ESTIMATING INDIA'S SOY PROTEIN CONSUMPTION AND EXPORTING SOY PRODUCTS TO INDIA

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by
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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

ESTIMATING INDIA'S SOY PROTEIN CONSUMPTION AND

EXPORTING SOY PRODUCTS TO INDIA

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and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Joe Parcell

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ABSTRACT

India holds a large percentage of the world's population at over 16%. India is a relatively poor country with an estimated per capita gross domestic product (GDP) of only $650 compared to the U.S. at $39,000 in estimated 2007 U.S. dollars. Studies have shown that low income countries with growing incomes have experienced increased protein consumption. The growing population, along with a growing per capita income, show that India is poised for this consumption growth. However, 60-70% of India's population is vegetarian. Thus, the consumption growth is expected to occur in the non-animal protein category. The objective of this study is to determine India's soy protein demand over the next ten years based on income projections and then, determine if feasible, the amount of U.S. soybeans that will be needed to fulfill this demand. Lastly, a logistical assessment of moving identity preserved soybean protein products from the U.S. Midwest to India is discussed.

1. INTRODUCTION

India, a country with a large population, is experiencing rapid income growth. In most developing countries, diets are based on cereals, but as incomes increase, consumption shifts to other products. Previous studies on diet trends with respect to income show that as per capita income increases, consumption of protein in the format of meat also increases for low income countries. Since approximately two-thirds of India's population is vegetarian, much of the increase in protein consumption is expected to come from a non-meat source.

The first objective of this thesis is to determine India's protein demand over the next ten years. Soy protein is becoming more prevalent in the world marketplace. Major crop and oilseed processors are recognizing this demand and developing products accordingly. Market indicators show that soy protein products are in a position to fill this niche. The second objective of the thesis is to determine the economic feasibility of exporting value-added soy products to India from the U.S., a major oilseed producer, to fill the growing protein demand.

The political, economic, social, and technological (PEST) analysis was conducted to summarize the future potential of exporting U.S. soy to India. The analysis (Figure 1.1) shows that although there will be some obstacles, most macroeconomic variables show strong potential for the venture. One setback is that India lacks efficient contract enforcement regulations. This could shy potential U.S. exporting companies away from India due to the increased risk of Indian companies not paying specified prices, etc. Also, the Indian rupee has been declining in value to the U.S. dollar for the last several years.

However, the shear magnitude of the population and its growth rate shows India to have a food demand surpassing that of nearly all other countries. The growth in per capita incomes, dietary trends, and other macroeconomic trends show the U.S. is poised to be a forerunner in exporting soy products to India.

U.S. soybean processors are putting forth more resources to soy protein products than other categories, making it one of the fastest growing food categories. Many U.S. products contain soy protein products, unknown to consumers, for health and structure purposes. Soy protein isolates, for example, are mainly used to improve the texture of meat products. Other countries, however, consume soy protein products in more of a raw state.

India's current and projected population levels and the state of the economy show the country is poised for a transition of diets that are higher in protein content. The vegetarian complex of the country has caused protein demand be derived from products such as soy. The Indian government has been slowly moving towards more liberal trade agreements by doing away with quotas and making restrictions tariff-based as shown in the economic portion of the PEST analysis in Figure 1.1.. This has allowed countries such as the U.S. to begin exporting more soy products. India is also recognizing the increasing trend in soy protein consumption. The number of soy food processors and soy products have greatly increased over the last 5-10 years.

Figure 1.1. Pest Analysis- Exporting Soy Protein Products to India

PEST Analysis: Soy Protein and India

Political

- India has a low political stability, ranking in the bottom 10% of all countries and lacks efficient contract enforcement
- IP protection in India surpasses that of most other Asian countries
- Cost of importing goods to India is lower than the average of all countries
- Indian businesses incur relatively high tax rates
- Require processed products to be processed in country and not imported

Economic

- Integration from quotas to tariffs, conforming to more open trade
- Most soy products incur duties and taxes of 36%
- Indian Rupee has been declining in value to the U.S. dollar since 2000 along with 5% annual inflation
- India ranks in the top five countries for both miles of roadways and railways
- Low workforce skill level (<60% literacy level) and low labor costs
- High economic growth rate, ~9%
- Strong demand for non-meat protein sources

Social

- Concentrated population- over 1.1 billion people in an area 1/3 the size of the U.S.
- Over 25% of population living below poverty line
- Population growth at over 1.5% annually
- Large working population with 60% in agriculture
- Religions: Hindu 80.5%, Muslim 13.4%; 60-70% of population estimated to be vegetarian
- Population is showing an increased state of health consciousness

Technological

- Currently nearly repressed in terms of economic freedom and product availability
- India has the knowledge potential to grow more technologically but has a slow technological diffusion rate
- Soy protein production is relatively straight forward and indicators show the Indian population will accept soy protein products

This thesis uses meat price, along with income, population, and dietary trend data, to determine India per capita protein consumption. Data on consumption and prices of beef, pork, poultry, and sheep for Asian countries were collected from the Food and Agriculture Organization of the United Nations. This database had an extensive record of price, production, consumption data, etc. for most countries in the world. Two countries, Hong Kong and Taiwan, were however dropped from the dataset for not having enough data available. A single annual weighted meat price for each country was used in the estimation of per capita meat consumption.

Macroeconomic data such as per capita GDP, population, and exchange rate data were collected from the U.S. Department of Agriculture. Per capita GDP, reported in 2000 dollars, was used as a proxy for per capita income. Quantity data was converted to short tons for all estimation measures. Additionally, per capita meat consumption was obtained by dividing meat consumption by total population for each country to determine pounds per capita. All data was collected for the selected countries from 1990-2005 while the meat price data was only available from 1991 to 2003. Thus, 1991-2003 was the estimation period utilized in this study.

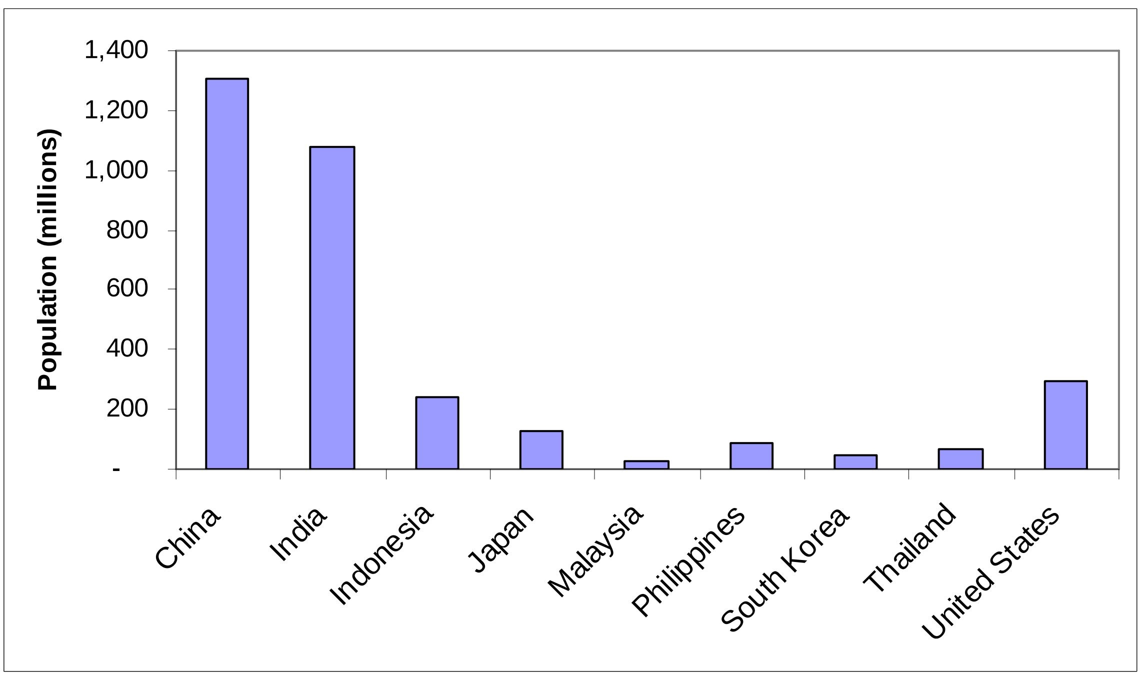
Evidence of the per capita income to meat consumption is illustrated in Figure 1.2 where the U.S. is included for comparison purposes. There was a strong positive correlation between per capita meat consumption and per capita GDP over the 1990-2005 time period with the exception of Thailand. In 2003, the U.S. had both high per capita income and meat consumption per capita of all selected countries, indicating the U.S. is a more developed country relative to the Asian countries in the study. The Philippines, Thailand, Indonesia, India, and Korea had meat consumption levels of less than half of that of the U.S. with incomes less than one-third of the U.S. income level. Exceptions to this included China and Malaysia having relatively low per capita income levels but high per capita meat consumption. On the other end of the spectrum, Japan is experiencing relatively low per capita meat consumption with per capita income levels surpassing that of the U.S. India, however, has the lowest per capita income and meat consumption levels of the entire sample. India is currently in a position to have a major shift in dietary patterns as shown by increasing per capita income levels. This change in food demand is further magnified by the shear population size and makeup of the country.

Additionally, 2005 population and income levels for the countries used in the study are shown below in Figures 1.3-1.4 along with meat price and consumption levels in Figures 1.5 and 1.6. India ranks lowest in income, meat price, and meat consumption per capita.

