segment, it is expected that the incumbent ingredients will continue to dominate the market, but niche ingredients such as pea, rice, and canola-based protein ingredients will emerge as serious contenders.
Egg proteins hold the largest segment as its more preferred by food formulators for its emulsifier, sensory, and textural properties. Dairy proteins are more preferred in higher-valued applications such as sports and infant nutrition formulas.

**Animal Protein Ingredients Market: % of Revenue by Category, Global, 2013**

- Egg Proteins: 69.9%
- Whey Proteins: 12.5%
- Casein/caseinates: 7.5%
- Gelatin: 4.6%
- Collagen: 1.9%
- MPCs: 3.7%

Source: Frost & Sullivan analysis.
Soy proteins, the market leader in the plant-based protein space, offer formulators a cost-effective way to reduce fat and match or increase the protein content of a variety of dairy products such as cheese, milk, frozen dairy desserts, whipped toppings, yogurt and coffee whiteners.

**Plant Protein Ingredients Market: % of Revenue by Category, Global, 2013**

- Soy protein isolate: 26.7%
- Soy protein concentrate: 32.2%
- Wheat: 22.2%
- Pea: 0.2%
- Textured soy protein: 18.5%
- Others (rice & canola): 0.1%

**Pea Proteins**

Pea proteins are one of the few plant protein ingredients that scores high on organoleptic acceptance by consumers. Pea protein isolates typically consists of 85 percent protein. Applications include meat substitutes, processed foods such as soups, sauces, and baked goods, snacks, nutraceuticals, and sports nutrition.

Source: Frost & Sullivan analysis.
Proteins and Amino Acid Ingredients—Product Attribute Selection Criteria

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioavailability</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Regulatory compliance</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Green Source</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Efficacy</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Cost effectiveness</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Water solubility</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Organoleptic Properties</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
<tr>
<td>Storage form</td>
<td></td>
<td>![Yellow]</td>
<td>![High]</td>
</tr>
</tbody>
</table>

Cost effectiveness and organoleptic properties play a key role in protein and amino acid ingredient selection by customers.

- **Bioavailability**: Protein and amino acids formulated into food should be stable and bioavailable for the complete period.
- **Regulatory compliance**: It is important that ingredients are regulatory approved for their health benefits.
- **Safety**: Safety is an important attribute as ingredients are processed in foods.
- **Green Source**: Green source of ingredients acts as a value added benefit for customers in marketing their functional food.
- **Efficacy**: Ingredient performance should be evidently demonstrated, through comparative analysis.
- **Cost effectiveness**: Cost effectiveness plays a key role in ingredient selection as the volume required is very high for food processing.
- **Water solubility**: Water solubility of proteins is critical, as food manufacturers are looking for ingredients that are completely soluble.
- **Organoleptic Properties**: Organoleptic properties improvement is imperative for sustaining growth.
- **Storage form**: Protein and amino acids should be available in solid, liquid and powder form for easy compatibility with different type of foods.

Source: Frost & Sullivan analysis.
Protein Ingredient Usage Trends

At the total level, functional demand of proteins hold the largest share with 59.8 percent. The functional properties are often enhanced by associated nutritional benefits.


- Egg Proteins: 88% Functional Benefits, 12% Nutritional Benefits
- Dairy Proteins: 56% Functional Benefits, 44% Nutritional Benefits
- Gluten: 60% Functional Benefits, 40% Nutritional Benefits
- Soy Protein: 60% Functional Benefits, 40% Nutritional Benefits
- Wheat gluten: 85% Functional Benefits, 15% Nutritional Benefits
- Other Plant protein: 70% Functional Benefits, 30% Nutritional Benefits
Mega Trends and Opportunity Identification Assessment for Protein Ingredients
The Objective is to Filter Top Level Mega Trends into Actionable Portfolio Prioritization

Identified core total addressable market and specific opportunities

Final output: Prioritized sustainable addressable markets and potential opportunities

Mega Trends Identification and Prioritization

Determination Which Addressable Markets are Sustainable and Driven by Mega Trends

Detailed analysis of specific need-based opportunities in each sustainable addressable market to provide actionable data and outcomes
Heart Health Ingredients Market—Opportunity Overview

Cardiovascular disease is the most costly non-communicable disease in the world in terms of medical spending and mortality. Protein ingredients have a big play here in this space if managed wisely.

• Cardiovascular diseases is a major cause for mortality globally. This factor drives the demand for heart healthy functional foods.
• The key heart health ingredients include proteins, omega-3 fatty acids, phytosterols, and fiber.
• The current trend in this market is to develop specialized ingredients for targeted applications such as cholesterol lowering, blood pressure control, and heart energy.