Figure 1.2. Per Capita Real GDP and Meat Consumption by Country, 2003

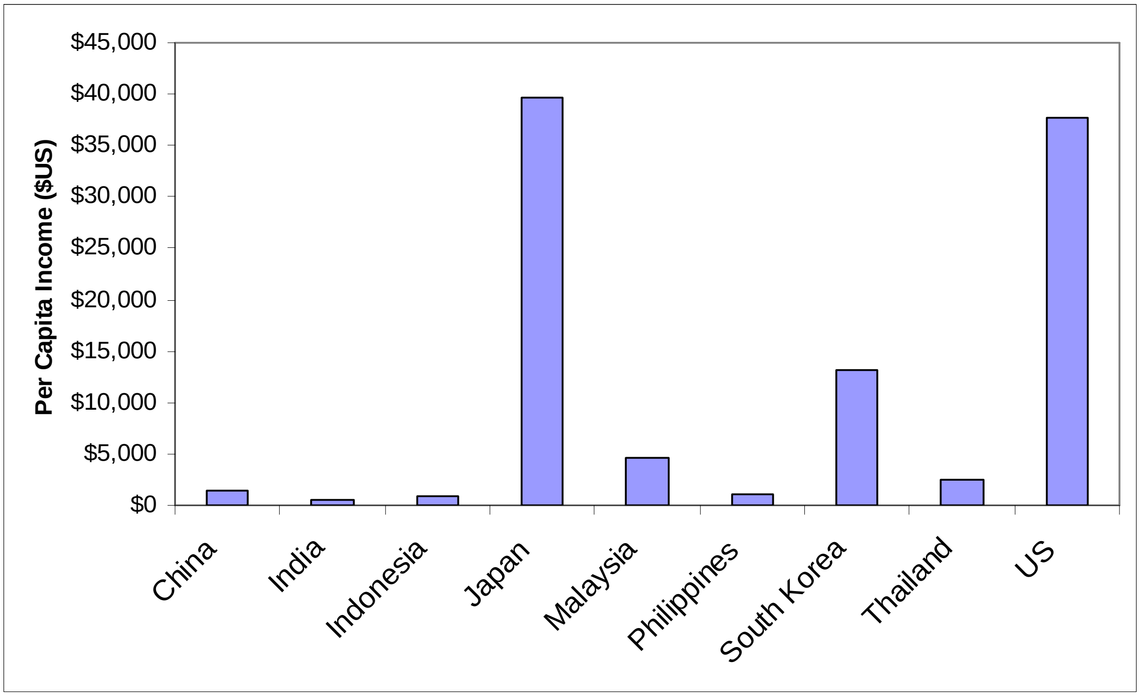
Source: USDA ERS and FAO Stat

Figure 1.3. Population Levels of Selected Countries, 2005



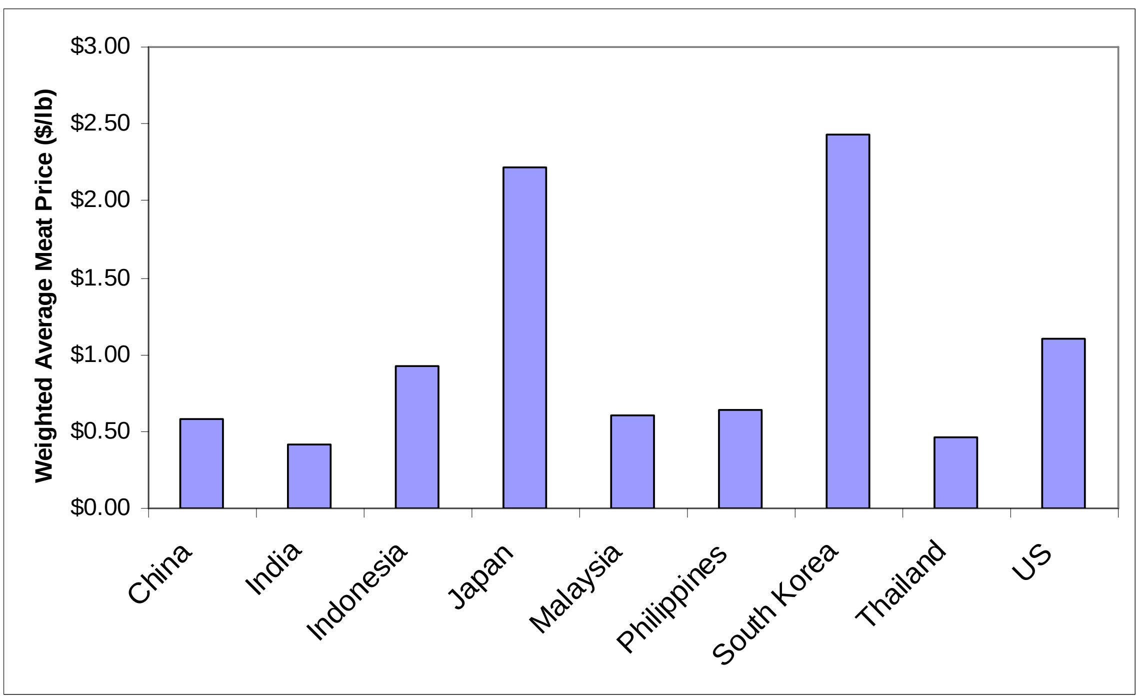
Source: USDA ERS

Figure 1.4. Per Capita GDP Levels of Selected Countries, 2005



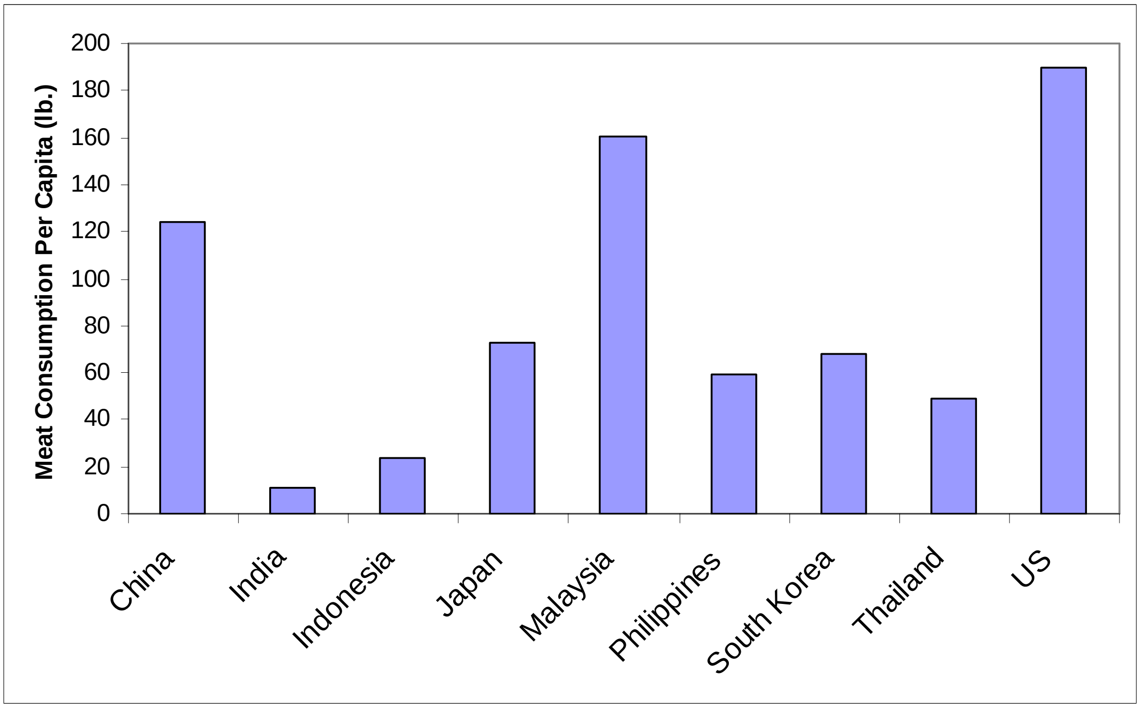
Source: USDA ERS

Figure 1.5. Weighted Average Meat Price for Selected Countries, 2005



Source: FAO Stat

Figure 1.6. Per Capita Meat Consumption Levels of Selected Countries, 2005



Source: FAO Stat

The set-up of this thesis does not follow the traditional outline as it is structured more closely to a feasibility study given the nature of the problem. India's large and growing population will need to continue to eat. Increasing incomes show India will be consuming healthier foods, increasing protein intake from non-meat sources. Soy protein is a likely source for this increased demand to come from. The U.S., with the infrastructure and ability, is set to readily supply India with the soy protein products associated with the new diets. This demand could account for a substantial amount of current U.S. soybean production and provide business opportunities for U.S. soybean processors.

2. LITERATURE REVIEW

The majority of previous research completed on protein consumption focuses on increased meat consumption with increased per capita incomes. However, evidence suggests the same principles associated with income and meat demand can be applied to India with non-meat sources of protein.

2.1. World Protein Consumption

A shift in global dietary patterns is taking place, resulting in the world now eating more meat than ever before. The growing middle class worldwide is adopting diets including much more protein (Holmes, 2001). In the case of Japan, which has recently climbed out of developing country status, showed meat consumption increase 360% from 1960-1990. Globally, meat consumption doubled over the same time period. Much of the growth in meat demand in developing countries is taking place in a few large nations, especially China and Brazil, which have accounted for more than half the increase in per capita meat consumption in developing nations over the last two decades.

2.2. Microeconomic Model of Food Consumption and Income

Food demand is estimated in many studies as this directly affects many aspects of the agricultural industry. Lin et al. (2003) researched food and agricultural commodity consumption, estimating U.S. consumption out to 2020. Their results found that U.S. consumption of food commodities is projected to rise through the year 2020, mainly due to an increase in population. However, the mix of commodities is expected to change due to a shift in demographic variables. These shifts are a result of an older and more diverse population, rising income, higher educational attainment, improved diet and health knowledge, and growing popularity of eating out. Using the projected values for the economic, social, and demographic characteristics, future food consumption was predicted for the years 2000, 2005, 2010, 2015, and 2020.

The basic food consumption model used in this study sets the per capita food consumption equal to a function of the price of food items, the price of nonfood goods and services, income, and social/demographic variables as shown below. The econometric model used is shown in Equation 1:

$$(2.1) \quad F_{ij} = f\,(P_1, P_2, \ldots, P_n, P_{gs}, Y_j, X_j)$$

where F_{ij} is the amount of i^{th} food consumed by j^{th} individual; P_i is the price of ith food; P_{gs} is a price index for nonfood goods and services, Y_j is income, and X_j is a vector of social and demographic characteristics of the individual j. Most food consumption studies utilize the same basic equations estimating quantity as some function of price, price of other goods, income, and sometimes other variables as well.

2.3. India Economic Growth

India is often characterized as a lumbering elephant when compared to the tigers and dragon of Southeast and East Asia. According to Landes (2004), the agricultural sector has outgrown the policies that contributed to past success. India’s economy has grown at an annual rate of 5.7 percent since 1980, ranking the country among the fastest growing economies. India is now facing new pressures as consumer incomes rise. The middle class of the world's second most populous nation is becoming wealthier and seeks greater diversity in food products. Average India households spend over half of their incomes on food. This, coupled with changing trade policies, is even changing food demand patterns. Many Indian consumers are spending more of their income on diversifying and upgrading their diets.

2.4. Religion and Practices

According to AsianInfo.org (2007), in India, religion is a way of life. Over 80% of India's population is Hindu with Muslims (13%) being the next largest religious group. Hinduism encourages being vegetarian and avoiding the eating of any animal meat or flesh. However, not all Hindus choose to practice vegetarianism, and they may follow the religion's dietary codes in varying degrees of strictness. Some Hindus refrain from eating beef and pork, which are strictly prohibited in the Hindu diet code, but do eat other meats (ElGindy, 2005). Muslims are restricted from consuming pork of any form. The consumption of meat products from goat, sheep, poultry, and cattle is allowed granted the animal was slaughtered by a Muslim according to Islamic rules.

2.5. Consumption and Income

The majority of previous research completed concerning food demand show that per capita income level is the most important factor affecting food consumption patterns. Studies concerning protein demand have focused on animal-source protein, relating meat consumption with income growth. Animal meat the most common source of protein around the world.

In *Income Growth and International Meat Consumption* by Schroeder, Barkley, and Schroeder (1995), international meat consumption is evaluated in an attempt to make a global model of meat consumption by quantifying the relationship between income growth and meat consumption. Looking at beef, pork, poultry, and lamb consumption data from 32 countries, the study found that meat consumption is particularly responsive to increases in income. Results showed that high income countries have experienced relatively constant per capita meat consumption while low income countries with growing income have experienced increasing meat consumption. A strong positive relationship existed between per capita meat consumption and per capita gross domestic product (GDP). In low income countries, the four meat categories were found to be normal goods, but as income levels increase, income elasticities were found to decrease. This shows that per capita meat demand does not grow as fast as income as countries become more developed. At higher income levels, lamb and poultry products appeared to become inferior goods. Also, high income countries typically did not increase per capita consumption with income growth; the high income countries are already at full consumption levels of meat products.

In *Global Food Consumption and Impacts on Trade Patterns* by Gehlhar and Coyle, it is stated that changes in consumption patterns are driven primarily by per capita income growth. Additionally, income growth on import demand differed from developed to developing countries. Developing countries showed a shift from basic staples to higher value meat products while developed countries shifted toward further processed and non-bulk commodities. These shifts may also be induces by diversification of consumption rather than increased per capita consumption alone. It is also stated that although, in the case of China, rapid economic growth has not greatly changed import demand for meat, the country domestically increased production to cover most demand needs.

China has been in the spotlight in the last decade in the area of food demand. Shono et al. (2000) researched China's diet patterns. FAOSTAT data from 1992-94 was compiled on per capita daily supply of grain, vegetables, meat, dairy, and seafood products for over 120 countries. The goal of the study was to determine how China's dietary pattern was changing. Results concluded that Chinese diets were moving from the developing country group to the developed country group. However, the transition is not mimicking that of the U.S. and other Western countries. Rather, China is moving towards the dietary patterns of other developed Asian countries such as those in Japan and Hong Kong. In these developed Asian countries, diets depend on more seafood as a protein source than places like the U.S. In this case, fish consumption partially replaces meat consumption.

Sarma and Yeung (1985) determined that consumption of livestock products is claiming increased shares of disposable incomes in developing countries as per capita income rises. The study covered 104 developing countries in Asia, Africa, and Latin America from 1961-65 and 1973-77. Between the two time periods, meat imports for the developing countries increased by 80%. Meat products are a high-quality protein source, therefore, meat consumption increases the quality of a diet. At the time of the study, meat consumption was four to five time greater in developed countries compared to developing countries. Additionally, countries having income growth of greater than 5%

annually showed annual meat demand growth at more than double than that of countries with income growth of less than 1% per year.

Mintert, Schroeder, and Marsh (2002) reaffirm the notion of increasing disposable incomes increases meat demand in their study on beef. The study finds that U.S. consumer expenditures rose from less than 90% of disposable income in the early 1980s to near 98% by 1999. Additionally, it was discovered that beef demand increases by 0.90% for a 1% increase in total per capita expenditures.

In Growing Demand for Animal-Protein-Source Products in Indonesia: Trade Implications by Fabiosa (2005), elasticities were estimated from Indonesia's 1996, 1999, and 2002 National Socio-Economic Survey, or SUSENAS, data using a double-hurdle demand specification. The study suggests that Indonesian household diets are expected to undergo major changes as income growth levels are sustained. Most countries with growing incomes experience a diet "trading-up" effect in which low quality diets are replaced or partially replaced by animal-source protein. In the case of Indonesia, diets of cereal grains such as rice were shown to be replaced by diets of wheat based products along with animal based sources of protein.

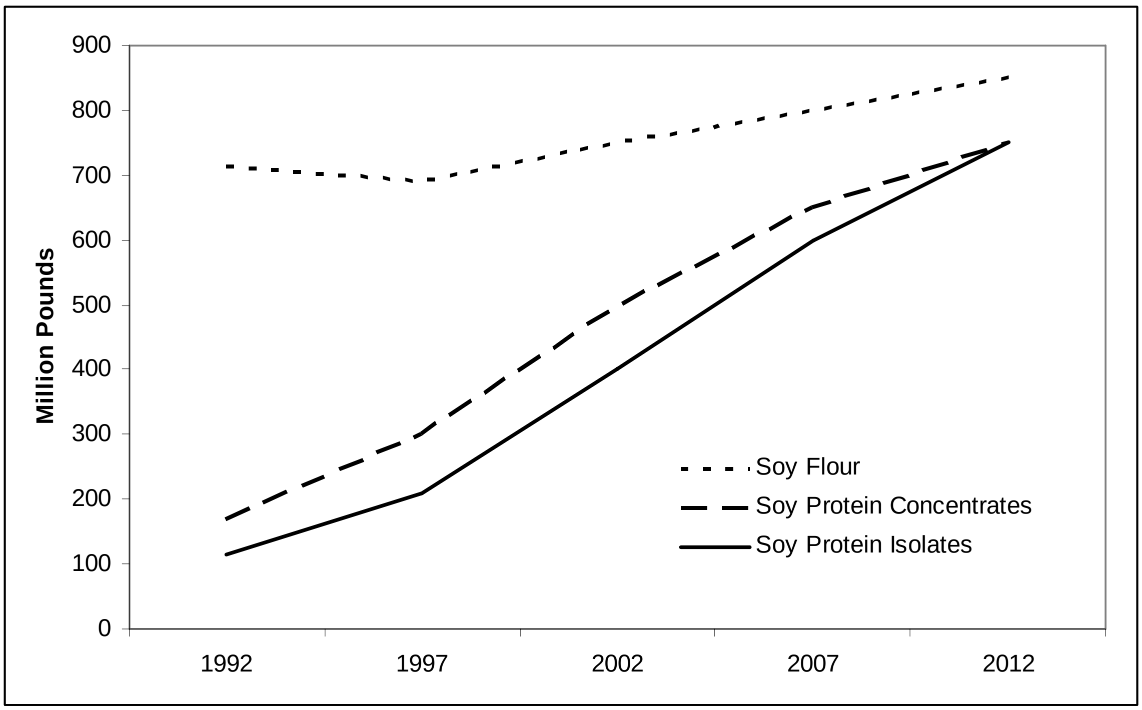
All eyes have been on China over the last few decades concerning dietary patterns and therefore trade opportunities (Cai et. al., 1998). An LA-AIDS model was used to determine price and income elasticities for different income classes of Chinese consumers. This study analyzed data composed of 11 annual observations from 1985-1995 from three income groups. Over the last two decades, Chinese per capita disposable income have shown extreme growth rates in urban households. The low income households were first concerned with consuming enough calories from the least cost source, usually rice in the case of China. As incomes rose, more variety and quality was added to their diets. Direct human consumption of cereal grains fell and meat consumption rose rapidly. Total meat expenditures to total food expenditures increased from 14% in 1990 to 24% in 1994 showing this change.

3. INDUSTRY OVERVIEW

3.1. Protein Demand

There is an increasing trend in the U.S. in the consumption of soy products as shown in Figure 3.1.1. This trend is especially evident in the soy protein concentrate and isolate categories with sharp growth trends over the last 10 years. Soy processors, as mentioned in later sections, are recognizing this demand growth and adjusting accordingly.

Figure 3.1.1. U.S. Further Processed Soy Product Demand, 1992-2012



Source: Freedonia

In the U.S., many of these products are not consumed as standalone goods. Rather, they are used as food additives for adding desired characteristics. Regardless of the use, soy protein is continuing to be more prevalently consumed in the U.S.

3.2. Soy Complex

Worldwide, 10,256 million bushels of soybeans are consumed. After the crush, over 167 million tons of SBM and 39 million tons of soy oil are consumed (FAPRI, 2006). This is equivalent to approximately12 pounds of soy being consumed per capita.

In the U.S., nearly all soybeans are crushed to extract the oil from the resulting meal. According to the USDA, most soybean meal (SBM) goes to livestock feed. FAPRI reports 2,521 million bushels of soybeans are currently consumed annually in the U.S. From this, nearly 10 million tons of soy oil and over 33 million tons of SBM can be made which is further processed into more higher-value products. The most common of the soy protein products include soy flour, soy protein concentrates, and soy protein isolates.

3.3. Soy Flows

The U.S. currently leads the world in soybean production. A record U.S. soybean production in 2006/07 raised world output by 4%. World production is expected to decline drastically in 2007/08 due to U.S. soybean planted acres down 15% from the previous year's record highs. This acreage reduction was due to a 19% increase in corn planted acres fueled by increased corn prices due to ethanol demand.

Although the U.S. is currently the largest soybean exporter, Brazil is expected to surpass U.S. levels with the 2008/09 crop and double U.S. exports by 2016 (USDA, ERS). The U.S. export reduction shown in Figure 3.3.1 is largely due to increased domestic use indicated by FAPRI. Some of the increases in domestic use could be from the increased consumption in soy protein categories. The United States, Brazil, and Argentina collectively account for more than 90 percent of world exports of soybeans, soybean meal, and soybean oil. Most of the projected growth in global soybean exports is expected to be satisfied from Brazil alone. The USDA states that Argentina continues to dominate world exports of soybean meal and soybean oil, as the country's modest domestic use and differential export taxes make it the most competitive place to process soybeans. Argentina taxes soybean exports at a higher rate than the exports of soybean meal and soybean oil, which favors demand by domestic processors.

USDA estimates show China as the leading importer of soybeans as illustrated in Figure 3.3.2. China’s projected import growth accounts for more than three-fourths of the projected gain in world trade by 2016/17. In many aspects, such as income and population growth, India is following in China’s footsteps only lagged by 10-20 years. Thus, India could become a major importer in the years to come only in soy protein products instead of raw soybeans. Just as Shono (2000) reports China as not following traditional dietary adjustments with increased income, India may very well begin to balance diets with soy protein.

Figure 3.3.1. Major World Soybean Exporters, 1995-2016

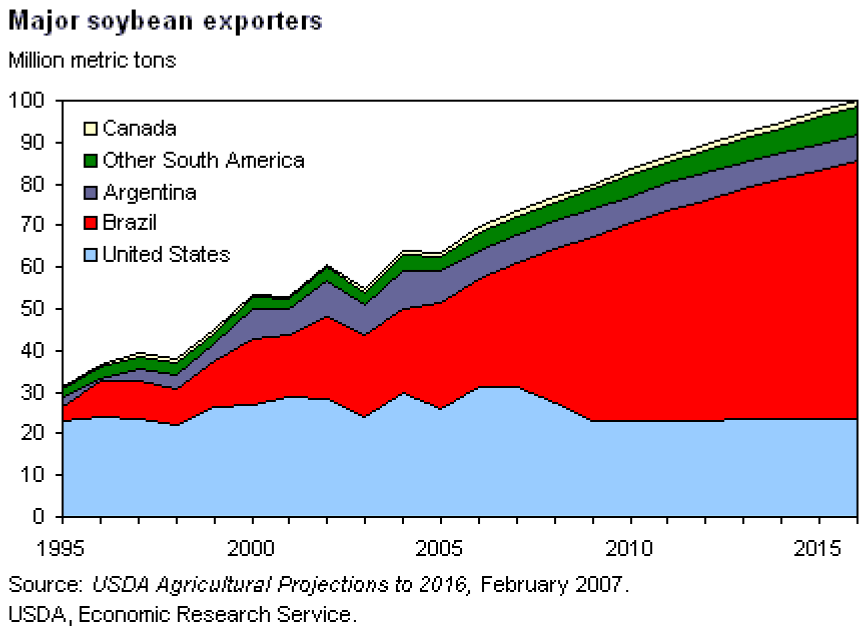
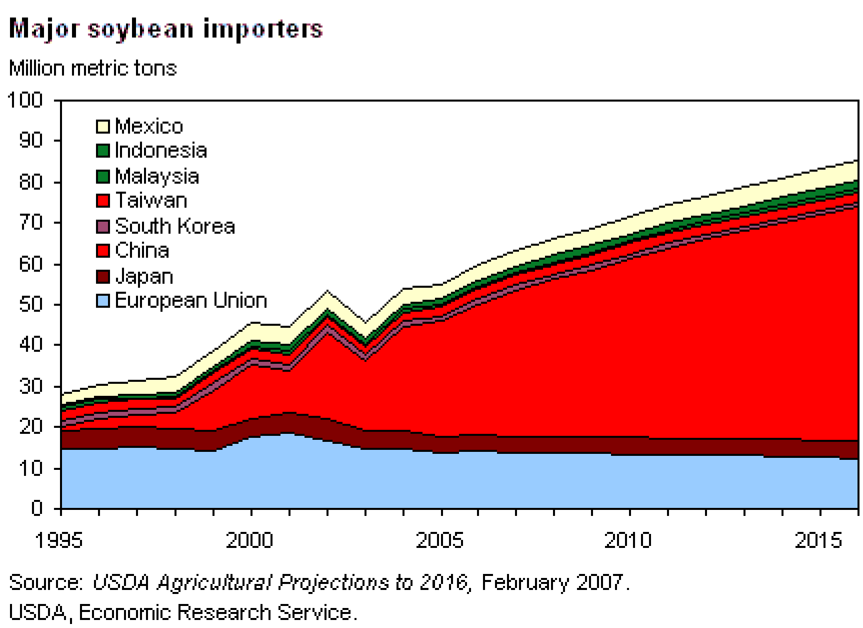


Figure 3.3.2. Major World Soybean Importers, 1995-2016



3.4. Industry Processors

Processors see the importance of soy protein products. Soy is versatile and very cost-effective for food manufacturers and food service providers to utilize. With the increased consumer demand for soy, it has become one of the fastest-growing food ingredient categories.

The U.S. soybean industry has been shifting resources toward production of soy based products, especially protein products. This can be seen in the Solae Company. The Solae Company is a strategic alliance founded in 2002 between DuPont and Bunge Limited to bring more soy-foods to the marketplace (Solae, 2004). DuPont is a science based company offering innovative products and services for agriculture, nutrition, safety and protection, and many other markets (DuPont). Bunge Limited is a leading grain and oilseed processor, manufacturing fertilizer, animal feed, baking ingredients, and food products (Bunge Limited). As more consumers are discovering the health benefits of consuming soy, a growing number of food manufacturers have introduced new and innovative products using Solae™ soy ingredients. As of September 2006, Solae produced nearly 75% of soy protein isolate and over 35% of soy protein concentrate worldwide.

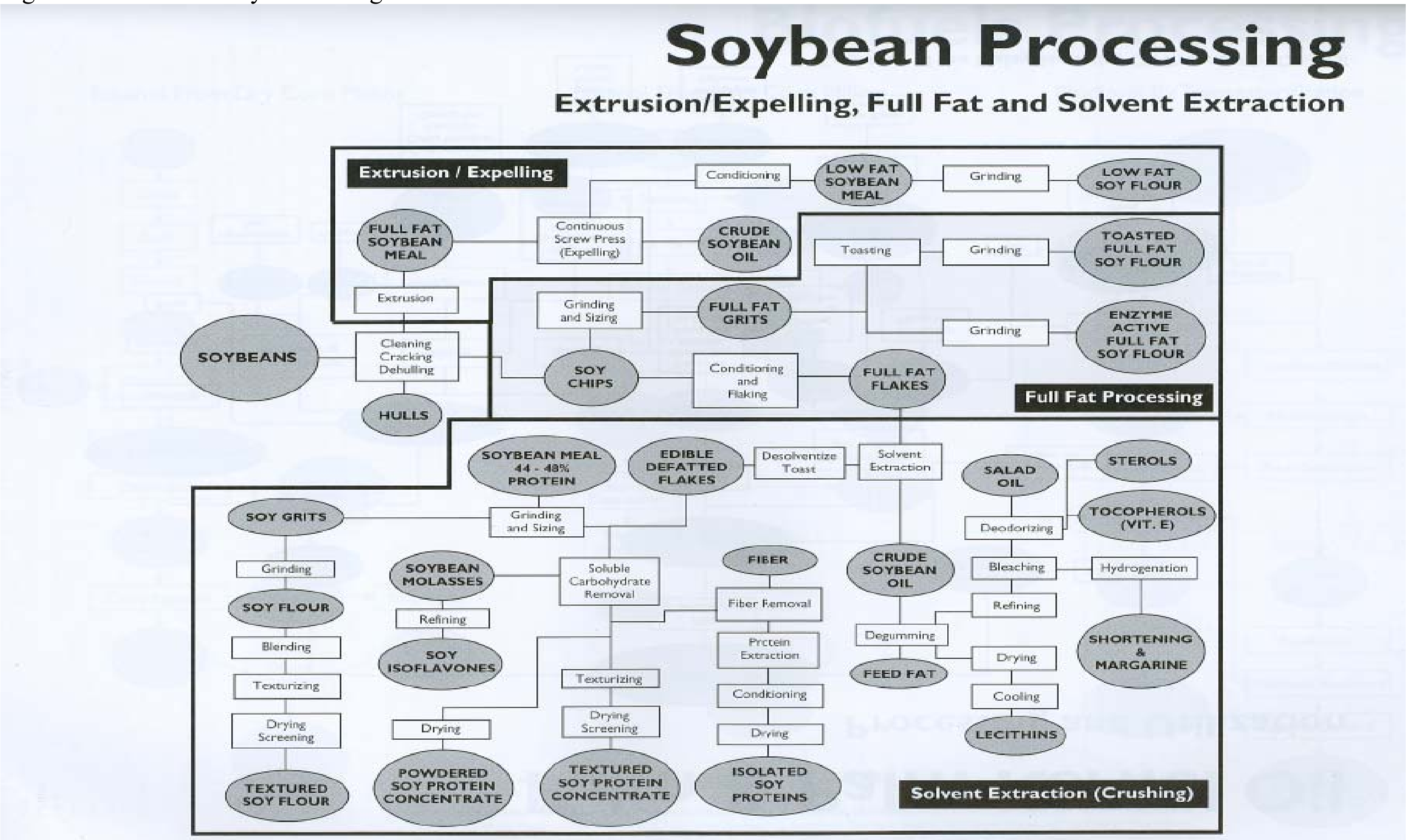
Archer Daniels Midland (ADM) is one of the world's largest agricultural processors of soybeans, corn, wheat and cocoa. ADM processes more than 50 soy protein concentrates and isolates alone, excluding soy flours, grits, and other enriched products such as pasta (Archer Daniels Midland Company). Many of these soy products are added to other food products or used as dairy supplements. ADM produces approximately one-forth of soy protein isolate and half of soy protein concentrate worldwide.

Cargill is yet another large provider of soy protein products. The Minneapolis based company makes manufactures goods such as flavored textured soy protein, soy flour, textured soy protein, and imitation bacon bits (Cargill). Their branded products include ProFull™ and Prolía™, full-fat and defatted soy flours, and a textured soy flour, Prosanté™ which is used to extend ground meat to increase yield, add juiciness and lower fat in various products. Additionally, Prosanté™ can be used to add protein and crunch to nutrition bars and snacks. Cargill states that positive attitudes towards soy and consumer demand for healthier foods continued to drive new product growth into the future.

3.5. Product Matrix

As mentioned previous, soybeans are processed into two main types of products during the crush process: soybean oil and soybean meal. From one bushel of soybeans (60 pounds), about 11.5 pounds of oil and 47.6 pounds of meal can be processed. This is equivalent to approximately 19% and 79% respectively. According to the USDA, soybean oil is the number one vegetable oil, accounting for two-thirds of all vegetable oils used for cooking and industrial applications. Soybean meal (SBM) accounts for 50-75% of the value of soybeans and is the most important protein feed in the world. Livestock feed is the greatest use of SBM, accounting for 98% of SBM consumption. Human consumption makes up much of the remainder of SBM use with applications in bakery, meat substitute, and other categories. After oil is removed, the remaining product can be further processed to other value-added products such as soy flour, soy protein concentrate, and soy protein isolate. The value chain is explained in Figure 3.5.1. Current value-added soy product ventures are concentrating on protein applications (American Soybean Association et. al., 2007).

Figure 3.5.1. Further Soy Processing Flow Chart



Source: 2007 Soya and Oilseed Bluebook

Soy protein is an inexpensive source of non-animal protein. Various methods exist to measure protein quality in regards to human consumption. The Biological Value (BV) score, on a scale of 0-100, and the Protein Digestibility-Corrected Amino Acid Score (PDCAAS), on a scale of 0.0-1.0, are two common measures. The PDCAAS evaluation method was recently approved by the U.S. Food and Drug Administration as a means of protein digestibility measure. Although products such as eggs have a larger biological value (BV), a measure of protein quality (encyclopedia.com) as shown in Table 3.5.1, cost makes soy protein the least expensive source of digestible protein on a per gram basis (Jolliet, 1998; McGilvery, 1970; McNamara, 2004; and Smith and Circle, 1972). Additionally, The Solae Company, an alliance between DuPont and Bunge Limited, has developed soy protein isolates with the maximum PDCAAS of 1.0 which ranks very high as shown in Figure 3.5.2. The Indian population currently consumes predominantly poor quality protein; approximately 75% of Indian protein consumption is from cereals (Itapu, 2007).

Table 3.5.1. Protein Products and Biological Value

Product	BV
White Flour	41
Corn	60
Full-fat Soy Flour	64
Soybean Curd (Tofu)	64
Whole Wheat	64
Beef	74
Soy Protein Isolate	74
Fish	76
Defatted Soy Flour	81
Rice	83
Cheese	84
Cow Milk	90
Soybean Milk	91
Chicken Egg	94

Note: The Biological Value (BV) score is on a scale of 0-100 with zero being the lowest quality protein to the human body and 100 being the highest.

Table 3.5.2. Protein Products and Protein Digestibility-Corrected Amino Acid Score (PDCAAS)

Product	BV
Whey	1.0
Egg White	1.0
Casein	1.0
Milk	1.0
Beef	0.92
Soy	0.91
Kidney Beans	0.68
Rye	0.68
Whole Wheat	0.54
Lentils	0.52
Peanuts	0.52
Seitan	0.25

Note: The Protein Digestibility-Corrected Amino Acid Score (PDCAAS) is on a scale of 0.0-1.0 with zero being the lowest quality protein to the human body and 1.0 being the highest.

Soy has many beneficial characteristics. Soy proteins supply all nine essential amino acids that the body needs, the only such vegetable source (Healthcastle Nutrition Inc., 2007). Soy also provides a cholesterol and lactose free source of proteins and are a rich source of calcium, iron, zinc, phosphorus, magnesium, B-vitamins, omega 3 fatty acids and fiber. Soy is a lower fat alternative to animal protein (Solae, 2004). In India, soy products are consumed directly as a flavored or seasoned side or as an alternative to meat. Soy has many beneficial characteristics; consumers are increasingly aware of the potential role of soy protein in heart and bone health, menopausal symptom relief, performance nutrition, and weight management. Soy protein has been found to reduce total and LDL cholesterol, reducing the chance of heart disease.

3.6. Soy Products and Uses

Various value-added soy products can be made from soybeans. Aside from soybean hulls, which are primarily used for animal feed purposes and oils which are used for cooking, soybean meal is further processed into more concentrated protein products. The following information on soy products was obtained from The Solae Company.

Soy Flours: Made by grinding dehulled, defatted soybean flakes. Soy flours are approximately 50 percent protein by weight and are primarily used in baked goods.

Soy Protein Concentrates: Made by removing a portion of the carbohydrates from defatted and dehulled soybeans. Soy protein concentrates retain most of the fiber in the original soybeans and must contain at least 65% protein on a moisture-free basis. They are often used as a functional or nutritional ingredient in a wide variety of food products.

Soy Protein Isolates: Prepared through a process using water extraction and minimum heat on soy flakes. The product is nearly carbohydrate and fat-free and are 90 percent protein by dry-weight. Isolated soy proteins are used as a nutritional, functional or economic alternative to traditional proteins in food bars, beverages, baked goods, breads, cereals, poultry, red meat, and seafood products.

Soy Lecithins: Lecithins are a naturally occurring component of soybeans. Lecithins are obtained from soy oil after the oil's extraction from the soybean flakes. A wide variety of refined lecithins are available, they provide important surface active properties to a variety of foods such as instant drink mixes, infant formulas, meat sauces and gravies, dispersible oleoresins, pan releases, chewing gum, and no-fat bakery and snack foods.

Soy Fibers: A fiber source derived from the soybean. Due to its neutral taste and light color, soy fiber can be incorporated into a variety of high-fiber and reduced-calorie products; such as, baked goods, cereal and beverages, without affecting traditional quality. Extensive clinical studies with soy fiber have proven that it provides all the benefits associated with both soluble and insoluble fiber.