Source: Frost & Sullivan
The frequency of cardiovascular death is correlated more with access to health care services as opposed to demand for services. Thus, this unmet need in emerging economies could feasibly be addressed by value-added nutritional protein ingredients.
Weight Management Solutions is Needed

Obesity is a leading current and future indicator for the prevalence of heart disease, and consequently an effective indicator of where the demand for nutritional protein ingredients is and will be in coming years.

* % of total adult population with a BMI>30 kg/m2, based on measures of height and weight

Source: OECD Health Data 2012
Protein and Amino Acid Ingredient Opportunity—Focus on Sports Nutrition

Sports Nutrition Ingredients Market: Unit Shipment and Revenue Forecast, Global, 2013-2020

- The global market for proteins and amino acids for sports nutrition applications is a high growth sector overall, expected to pegged at over 8% growth during the forecast period.

- Dairy-based ingredients is expected to hold its market dominance during the forecast period, but plant-based and algae proteins (contained in ‘others’) is expected to cut into this lead.

Sports Nutrition Ingredients Market: Revenue Share by Ingredient Type, Global, 2013-2020

- Powders and bars will remain the most popular protein delivery format in the sports nutrition space over the course of the forecast period.

Note: All figures are rounded; the base year is 2013. Source: Frost & Sullivan analysis.
Economic Development drives the demand for higher nutritionally-valued food products.

Based on current projections, it is expected that by 2030, East Asia will surpass the North America as the biggest global economy in terms of total gross domestic product.

- During the forecast period, China will likely become a first world country in terms of economic might and, coupled with the continued economic strength of Japan and South Korea, will make East Asia the global center of economic activity.
- However, North America will continue to be an economic powerhouse and the primary bread-basket of the world.
- West Europe will eventually shake off the currently Long Recession and maintain its place as the third pillar of the global economy.

Note: MENA = Middle East and North Africa. EE&CA = East Europe and Central Asia.
### Economic Development: What is Urbanization?—Centers of Demand for Value-added Food Products

By 2025, globally there will be 21 Mega Regions. Shanghai and Guangdong Mega Region to house 9% of total population of China and increasingly fuel its economic development. Understanding food use drivers will highly dependent on understanding the various needs of these urban agglomerations.

![Map of Mega Regions](image)

**Population above 40 Million**
- Beijing-Tianjin
  - 51 Million

**Population between 20-40 Million**
- Greater Los Angeles
  - 20.9 million
- Greater Sao Paulo
  - 28.78 million
- Greater Jakarta
  - 29.8 million
- Greater Bangkok
  - 19.2 million
- Tri State Area
  - 36.86 million
- Washington DC Baltimore Area
  - 15.63 million
- Lagos and Eko
  - 25 million
- Greater Rio de Janeiro
  - 17.24 million
- Greater Sao Paulo
  - 17.64 million
- Marmara Mega Region
  - Istanbul, Kocaeli
  - 20.58 million
- New Delhi, Noida, Greater Noida, Ghaziabad
  - 28.53 Million
- Gurgaon, Faridabad
  - 28.91 Million

**Population between 15-20 Million**
- Greater Jakarta
  - 34.42 Million
- Guangdong Region
  - 58.75 Million
- National Capital Region in the Philippines
  - 27.75 Million
- Lagos and Eko
  - 15.63 million
- Greater Rio de Janeiro
  - 17.24 million
- Greater Sao Paulo
  - 28.78 million
- Greater Buenos Aires
  - 36.48 million

Protein demand is highly correlated to population growth in emerging regions and associated growth in meat and dairy consumption.

The East Asia (which includes China, Japan, and Korea) and South Asia (which consists of India, Pakistan and Bangladesh) regions are the engines of growth in global populations.

- Continued growth in Asia is expected to continue and any significant shocks to their respective economies (both market and political) will have increasingly greater ripple effects on all other regions.
- Africa, which is defined here as all nations south of the Sahara desert, is expected to significant population growth during the forecast as this part of the world becomes increasingly more economically developed.

A general rule of thumb which is validated through many historical observations, as a given region’s income increases, so does its taste for food rich in animal proteins, and thus the demand for proteins.

• The production of meat products through raising livestock is very cereal use-intensive and consequently the demand for cereal increases markedly when the demand for meat products increases. This in turn will drive cereal prices upward in heavy meat consuming regions.

• For example, in the United States, the per capita demand for cereal is more than double due to its population’s generally high level of income and consequently animal protein-rich diet.