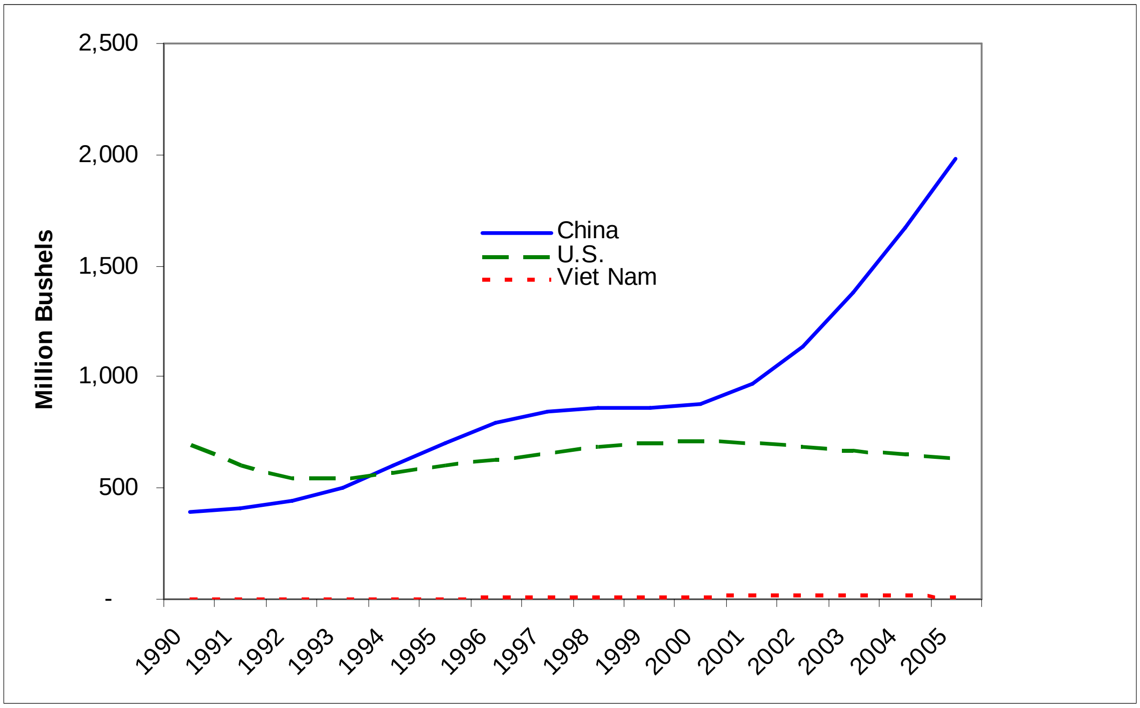
Soy Polymers: Provide benefits as functional additives for the coated paper and paperboard markets. High performance, soy-based polymers are derived from innovative technology for specific market applications.

3.7. Domestic and Selected Country Usage Projections

Human soy consumption is on the increase in many countries. The U.S., a developed country, has not shown much increase in soy consumption over the last 15-20 years as shown in Figure 3.7.1. China's food demand for soy products has been sharply rising. From 2000 to 2005 alone, China's food consumption of soy over doubled. Viet Nam, although on a much smaller scale, has also experienced sharp increases in food consumption of soy.

Although U.S. soy consumption has been stagnant, new soy products and uses are being developed. Historically, the U.S. has not been a large consumer of raw soy products. New developments by leading soy processors have the potential to increase U.S. consumption through soy additive products. China's increasing consumption trend is expected to hold as new products enter the market and information on health benefits soy become more familiar with the population. U.S. soy consumption has potential to increase as well, as soy products become more prevalent and health benefits are more widely diffused into the market. More recent estimates show U.S. soy protein product demand increasing sharply.

Figure 3.7.1. Food Consumption of Soy for Selected Countries, 1990-2005



Source: FAO Stat

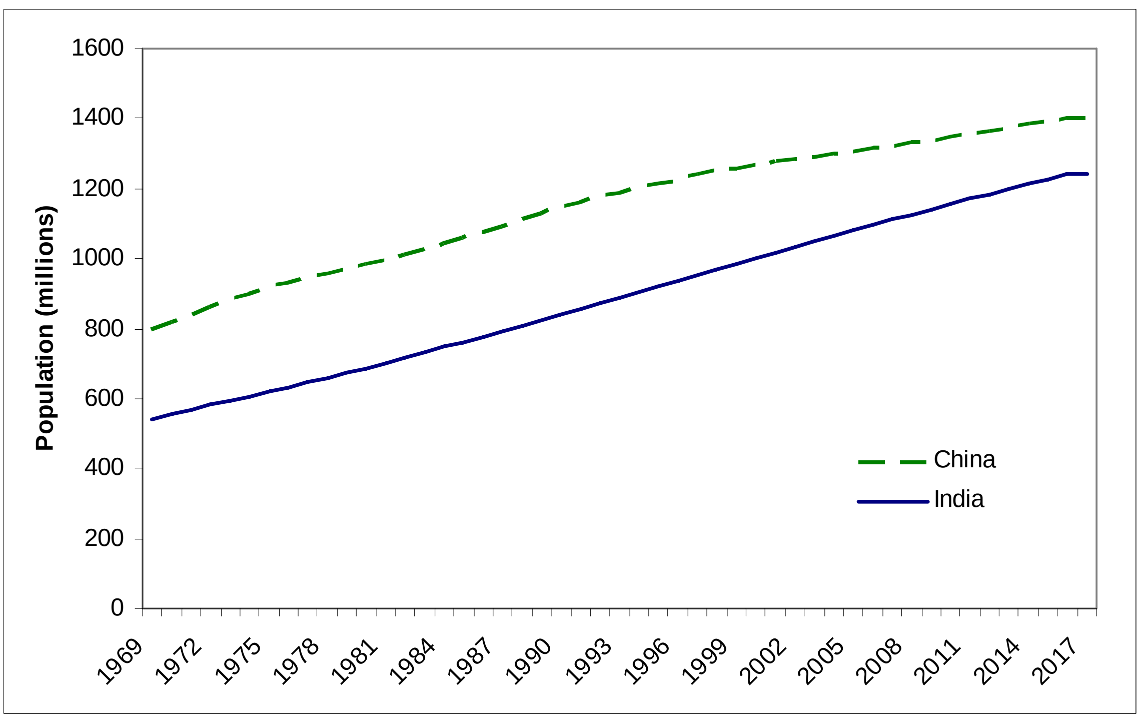
As shown, soy protein is becoming an important food ingredient. U.S. companies are leading the way in processing these products. Soy protein ranks very competitively in protein digestibility against many traditionally thought high protein foods. There are also many health benefits associated with soy products, further driving soy protein demand.

4. INDIA MARKET PLACE

4.1. Population and Economy

India's population stands at over one billion making in the second most populous nation to China. India holds 16% of the world's population. Although China is the nation with the largest population, the country is experiencing a growth rate of only 0.50%. The Indian population is currently growing at approximately 1.5% annually and is expected to hold this growth rate at least through 2017 as shown in Figure 4.1.1 (USDA ERS). Thus, India is positioned to become the nation with the largest population within the next few decades. The United Nations (2006) estimates this switch could occur as early as 2025.

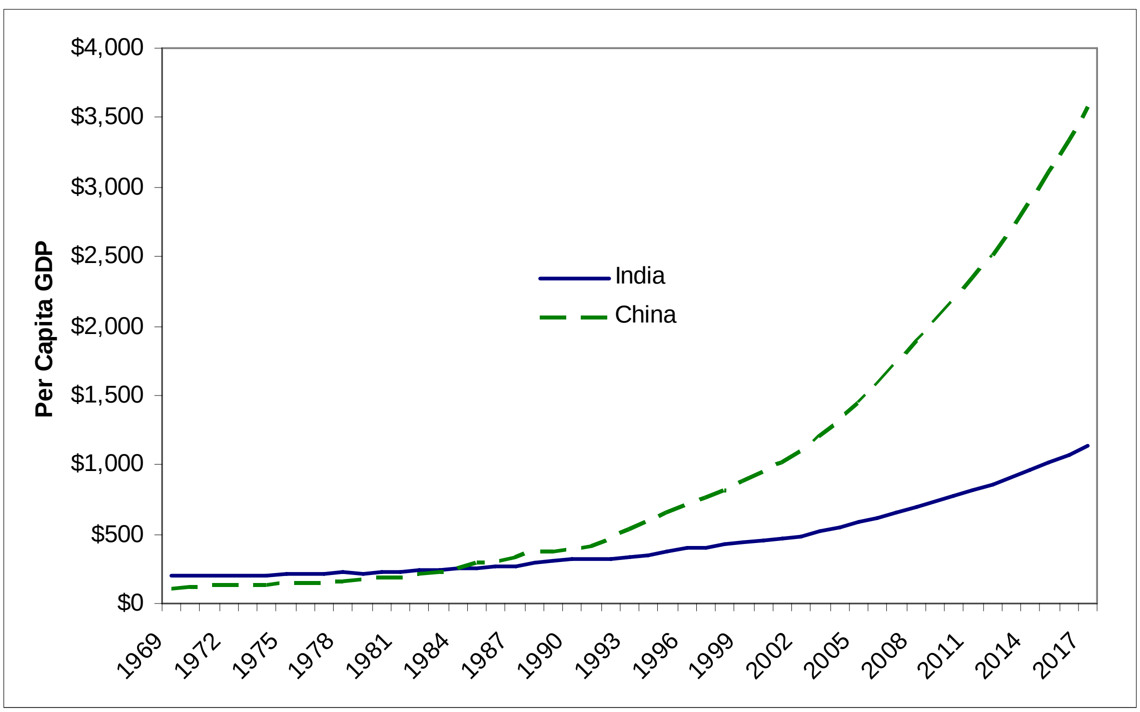
Figure 4.1.1. Historical and Projected Populations of India and China, 1969-2017



Source: USDA ERS

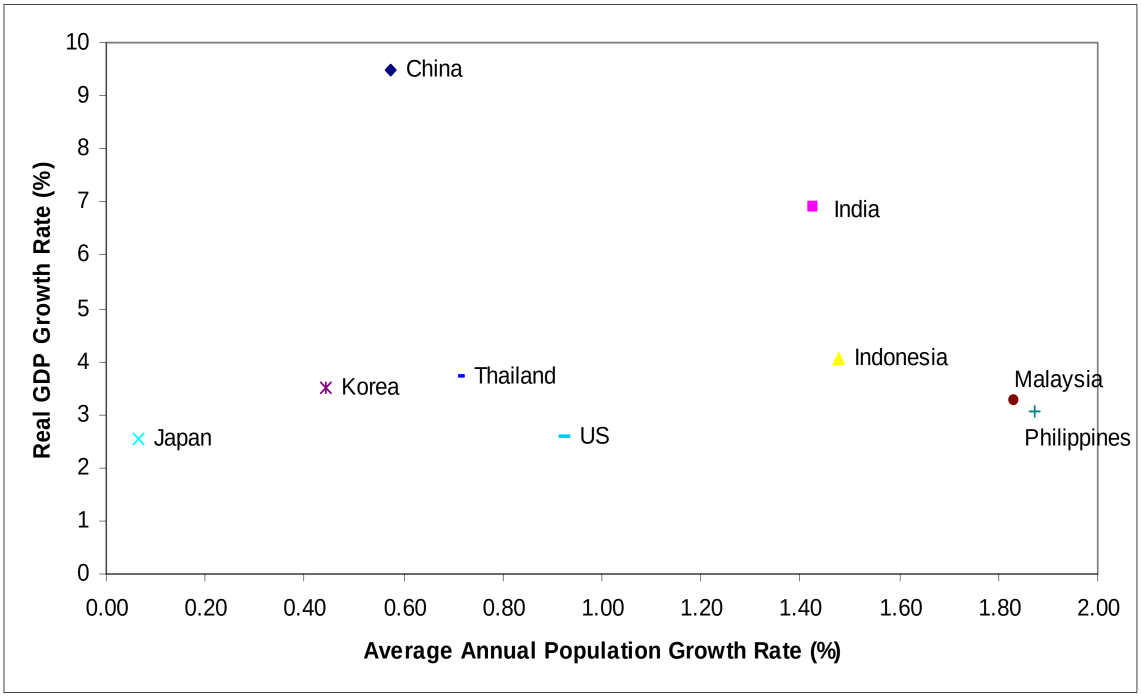
India has had what is considered a very closed economy until major reforms were made to industrial, trade, and exchange-rate policy in the early 1990s. Since then, India has had one of the fastest growing economies (USDA ERS, 2000). India is a relatively poor country with an estimated per capita GDP of only $650 USD compared to the U.S. at $39,000 USD and China at $1700 USD in estimated 2007 dollars. However, India's per capita GDP is currently growing at a steep rate of about 7-9% annually while China is growing at over 9% as shown in Figure 4.1.2. In comparison, the U.S. per capita income level is growing at about 2% per year (USDA ERS). The WTO estimates India's economic growth at over 9% for 2006/07. Looking at population and per capita GDP growth rates plotted against each other in Figure 4.1.3, India stands out in both categories while China's population growth rates have slowed.

Figure 4.1.2. Historical and Projected Per Capita GDP of India and China



Source: USDA ERS

Figure 4.1.3. Average Per Capita Real GDP and Population Growth Rates, 2005



Source: USDA ERS

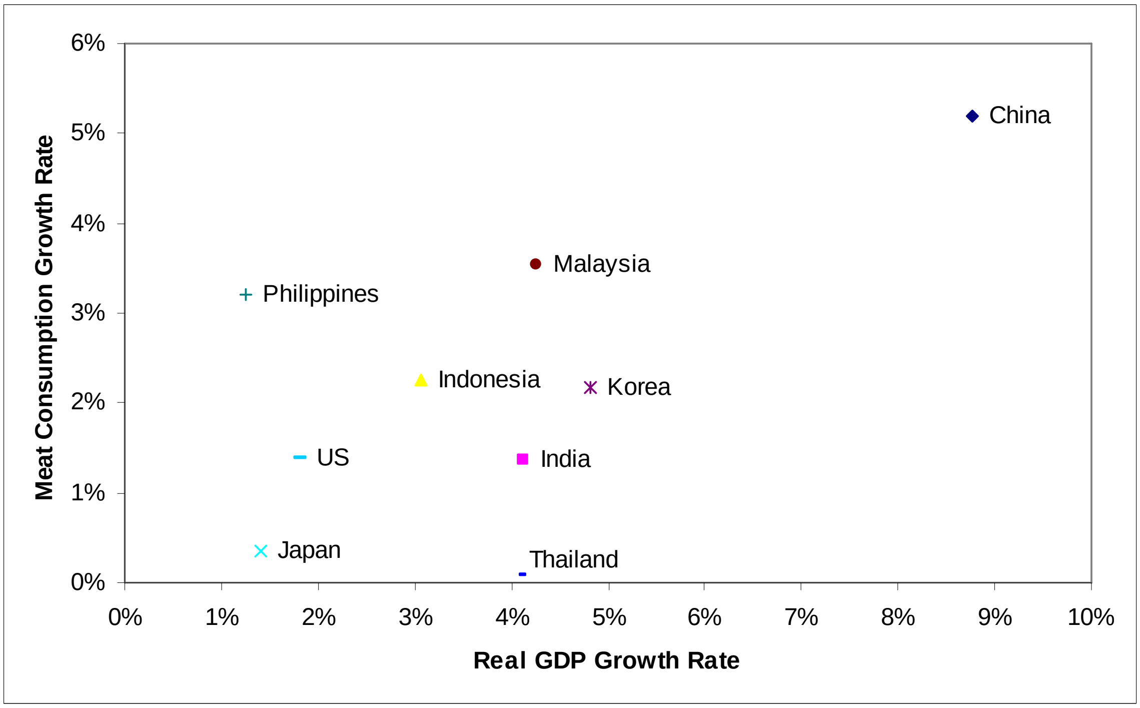
India's per capita GDP and population levels growth rates have been similar to those of China. In today's globalized economy, many industry players watch China in an effort to adjust accordingly to the activities of the world giant. As illustrated in Figures 4.1.1 and 4.1.2, India is currently at population and per capita GDP levels China was at 10-15 years ago (USDA ERS).

4.2. Protein Demand

Numerous studies have shown that increased per capita meat consumption is largely driven by increased per capita incomes. When plotting per capita meat consumption growth rates against real GDP and for the selected countries (Figures 4.2.1 and 4.2.2), China leads the pack in both categories on average over the 1990-2005 time period.

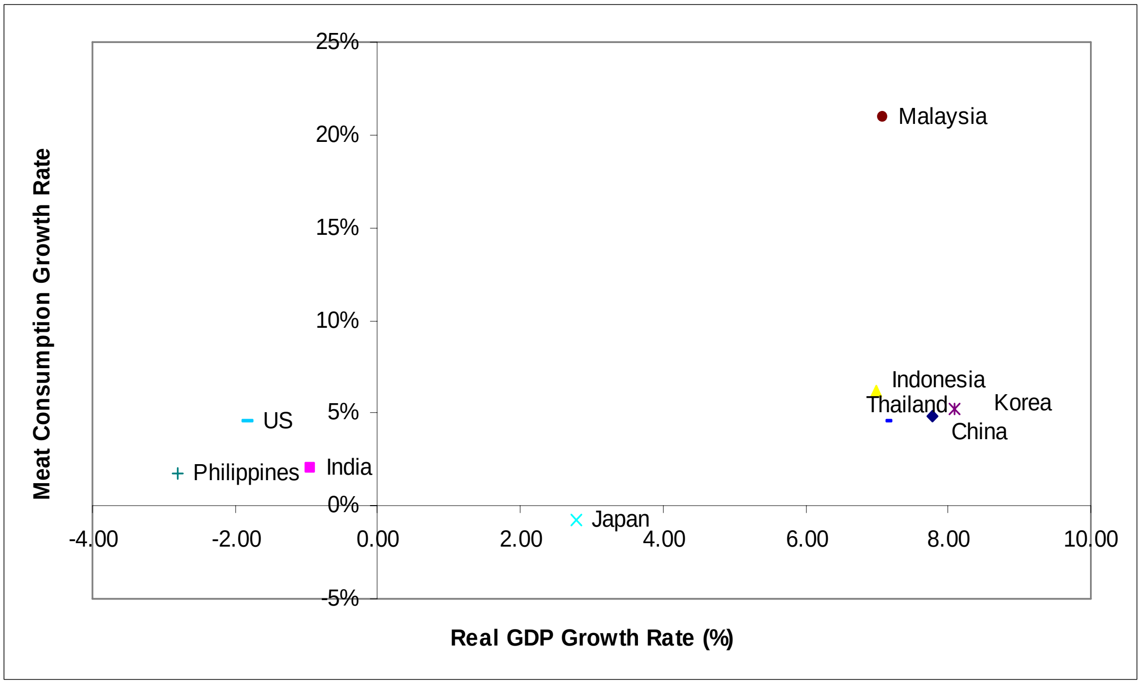
When the same analysis is conducted for 1991, China does not stand out from the other nations.

Figure 4.2.1. Per Capita Real GDP and Meat Consumption Growth Rates by Country, 1990-2005



Source: USDA ERS and FAO Stat

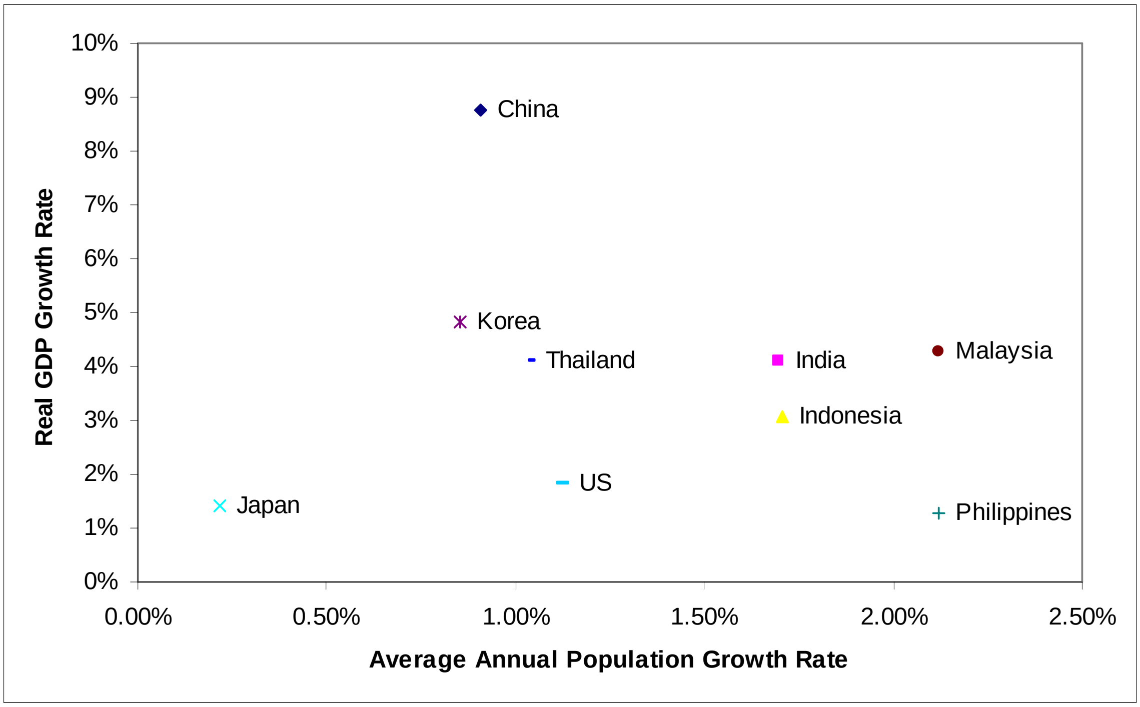
Figure 4.2.2. Per Capita Real GDP and Meat Consumption Growth Rates by Country, 1991



Source: USDA ERS and FAO Stat

Studies have shown that low income countries with growing incomes have experienced an increase in meat consumption. India's growing population, along with a growing per capita income as illustrated in Figure 4.2.3, show that India is poised for this consumption growth. Figure 4.2.1 illustrates that India, although leading in per capita income growth rates, is lagging in per capita meat consumption for a developing country. Nearly 100% of India's population is Hindu (~81%) or Muslim (~13%) (World Fact Book). Hinduism encourages being vegetarian and avoiding the eating of any animal meat or flesh. Muslims are forbidden to eat pork and strict rules must be followed in the slaughter of other animals for consumption. Low incomes also dictate the amount of meat consumed by Indians. Thus, 60-70% of India's population is vegetarian. Surveys have shown that the non vegetarian population eats meat at most twice weekly (Itapu, 2007). Therefore, the protein consumption growth is expected to occur in the non-animal protein category, such as soybean products.

Figure 4.2.3. Average Per Capita Real GDP and Population Growth Rates, 1990-2005



Source: USDA ERS

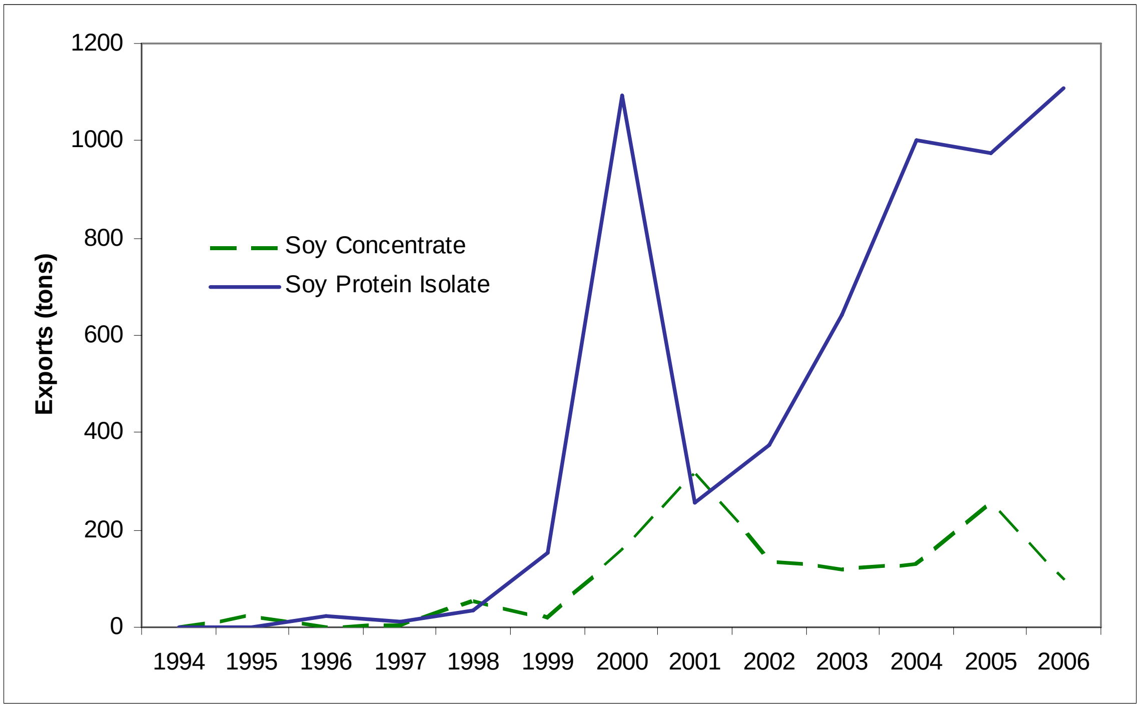
4.3. Current Soy Protein Demand and Projections

The type of soybeans or soybean products desired by Indian consumers is those of the non-GMO type according to the USDA's GAIN report. Thompson (2007) reports that nearly 90% of 2006 U.S. soybean production included genetically modified soybeans, leaving only a little over 10% of production to fill the Indian market. Several U.S. companies are capable of using the identity preservation methods needed to export soy products to India.

Several IP companies have experience segregating and delivering IP products around the world. Some of these companies have the ability to secure quality control from planting, growing, and harvesting all the way through storage, transportation, and delivery to the final user. India, an emerging economy, currently lacks of capital and relationships to adequately complete these IP tasks. Thus, the door is wide open for U.S. firms to export soy products to India.

Historically, India has been a large consumer of soy. Evidence exists of the wide acceptance of soy products by the Indian population (American Soybean Association et. al., 2007). However, to date India soybean production has been sufficient to meet soy demand. India has been a global competitor of the U.S. soybean industry. This situation is not unlike China 20 years ago, but today China is the largest importer of U.S. soybeans. India is poised to be the next China in terms of demand for soybeans which gives rise to many opportunities. In 2002, the United States began exporting value added soy products, including soy isolates, concentrates, soy flour, soy milk, soy nuts, and tofu, to India in order to help meet the bulge in demand for protein. The amount that is imported every year has continued to increase as shown in Figure 4.3.1.

Figure 4.3.1. U.S. Soy Product Exports to India, 1994-2006



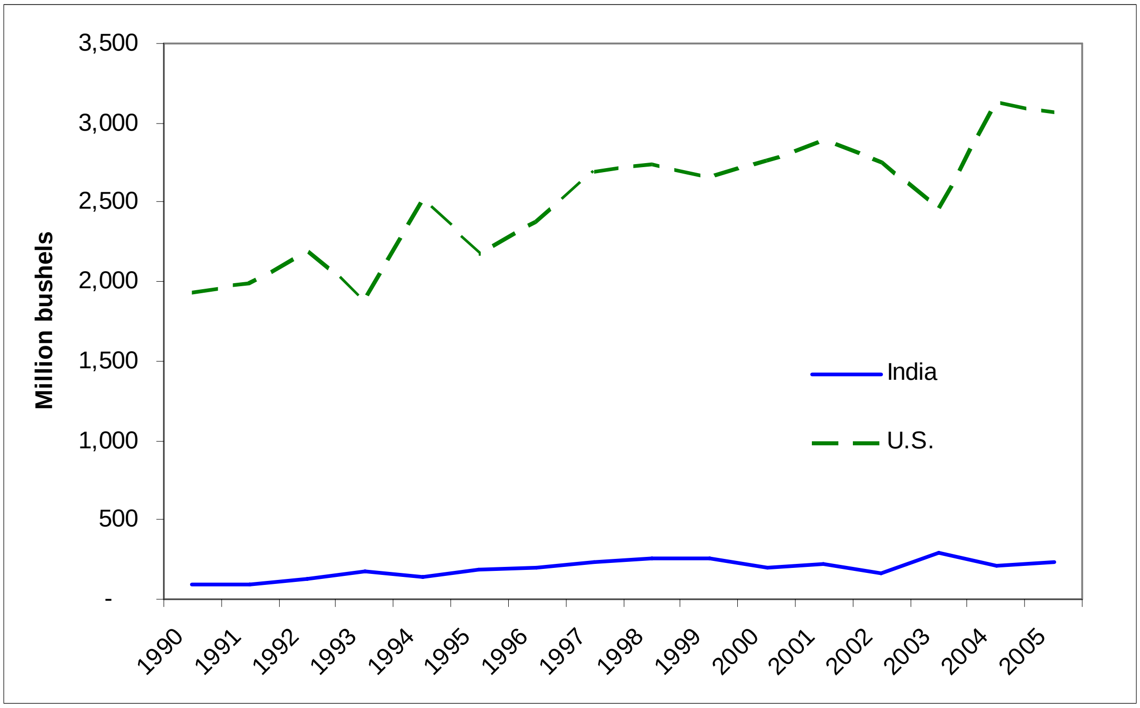
Source: USDA FAS

According to the American Soybean Association et. al., many soy promotional activities have been led in India, including seminars, exhibitions, literature distribution, sampling, and chefs' competitions, to introduce soy protein products. Generic campaigning for soy products is supported by the government and industry; an effort is underway to make soy foods tax exempt (Itapu, 2007).

There are many areas where soy protein products would benefit a large population. The World Bank estimates that almost a third of Indians live below the national poverty line and nearly half of children under 5 are malnourished. Therefore, perhaps the best-suited sector soy protein products would help out is the youth in school lunch programs. This group alone accounts for over 58 million children at over 500,000 locations. The American Soybean Association International Marketing (ASA-IM) has aided in convincing the schools in seven of India's 28 states to include soy in their feeding programs through their marketing efforts with more to follow. Another large, readily accessible market is India's defense sector which includes approximately three million servicemen and ex-servicemen. The ASA-IM has convinced the defense sector to begin including soy in some of the training centers (Itapu, 2007).