• Today, India’s per capita level of income and cereal demand is relatively low for an emerging nation, but it is expected that even if and when India’s per capita income increases, per capita meat consumption will remain low due to cultural factors.
Final Remarks and a Look into the Crystal Ball
<table>
<thead>
<tr>
<th></th>
<th>The global protein and amino ingredients market is a relatively fragmented and competitive, meaning price matters.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The consumption pattern of protein ingredients varies across geographies and by income. Hence, higher-valued concentrated ingredients are more prominent in the west than the east.</td>
</tr>
<tr>
<td>3</td>
<td>Vertical integration is a critical success factor in this market.</td>
</tr>
<tr>
<td>4</td>
<td>As the market is becoming more technology intensive, increase in R&amp;D spending serves as a competitive edge.</td>
</tr>
<tr>
<td>5</td>
<td>Best practices like customer service, product differentiation and value addition boost company growth.</td>
</tr>
</tbody>
</table>
Suggested Promotion Strategy—Communicating Health Care Cost Savings

Understanding the link between smart prevention and health care cost savings will help key stakeholders, including patients, health care professionals, governments, insurance companies and employers, make better-informed decisions on the best course of action that minimizes current and future health care costs and maximizes long term potential benefits.

- A significant amount of scientific research has been conducted involving dietary supplements and many demonstrate a positive impact on reducing the risk of a disease event through supplement use.
- Disease events require costly treatment services, but until now there has been little effort to effectively calculate the cost-effectiveness of such supplement use.
- Our report demonstrates that significant cost savings can be realized through the smart use of scientifically-substantiated dietary supplements among high risk populations.
Once the expected risk reduction factor is derived from the scientific literature review, the potential cost savings derived from increasing nutrient intake among a given high risk population can be calculated.

**Determine Hospital Utilization Costs in the Current State**

- **Avoided Hospital Utilization Costs Given 100% Use of Dietary Supplement Regimen at Preventive Intake Levels**

- **Revised Hospital Utilization Costs Accounting for Dietary Supplement Usage**

- **Costs of Dietary Supplement Utilization**

- **Potential Net Cost Savings from Dietary Supplement Usage**
Finally...the end. But before we go, let’s look into the Crystal Ball

Marketing to Healthcare Providers

- Increasingly, dietary supplement companies are directly marketing to healthcare providers for two key reasons—it increases the creditability (and differentiation) of product attributes in the minds of the final end user and it is a way to avoid the marketing noise many companies face in the dietary supplement channel.

“Over-the-Counter”-like Marketing will be the New Normal

- In the long run, consumers will increasingly prefer a non-prescription option due to personal budget and hassle constraints. The key challenge that could emerge however is to ensure that the market won't further digress into the noisy dietary supplement channel dynamics.

The Global Demand for Cereal will Drive Up Food Prices Across the Board

- As stated, the production of meat products through raising livestock is very cereal use-intensive and consequently the demand for cereal increases markedly when the demand for meat products increases. This is a prime, and growing, opportunity for protein ingredient suppliers to help supplement nutritional needs in the emerging world where meat is still a luxury.
1. The Health and Wellness Mega Trend will sustain the growth of the protein and amino acid ingredients market.

2. Pea, canola, rice, and algae-based protein suppliers are ready to compete....are you?

3. The new emerging markets (beyond BRIC) represents a promising potential for global protein and amino acid manufacturers to penetrate.

Source: Frost & Sullivan
Christopher Shanahan
Global Program Manager
Food Ingredients & Feed

210-477-8419
christopher.shanahan@frost.com

10+ years experience in agricultural, chemical, and natural resource markets. Expert in ingredients, chemicals, material, and agriculture markets with a focus on food & agriculture, organic polymers, energy, and natural resources

Education
Master of Science in Agricultural Economics, The Ohio State University,
Legal Disclaimer

Frost & Sullivan takes no responsibility for any incorrect information supplied to us by manufacturers or users. Quantitative market information is based primarily on interviews and therefore is subject to fluctuation. Frost & Sullivan research services are limited publications containing valuable market information provided to a select group of customers. Our customers acknowledge, when ordering or downloading, that Frost & Sullivan research services are for customers’ internal use and not for general publication or disclosure to third parties. No part of this research service may be given, lent, resold or disclosed to noncustomers without written permission. Furthermore, no part may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the permission of the publisher.

For information regarding permission, write to:

Frost & Sullivan
331 E. Evelyn Ave. Suite 100
Mountain View, CA 94041

©2014 Frost & Sullivan. All rights reserved. This document contains highly confidential information and is the sole property of Frost & Sullivan. No part of it may be circulated, quoted, copied or otherwise reproduced without the written approval of Frost & Sullivan.