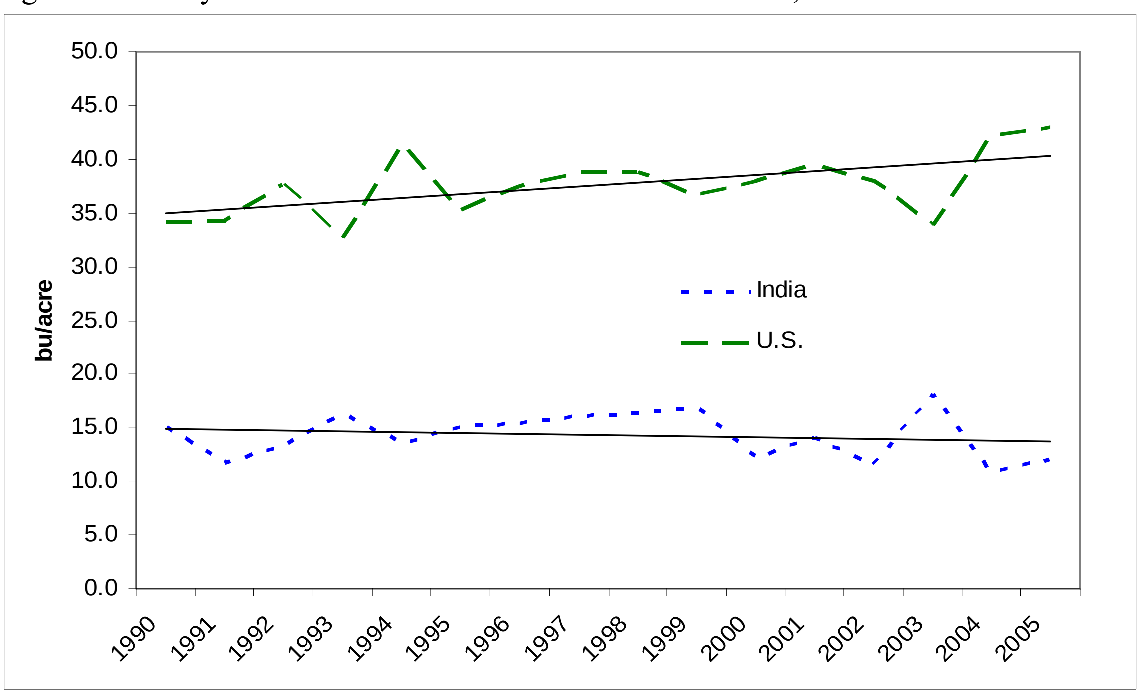
Soy protein has potential to be large portion of Indian diets in the future. The U.S. is more efficient of producing soybeans, having average yields of over 40 bu/acre. The U.S. produces over 3 billion bushels of soybean and exports nearly one-third of domestic production on an annual basis. India soybean production only yields 12 bu/acre and produces about 250 million bushels of soybeans annually as shown in Figure 4.3.2 (FAO Stat, FAPRI). According to India's Ministry of Agriculture, soybean production has been very sporadic. India is not showing any signs of increased soybean production in the future (American Soybean Association et. al., 2007). According to the USDA ERS (2000), population growth is substantially outpacing farm output which is on the decline. Additionally, India is putting resources towards cereal grains such as wheat and rice production. The USDA also states that, "The combination of higher incomes, sluggish domestic production, and more liberal import policies led to rapid growth in India's imports of pulses and edible oils in the 1990s. India is now the world's largest importer of pulses …", so soy will need to be imported to sustain consumption patterns of the non-meat protein source (2000). Trend yield for India is actually on the decline as opposed to increasing U.S. yields as illustrated in Figure 4.3.3 (FAO Stat, FAPRI). The U.S., with the production needed and the processing facilities available, is set to be a forerunner in marketing soy products to India.

Figure 4.3.2. Soybean Production in the U.S. and India, 1990-2005



Source: FAO Stat

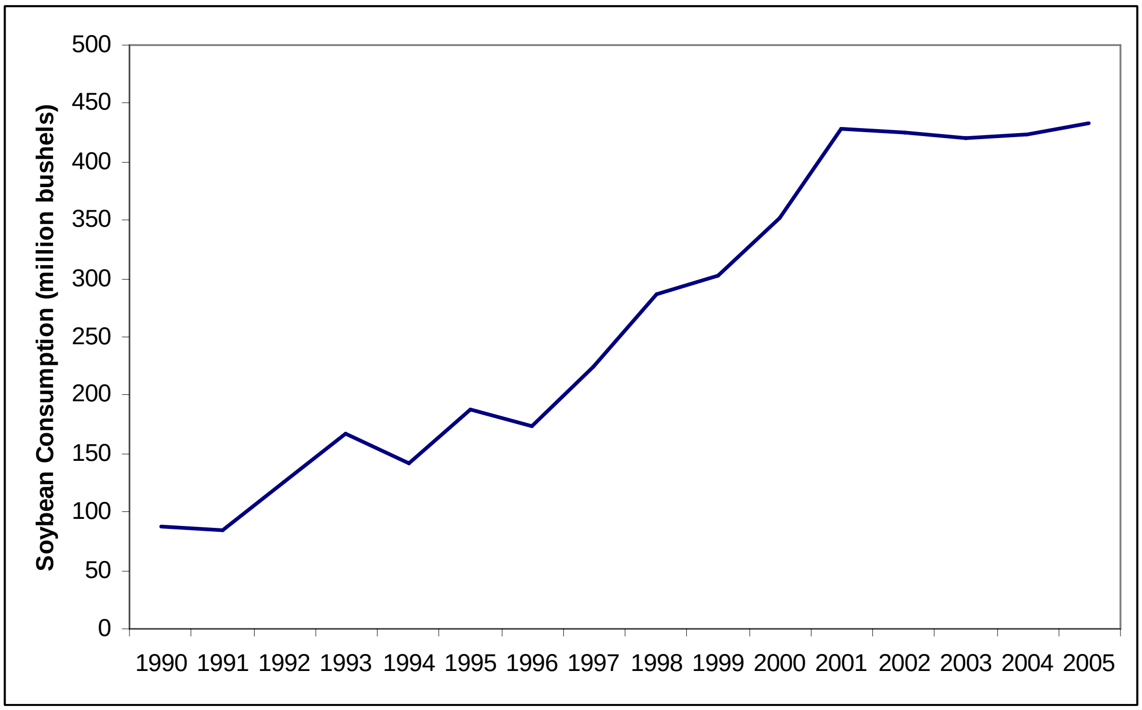
Figure 4.3.3. Soybean Yields and Trends in the U.S. and India, 1990-2005



Source: FAO Stat

Food consumption of soybeans in India from 1990-2005 is illustrated in Figure 4.3.4. According to FAO Stat, 2005 soy food consumption was at 433 million bushels. This level aligns with soybean consumption as estimated in this study in Scenarios 2,4, and 6 as illustrated in Figure 4.3.5 presented later, reassuring the estimates are not out of line and that the higher estimates are more realistic.

Figure 4.3.4. India's Food Consumption of Soybeans, 1990-2005



Source: FAO Stat

This study developed a model to estimate future protein demand in India. The model uses a weighed average meat price of beef, pork, poultry, and sheep along with consumption data from FAO Stat data for select Asian countries. Population and per capita GDP data were collected from the U.S. Department of Agriculture, was used as a proxy for per capita income. Quantity data was converted to short tons for all estimation measures. Additionally, per capita meat consumption was obtained by dividing meat consumption by total population for each country to determine pounds per capita. All data was collected for the selected countries from 1990-2005 while the meat price data was only available from 1991 to 2003. Thus, 1991-2003 was the estimation period utilized in this study.

The model used to estimate India's per capita meat consumption utilized the log of a weighted average meat price of beef, pork, poultry, and sheep for the selected Asian countries, along with a trend variable and the log of per capita income and per capita income squared as shown in equation 4.1

$$(4.1) \quad \ln Q_{ijt} = \beta_0 + \beta_i \ln P_{ijt} + \beta_{y1} \ln INC_{jt} + \beta_{y2}[\ln INC_{jt}]^2 + \beta_t TREND$$

where i refers to the meat commodities combined, j refers to country, t refers to country, Q is per capita consumption is pounds, P is the weighted average meat price in US $/lb., INC is per capita income in US $/capita, and TREND is a simple linear trend where year one =1, year two = 2, etc. The parameters $\beta_{0,\ldots}$ β_{y2} are elasticities to be estimated. This equation utilizes the squared lnINC variable to allow income elasticity to vary by income level.

Simple linear regression was used in the estimation of protein consumption for seven Asian countries. Results from the analysis will show how meat price, income, and time have an effect on protein consumption per capita. The meat consumption equation performed well, having a R-square of 0.99. As expected, income had the most influential coefficient and significant. Income elasticity of meat demand for the sample of selected

Asian countries was found to be 0.80. Thus, for a 1.0% increase in per capita income, per capita meat consumption increases by 0.80%.

Per capita income growth estimates published by USDA ERS from the International Macroeconomic Data Set were used to forecast annual per capita protein consumption rate increases to 2017. Results show India's per capita protein consumption increasing at an average rate of 4.51% per year for 2007-2017 as reported in Table 4.3.1.

The annual protein consumption growth rates in Table 4.3.1 can be used to estimate total pounds per capita protein consumption. It is unknown exactly how accepting the Indian population will be of soy protein products. As mentioned previously, 60-70% of India's population is vegetarian. Some of these residents are vegetarian due to income restraints. Additionally, even non-vegetarians eat meat only about twice per week. This indicates that non-vegetarians will utilize some soy products as a protein source. Table 4.3.2 shows the scenario of using 50, 60, 70, and 80% soy protein to fulfill that amount of protein consumption.

Table 4.3.1. Current and Estimated Protein Consumption Growth in India

	2005	2010	2015	Average, 2007-2017
Increase in Per Capita Protein Demand (%)	5.53	4.43	4.53	4.51

Table 4.3.2. Current and Estimated Per Capita Protein Consumption in India

	2005	2010	2015	Percent Increase (2007-2017)
Per Capita Consumption (lb./capita)				
Protein	11.24	14.12	17.58	55.21%
Soy Protein				
Assuming 50% soy diets	-	7.06	8.79	-
Assuming 60% soy diets	-	8.47	10.55	-
Assuming 70% soy diets	-	9.88	12.31	-
Assuming 80% soy diets	-	11.29	14.07	-

Multiple scenarios were then run to simulate variation is estimates of per capita incomes. The scenarios are as follows:

Scenario 1: USDA Income Estimates w/ Soy Protein 60% of Protein Consumption

Scenario 2: USDA Income Estimates w/ Soy Protein 70% of Protein Consumption

Scenario 3: USDA Income Estimates + 1% w/ Soy Protein 60% of Protein Consumption

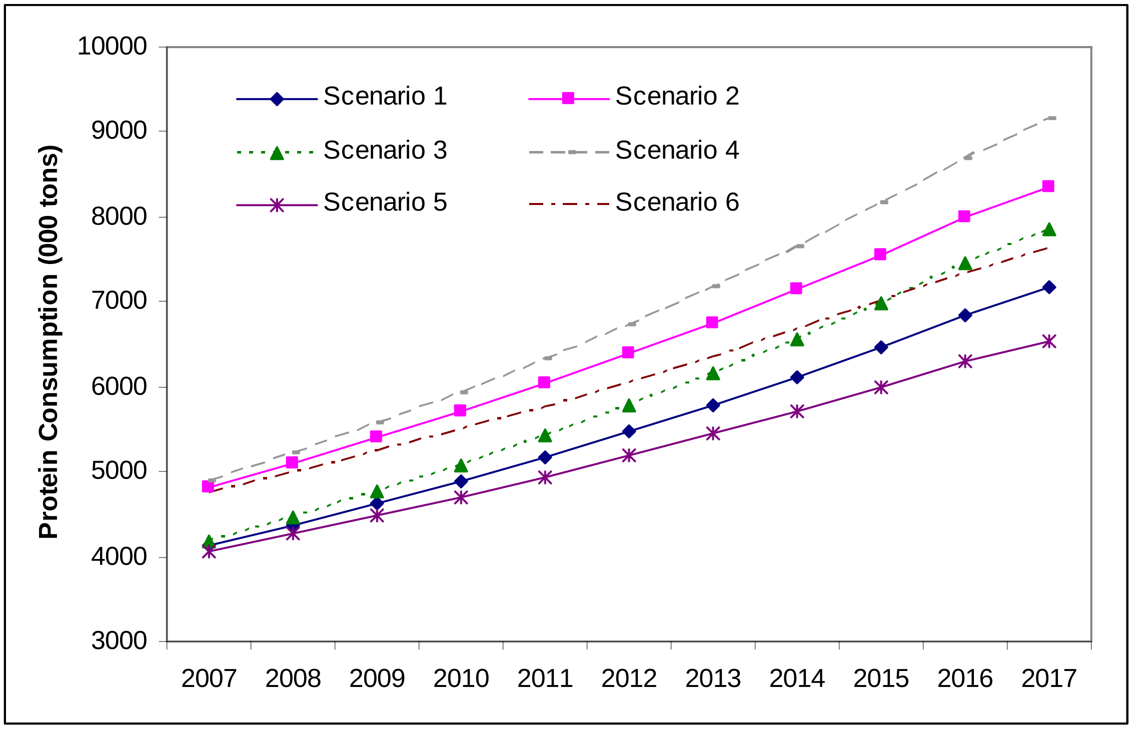
Scenario 4: USDA Income Estimates + 1% w/ Soy Protein 70% of Protein Consumption

Scenario 5: USDA Income Estimates - 1% w/ Soy Protein 60% of Protein Consumption

Scenario 6: USDA Income Estimates - 1% w/ Soy Protein 70% of Protein Consumption

Other studies, including that by Tyers, R. et al. (2006) show per capita income levels growing at faster rates than reported by the USDA. By varying the income growth rates by one percent in either direction, total protein consumption varies as show in Figure 4.3.5. Results from the simulation show that varying GDP growth rate has a greater effect on total protein consumption than varying the amount of soy protein in one's diet by the same amount.

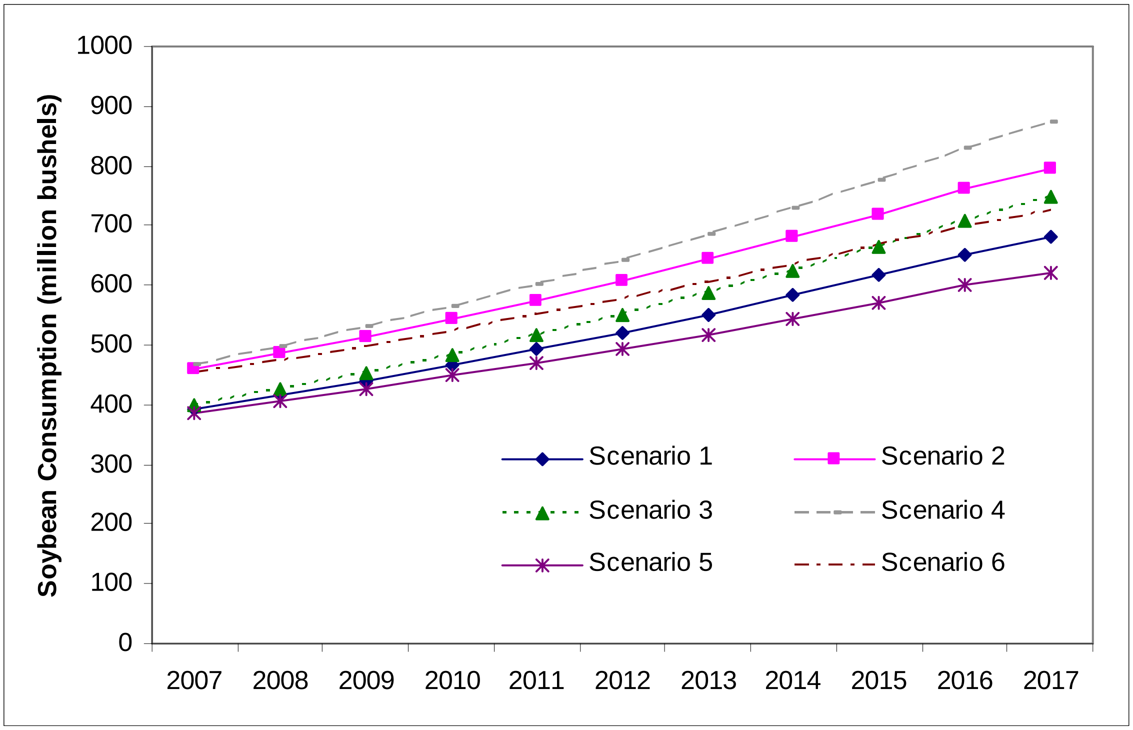
Figure 4.3.5. Estimated Indian Soy Protein Consumption with Various Scenarios, 2007-17



According to Maier (1998) at Purdue University, raw soybeans yield approximately 35% protein. The standard USDA measure for one bushel of soybeans is 60 pounds. Therefore approximately 21 pounds of every soybean bushel is protein. Looking at the ratio alternatively, one pound of protein is equal to 2.857 pounds of raw soybeans. In terms of soy protein isolate, one bushel of soybeans yields 21-23 pounds depending on protein content. Approximately 21 pounds of 100% protein is contained in one bushel of soybeans.

By taking the factor of 2.857 multiplied by protein consumption, the amount of soybeans needed to provide the desired amount of protein can be determined as illustrated in Figure 4.3.6. Scenario 5, assuming income growth at 1% less than USDA estimates and 60% of the protein in Indian diets coming from soy, shows the low estimates of soybean consumption. Scenario 4, with income growth at 1% more than USDA estimates and 70% of the protein in Indian diets coming from soy, shows the high estimates of soybean consumption.

Figure 4.3.6. Estimated Indian Soybean Usage for Soy Protein Consumption with Various Scenarios, 2007-2017



4.4. Internal Logistics of Transportation

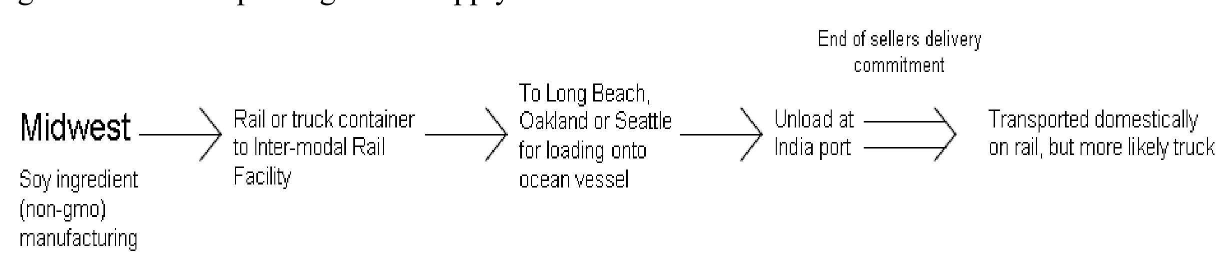
A soybean marketer with IP experience in the Midwestern U.S. would utilize a truck to rail to cargo ship logistical strategy for exporting to India. Primary US western export ports include Long Beach, Oakland, and Seattle as shown in Figure 4.4.1. Each US export port is rail accessible. There is a tremendous flow of consumer durable goods, from Asia, entering through these US ports and transported via rail to inter-modal facilities in the Midwest for distribution. The lowest cost delivery system for Midwest soybean value added goods is to ship containers through an intra-modal rail facility because of the excess supply of empty containers being returned to Asia to be loaded with more consumer durable goods for the US. Figure 4.4.2 is a logistical map suggested for Midwest soybean value added processors.

Business entities interested in rail freight rates may contact the various rail lines serving intermodal rail facilities in the US Midwest. For example, the Union Pacific railway offers a full line of services for business entities wishing to utilize the Kansas City intermodal rail facility to ship containers to western port locations. Marketers may find it relatively economical to utilize rail containers from the US Midwest to Asia due to the surplus of containers. The lower cost is due to containers being used for backhaul purposes, reducing the overall cost of moving durable goods from Asia to the US.

The U.S. and India have the same growing season, meaning soy supplies come available in both countries at about the same time. Brazil is expected to become the worlds largest exporter of soybeans with the 2008/2009 crop as shown in Figure 3.3.1. Brazil would have an advantage in exporting soy products to India due to being in the Southern hemisphere, have a growing season and therefore product supply opposite that of India and the U.S. However, Brazil does not have the proper processing infrastructure to handle India's consumption demands. Therefore India has an advantage in exporting soy products to India even compared to other large growers.

Figure 4.4.1. Map of Union Pacific Railroad System in U.S.

Figure 4.4.2. Example Logistical Supply Chain from US Midwest to India



4.5. Logistics of U.S. Coast to India

All of India's current imports of processed soybean products arrive via container through major coastal ports such as Mumbai, Cochin, Calcutta and Chennai as shown in Figure 4.5.1. Soy ingredient users are located across India, however there appears to be greater concentration in the region accessed though the port of Mumbai. After arriving at a coastal port, containers are loaded on either rail or truck for internal distribution. Internal logistics of moving soy products in India should not be much of a problem. The infrastructure for moving product is in place, with over 63,000 km of railways and three million km of roadways. This gives India the fifth and second largest transportation infrastructures, respectively.

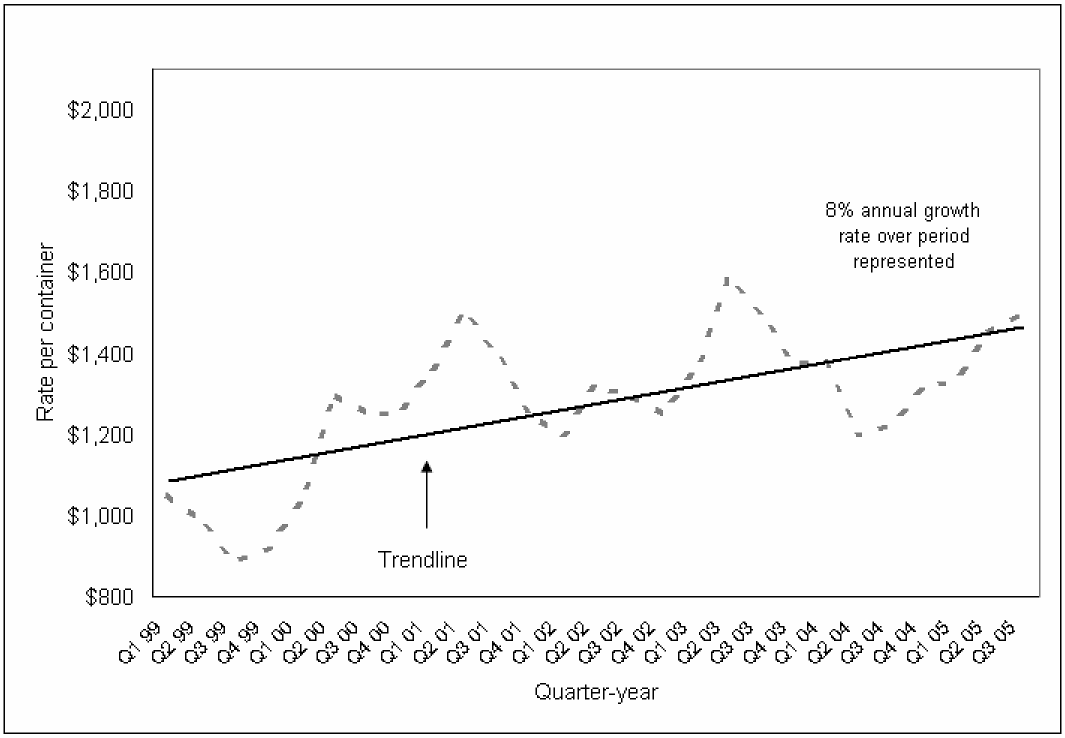
To date, exporters of intermediate processed soy ingredients to India prefer cash transactions to a letter or credit (LOC). The preference for cash transactions as opposed to a LOC is not unique to India and is common throughout the world. According to sources in India, access to cash for container sized transactions is not an issue except for the smaller processors. Because of the growing number of small niche processors, exporters to India may initially find it beneficial to work through a broker or consolidator that can deal in container lots to best tap the small processor market.

Example historical container ship rates from western ports to Asia are reported in Figure 4.5.2. Soy ingredient business entities interested in moving freight beyond U.S. boarders will contact want to contact visit the Agricultural Marketing Service (AMS) web site for their Directory of Freight Forwarders Serving Agricultural Shippers. Freight forwarders provides information on freight costs, port charges, consular fees, cost of special documentation, insurance costs, and freight forwarder's fees. The selected freight forwarder can then help with booking space with a carrier, export documentation, guidance on packaging, and assisting with destination country import regulations. Upon entry into India, the container will be off-loaded from the ocean going vessel and loaded to either truck or rail. India, not unlike many countries during their development, does not have in place national laws regulating inter-state commerce. Thus, buyer offer-price may differ because of state taxation. Thus, it will be good strategy for the exporter to agree to deliver container to no further than the port of entry and allow for the buyer or broker to take ownership and handle internal India transportation logistics.

Because rail and container ship rates are highly correlated to fuel price, rail and ocean freight rates have been volatile over the past four years. Business entities interested in exporting containers to India must check current rates, as opposed to using rates reported here in their cost calculations. Volatile oil prices and other political factors can greatly affect shipping rates.

Figure 4.5.1. Sea Ports of India

Figure 4.5.2. Historical Ocean Vessel Container Rates from U.S. Western Ports to Asia



Source: USDA, Agricultural Marketing Service

4.6. India Import Tariffs, Taxes, and Duties

According to the USDA- ERS (2000), India has been removing many licensing and quota restrictions on agricultural imports following proceedings with the WTO. Although many of these quotas are being replaced by high tariffs, the transition is a step toward more open trade and integration into the global market. Before the 1990s, restrictive policies curbed trade on over 11,000 products by import barriers other than tariffs. After the trade policy reform, India's agricultural exports rose $3.5 billion to $6.7 billion and imports increased by $2.5 billion to $3.3 billion in 1999. At the time of the ERS publication, 471 of 620 agricultural and consumer products were free quotas. The remaining 149 products were scheduled to come off the list in 2001.

India imposes relatively high trade barriers compared to other Asian countries. China places taxes and duties on soybeans and soy products four to ten times less those of India. India places import duties on most bulk commodity and intermediate processed commodities. There is no quota level, so import duties and taxes are applied to all quantities imported into India. Intermediate products for soybeans and the approximate duties and taxes applied per declared value are summarized in Table 4.6.1. The U.S. will have the most potential exporting soy protein isolates. This category has lower import duties and taxes as compared to other soy products. While India does have some bilateral trade agreements with other countries, there are no bilateral trade agreements with the United States. Additionally, India law requires goods to be assembled domestically. Thus, ingredients, not finished products, can be imported.

Table 4.6.1. Summary of Import Duties and Taxes Levied on India Imported Soy Products[a]

Soy Intermediate Processed Good	Approximate Duty and Taxes Applied[b]
Soy Flour (full fat)	36%
Soy Flour (defatted)	36%
Soy Flakes	36%
Textured Soy Protein	36%
Soy Concentrate	36%
Soy Isolates[c]	15%
Soy wax	36%

a. Duty and taxes applied to importers declared value of good
b. Duty level reported includes duty rate and other miscellaneous taxes.
c. Duty level lower for soy protein concentrate because of governmental lobbying effort in the early 1990s that established soy protein concentrate as a separate intermediate good.

4.7. India Processors

In 2000, only about 50 soy food manufacturers existed in India; as of February 2007, over 400 were present in the country. There has also been an increase in the number of types of soy food available in India as shown in Table 4.7.1. As of March, 2007, more than 20 soy food categories were available in India, up from five in 2000 (Itapu, 2007). This rapid growth in the soy protein market, with 100% average annual growth in the industry, shows soy protein products are poised to be an important part of Indian diets in the future.

Table 4.7.1. Soy Food Product Categories

Indian Traditional Products

- **Soy Drink -** made by mixing soy protein powders with water- excellent alternate for lactose intolerants
- **Tofu** - made by coagulating soy milk and pressing curd into blocks- excellent alternate for lactose intolerants
- **Wheat soy flour**- contains up to 40% soy flour; used for baking while providing more nutrients than traditional wheat flour alone
- **Fortified gram flour** - flour from chickpeas used for baking in India diets with added soy flour for added health benefits
- **Soy Papad** - popular food item in the Indian diet- essentially a wafer, rolled from dough made out of pulse such as black gram with up to 40% soy flour
- **Soy-based traditional snacks** - example: soy sattu, a mixture of gram, wheat, and sugar
- **Lentil analogue** - a substitute for lentils (a legume used heavily in Asian diets) because of higher protein content
- **Whole soybeans** - usually roasted and flavored

Non-traditional products

- **TVP (Nuggets, Granules…)** - aka **Textured Soy Protein** (**TSP**) is a meat substitute made from defatted soy flour, a by-product of making soybean oil
- **Bakery products** - soy flour, a healthy wheat flour substitute
- **Extruded Snacks**- soy uses in protein bars
- **Soy Fortified noodles** - soy flour is added to traditional wheat flour in the making of noodles, improving the nutritional quality and giving some functional benefits such as greater water retention and reduction of egg use
- **Breakfast cereals**- soy flour can be added to cereals such as wheat, rice, corn, etc. to make a healthier breakfast option since most of the breakfast options are high in carbohydrates and low in protein. Addition of 10-12% soy flour to these cereals will improve protein quality and quantity

Soy Nuts - soybeans which have been soaked in water and then baked- soy nuts are similar in texture and flavor to peanuts

Defatted soy flour - a low fat high protein flour made from soybeans that can be used as a partial replacement to wheat flour

Protein Supplements - pharmaceutical companies are coming up with general protein supplements to help ensure proper protein consumption

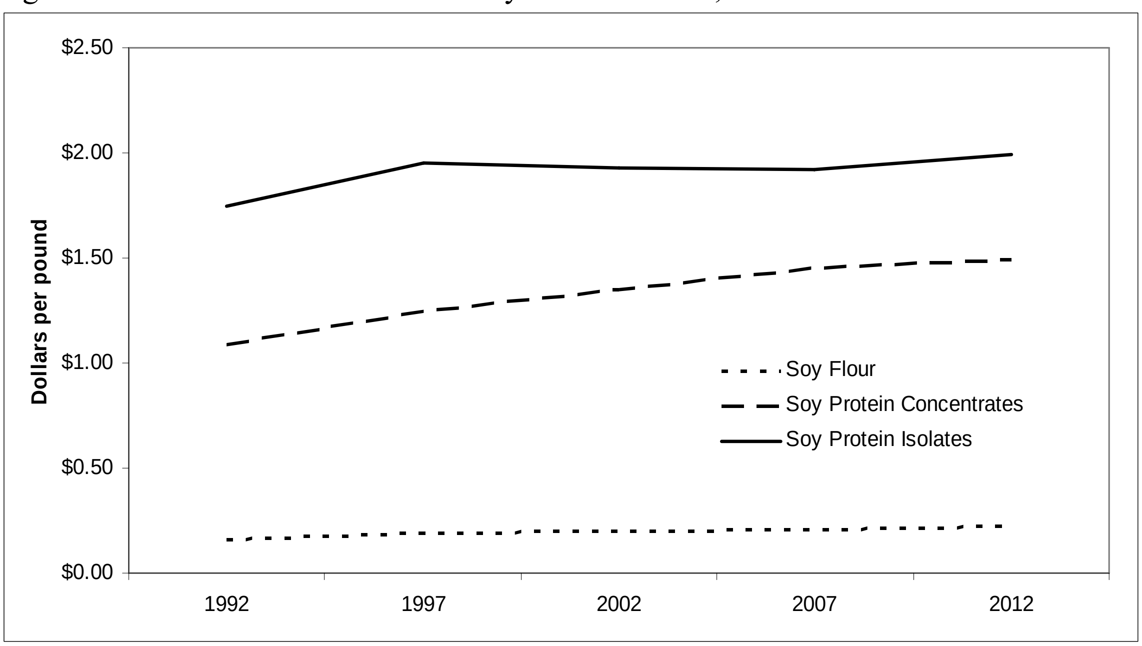
Source: ASA-IM

5. COST AND VALUE

5.1. Expected Value of Soy Protein in India

Historical prices of soy protein products are shown in Figure 5.1.1. While all protein product prices have been showing a general increasing trend, soy protein concentrates and isolates have a much higher value on a per pound basis. Prices have been rising slowly; soy flour and soy protein concentrate prices have been growing at more than 1.5% annually since 1992 while soy protein concentrate prices have shown less than 1% annual price growth as shown by industry estimates.

Figure 5.1.1. U.S. Further Processed Soy Product Prices, 1992-2012



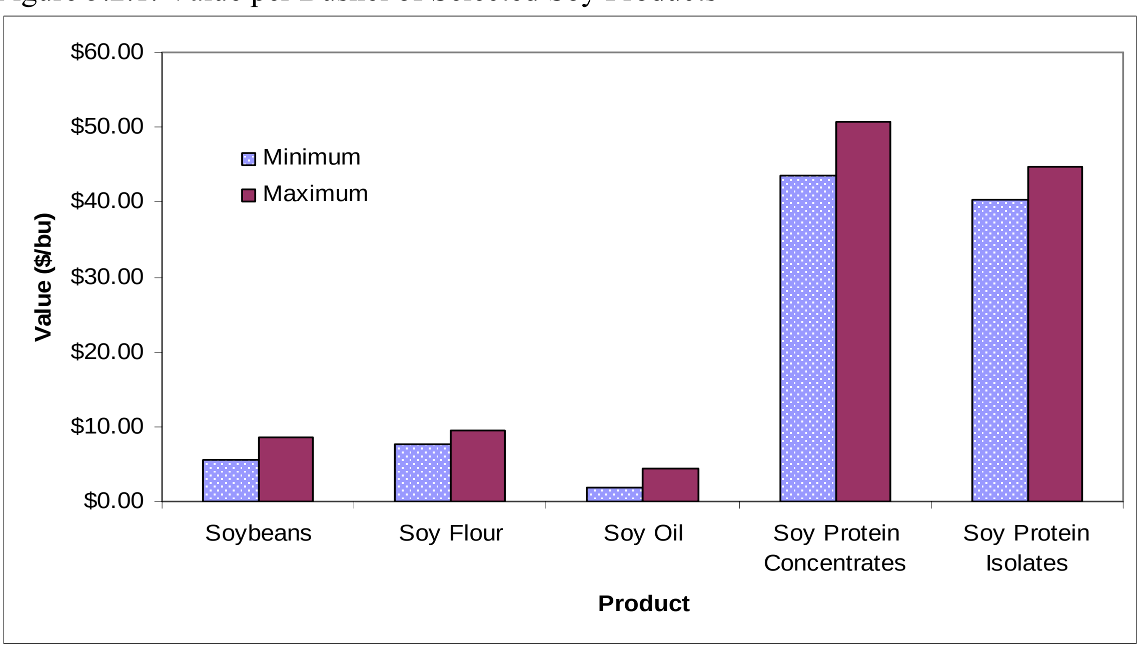
5.2. Expected Premiums/ Returns

Further processing soybeans into more concentrated protein products adds value. Figure 5.2.1 illustrates the value of selected soy products that can be derived from one bushel of raw soybeans. Soybeans are assumed to be valued at $5.50-$8.50 per bushel. This chart is somewhat misleading in the fact that as these products are prepared, other co-products are also produced and sold off along the way. Table 5.2.1 summarizes average price of selected soybean products along with their value per bushel.

Table 5.2.1. Average Price per Pound and per Bushel of Selected Soy Products

Product	$/lb	$/bu
Soybeans	$0.12	$7.00
Soy Flour	$0.21	$8.51
Soybean Meal	$0.13	$6.12
Soy Oil	$0.28	$3.03
Soy Protein Concentrates	$1.45	$47.13
Soy Protein Isolates	$1.92	$42.53

Figure 5.2.1. Value per Bushel of Selected Soy Products



U.S. processors will ship largely the higher value soy products to India, such as Soy protein concentrates and isolates. These products are valued in the U.S. at approximately $1.45-$1.92/lb. Transportation costs are estimated at $1,557 per container or about $0.03 per pound to ship containers from Western U.S. ports to Asia. After duties and taxes are applied, breakeven prices for soy protein concentrates and isolates are $2.00 and $2.24, respectively as shown in Table 5.2.2. Import duties could be reduced to the U.S. processors by exporting through a country of lower tariffs, which the country has a free trade agreement with India.

Table 5.2.2. Breakeven Soy Product Prices to U.S. Processors from Western Ports, 2007

	$/lb	
	Soy Protein Concentrate	Soy Protein Isolate
Soy Product Value (U.S.)	$1.45	$1.92
Transportation	$0.03	$0.03
Import Duties and Taxes	$0.52	$0.29
Breakeven Price to U.S. Processor	$2.00	$2.24

6. SUMMARY

Developing countries have been shown to change their dietary patterns as disposable income increases. The change is usually a transition from low quality to higher quality foods. Most countries experiencing increased per capita incomes also see increased meat consumption. This shift is more generally viewed as a shift to increased protein consumption.

The SWOT analysis (Figure 6.1), highlighting the strengths, weaknesses, opportunities, and threats for exporting soy products to India was conducted. Results show that with relationships and experience, there is great opportunity. India is now moving towards more trade with other countries, offering much opportunity to this market.

In the case of India, a primarily vegetarian country, increasing per capita incomes point towards an increase in protein demand from a non-meat source. Although Indian incomes are on an increasing trend, India is still a poor country. Soy protein has been found to be the least cost source of digestible protein on a per gram basis. Thus, it makes sense that India will utilize soy as a source of protein in the wake of shifting dietary patterns.

Food consumption of soy protein products has been on the rise in many Asian countries, especially China, Vietnam, and India. India is poised to further increase their per capita consumption of soy proteins more so than other countries because of their diets. Additionally, India's extremely large population coupled with a fairly aggressive growth rate show total soy demand growing at significant rates, another great opportunity for exporting soy products to India.

Figure 6.1. SWOT Analysis for Exporting Soy to India

SWOT Analysis	
Strengths • Religions: Hindu 80.5%, Muslim 13.4%; 60-70% of population estimated to be vegetarian • Concentrated target market- over 1.1 billion people in an area 1/3 the size of the U.S. growing at over 1.5% annually	***Weaknesses*** • Products must be assembled in India • Relatively high import tariffs
Opportunities • IP protection in India surpasses that of most other Asian countries • Cost of importing goods to India is lower than the average of all countries • Integration from quotas to tariffs, conforming to globalization • India ranks in the top five countries for both miles of roadways and railways • High economic growth rate, ~9% • Strong demand for non-meat protein • Over 25% of population living below poverty line • Population is showing an increased state of health consciousness • India possesses the highest rate (at 70%) of coronary heart disease of any country in the world • Company may export through a country of lower tariffs, which the country has a free trade agreement with India • Company may form a strategic alliance to maneuver around some India Regulations	***Threats*** • India has a low political stability, ranking in the bottom 10% of all countries and lacks efficient contract enforcement • Indian businesses incur relatively high tax rates • Indian Rupee has been declining in value to the U.S. dollar since 2000 along with 5% inflation • Low literacy level may prove difficult to educate citizens on benefits of soy products

This research is a first step in determining India's future need for soy-based protein products. The objective of this study is to determine India's protein demand over the next ten years. Then, using the per capita protein demand derived from this study, along with income, population, and dietary information, per capita soy protein consumption was estimated for the same time period. It was found that income growth has a large positive affect on protein consumption.

The findings from this study show that by the year 2017, India will be utilizing approximately twice the amount of soybeans currently consumed. Resource limitations show India will struggle to domestically meet these demand levels. U.S. business organizations, with the technology and resources needed, are positioned to be forerunners in exporting identity-preserved (IP) soy to India to fulfill the protein demand.

This study used the assumptions of the Indian population using 60-70% soy protein products to fill future protein needs. Currently, approximately 60-70% of the Indian population is considered vegetarian, mostly due to religious belief. Some vegetarians, however, refrain from meat consumption due to income restraints. The percent of the Indian population that will continue the vegetarian diet after increases in incomes are experienced is difficult to measure.

Results show that India will be increasing soy protein consumption over the next decade. Based on estimates from this study, Indian soy consumption could nearly double over the next 10 years. This consumption is equal to 10-20% of U.S. soybean production levels. The U.S. is in a position to fill India's protein demand. Market research shows that U.S. companies, would be a forerunners in logistical issues around moving the desired products to India.

REFERENCES

American Soybean Association, U.S. Soybean Export Council, and the United Soybean Board. "Soy Promotion in India." American Soybean Association- International Marketing. 2007.

Archer Daniels Midland Company. "ADM Capabilities." Archer Daniels Midland Company. Available at http://www.admworld.com/naen/about/overview.asp. [Retrieved June 28, 2007].

AsianInfo.org. "India's Religion and Philosophy." AsianInfo.org. Available at http://www.asianinfo.org/asianinfo/india/religion.htm. [Retrieved June 28, 2007].

Berk, Z. "Technology of Production of Edible Flours and Protein Products from Soybeans." FAO Agricultural Services Bulletin No. 97. 1992.

Bunge Limited. "Food Products." Available at http://www.bunge.com/about-bunge/our-businesses.html. [Retrieved June 28, 2007].

Cai, H., C. Brown, G. Wan and J. Longworth. "Income Strata and Meat Demand in Urban China." Agribusiness Review 6(1998).

Cargill. "Accelerating Health Innovation." Cargill Health and Food Technologies. Available at http://www.cargillhft.com/industry_prolisse_faq.html. [Retrieved June 28, 2007].

DuPont. "Our Company." Available at http://www2.dupont.com/Our_Company/en_US/. [Retrieved June 28, 2007].

ElGindy, G. "Hindu Dietary Practices: Feeding the Body, Mind and Soul." Minority Nurse. Available at http://www.minoritynurse.com/features/health/10-25-05b.html. [Retrieved March 15, 2007].

Encyclopedia.com website. http://www.encyclopedia.com/.

Fabiosa, J. "Growing Demand for Animal-Protein-Source Products in Indonesia: Trade Implications." Center for Agricultural and Rural Development. Iowa State University. Working Paper 05-WP 400. July, 2005.

Food and Agricultural Policy Research Institute (FAPRI). "U.S. and World Agricultural Outlook." Iowa State University and the University of Missouri-Columbia. 2006.

Food and Agriculture Organization of the United Nations website. Available at http://faostat.fao.org/ default.aspx. [Retrieved May 25, 2007].

Freedonia. “Refined Soy Products.” The Freedonia Group. 2006.

Gehlhar, M. and W. Coyle1. “Global Food Consumption and Impacts on Trade Patterns.” Changing Structure of Global Food Consumption and Trade / WRS-01-1. Economic Research Service/USDA.

Healthcastle Nutrition Inc. “Powerful Benefits of Soy.” Healthcastle Nutrition Inc. 2007. Available at http://www.healthcastle.com/herb_soy.shtml. [Retrieved June 28, 2007].

Holmes, K. “Carnivorous Cravings: Charting the World’s Protein Shift.” Earth Trends. 2001.

Itapu, S. “Indian Soy Food Scenario.” American Soybean Association- International Marketing, 2007.

Jolliet, P. "Enteral nutrition in intensive care patients: a practical approach." Intensive Care Medicine. 1998.

Landes, M. “The Elephant Is Jogging: New Pressures for Agricultural Reform in India.” USDA, ERS. 2004.

Lin,B., J. Variyam, J. Allshouse, and J. Cromartie. “Food and Agricultural Commodity Consumption in the United States: Looking Ahead to 2020.” USDA, ERS. Agricultural Economic Report No. 820. 2003.

Maier D., J. Reising, J. Briggs, K. Day, and E. Christmas. “High Value Soybean Composition.” Grain Quality Task Force Fact Sheet #39. Purdue University. 1998.

McNamara, D.J. “The Nutritious Egg.” Egg Nutrition Center. Washington, DC. 2004.

McGilvery, R. “Biochemistry.” Saunders, PA. 1970.

Ministry of Agriculture, Department of Agriculture and Cooperation. “Second Advance Estimates of Oilseeds & Other Commercial Crops Production for 2004-05.” Government of India.

Mintert, J., T. Schroeder, and T. Marsh. “Focus on Beef Demand.” Managing for Today’s Cattle Market and Beyond. Kansas State University. March, 2002.

Sarma, J. and P. Yeung. “Livestock Products in the Third World: Past Trends and Projections to 1990 and 2000.” International Food Policy Research Institute. April, 1985.

Schroeder, T.C., A.P. Barkley, and K.C. Schroeder. "Income Growth and International Meat Consumption." Journal of International Food & Agribusiness Marketing 7(1995):15-30.

Shono, C., N. Suzuki, and H. Kaiser. "Will China's diet follow Western diets?" Agribusiness. Hoboken: Summer 2000.

Smith, A. and S. Circle. "Soybeans: Chemistry and Technology." Westport, CT. 1972.

Solae. "Soy Essentials." The Solae Company. 2004. Available at http://www.solae.com/company/soyessentials/soyprotein.html. [Retrieved June 7, 2007].

Soya. "Information about Soy and Soya Products" Soya. 2006. Available at http://www.soya.be/soy- protein-concentrate.php. [Retrieved June 7, 2007].

Soyatech, LLC. "2007 Soya and Oilseed Bluebook." Friesens Corporation. Manitoba, Canada. 2006.

Thompson, D. "Food Grade, Non-GMO/IP World and USA Market Supply and Demand Issues." Illinois Crop Improvement Association, Inc. Champaign, IL. 2007.

Tyers, R. et al. "Demographic Change and Policy Responses: Implications for the Global Economy." Presentation from PGDA Seminar Series at Harvard University. 2006.

Ulama, Jami'yyatul. "Halal Guidelines." Canadian Council of Muslim Theologians. Available at http://www.jucanada.org/halalguidelines.htm. [Retrieved June 28, 2007].

United Nations. "World Population Prospects: The 2006 Revision Population Database." Available at http://esa.un.org/unpp/index.asp?panel=1. [Retrieved February 21, 2007].

United States Department of Agriculture, Economic Research Service. "India Relaxes Restraints on Agricultural Imports." Agricultural Outlook. 2000.

United States Department of Agriculture, Economic Research Service. "International Macroeconomic Data Set." Available at http://www.ers.usda.gov/Data/macroeconomics/. [Retrieved February 21, 2007].

United States Department of Agriculture Foreign Agricultural Service website. Available at http://www.fas.usda.gov/ustrade/USTExFAS.asp. [Retrieved February 21, 2007].

World Fact Book. "India." U.S. Central Intelligence Agency. Available at https://www.cia.gov/library/publications/the-world-factbook/print/in.html. [Retrieved February 21, 2007].