Chapter 20

Global Soybean Marketing and Trade: A Situation and Outlook Analysis

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1. Introduction

Global soybean production and trade has been changing dramatically in the past 23 years. These changes have been driven by the increasing demand for soybean meal, which accounts for 65% of animal feeds (Ash *et al.*, 2006). Until 1985, production and export of soybean was dominated by the USA. The combined soybean production of Brazil and Argentina now surpasses the USA production (Ash *et al.*, 2006). The growing economies in China, India and other developing countries have increased dramatically the demand for livestock products, which, in turn, has increased the demand for soybean meal (Delgado *et al*., 1999). Soybean has also taken a key role in the emerging bio-fuel sector. Brazil and Argentina produce biodiesel, respectively deriving 66% and 100% of feedstock from soybean (Trostle, 2008).

On the trading side, high income countries accounted for 46% of the total demand (165 million tonnes) for soybean in 2000, 90% of which was for non-food use – mainly animal feeds and recently biodiesel production. The European Union (EU) has been the leading importer of soybean products (USDA, 2005). However, in 2002 China's imports surpassed those of the EU, thus becoming the leading global importer of soybean. This was achieved after China eased trade restrictions and joined the World Trade Organization (WTO) in 2002 (USDA, 2005). These rapid changes in the production and trade of soybean have prompted a renewed interest in examining the drivers of these changes and to forecast future scenarios. This chapter discusses global soybean trade and examines factors that determine future major dynamics.

Three soybean products (grains, meal, and oil) are often traded. Together, these three products represent the most important agricultural exports of Brazil, accounting for 8% of Brazil's total exports in 2006 (Perez *et al*., 2008). Producing about 80% of world soybean (Hamamoto *et al.*, 2002; Andino *et al*., 2005), Brazil, United States and Argentina (in that order) are also the three major exporters in international protein meal markets. In recent years, these countries accounted for about 85% of the global trade on soybean meal, a share that is projected to increase to >90% in the future (USDA, 2005). While the USA dominates the soybean grains export market, Argentina is the principal exporter of soybean meal and soybean oil, followed by Brazil and the USA (Andino *et al*., 2005). The other major soybean importing countries and regions are India, Germany, Indonesia, Japan, Mexico, the Netherlands, Korea, Spain, Thailand, North Africa, the Middle East, Central America and the Caribbean (USDA, 2005). The top ten oilseeds exporting countries are given in Table 20.1.

Table 20.1. Top ten oilseeds exporting countries by export per cent share in 2005 (Adapted from Perez *et al.*, 2008)

Country	2005 share (%)	% change (1995–2005)
USA	32.0	–19.1
Brazil	25.7	19.0
Argentina	11.6	4.0
Canada	6.8	–4.0
China	3.2	–1.1
France	2.9	–2.0
Paraguay	2.9	1.3
Netherlands	2.1	0.1
Australia	1.4	0.7
India	1.4	0.2
Total	90.0	-

The EU remains the world's leading importer of soybean meal, as import prices for meal relative to soybean grains put pressure on crush margins, curtailing soybean (grains) imports in favour of soybean meal (USDA, 2005). However, increases in grain and rapeseed (*Brassica* spp.) meal feeding are expected to continue to slow the growth in EU soybean meal and soybean grain imports. Latin America, North Africa, the Middle East, Southeast Asia, and the former Soviet Union constitute important markets for soybean meal (USDA, 2005).

2. Present Situation of Export and Import

2.1. Repeatedly in the limelight

Soybean is repeatedly in the limelight these days, being a booming crop in Brazil, with an export value equivalent to US$10 billion (over 10% of the value of the total Brazilian exports) in 2004 (Smaling *et al*., 2008). By 2003/4, Brazil was the world's largest soybean exporter and the second largest producer after the USA (Perez *et al*., 2008) (see Table 20.2). Three-quarters of the total soybean production in Brazil is exported, mainly to China and the EU (Smaling *et al*., 2008).

Table 20.2. Global soybean production in 2005 (FAO, 2007)

Country/region	Quantity produced (Metric tonnes)	%
United States of America	83,368,000	39.0
Brazil	53,053,000	24.8
Asia	25,746,286	12.0
Europe	3,050,403	1.4
Africa	1,238,443	0.6
Others	47,520,152	22.2
World	213,976,284	100.0

2.2. Global soybean import demands

Global soybean imports have been increasing rapidly. There has been a growing demand for soybean in Asia. The demand surge (with a nine-fold increase in soybean imports in 10 years 1994–2004) largely stems from China, with insignificant domestic production (Smaling *et al.*,

2008). Demand surge was triggered by China's 2002 WTO membership, which ended border tariffs, in turn, boosting trade. The increasing global demand for soybean has been met through a strong supply response from Brazil and Argentina. Soybean cultivation in Brazil is expected to expand further in the coming decades, mainly responding to growing demand in Asia (Smaling *et al*., 2008). Country statistics show that in 2004, Brazilian production exceeded 50 million tonnes, twice the amount realized in 1997. Area and production increases were particularly strong in the period 2001–2005, following a favourable devaluation of the Brazilian currency. Soybean exports in 2004 earned Brazil over 10 billion US$, against 4.2 billion US$ in 2000.

Import demand for soybean oil is rising in nearly all countries and regions except for the Former Soviet Union (FSU). Countries with the largest projected gains were China and India. In China, growing demand for high-quality vegetable oils outpaces domestic oil production and fuels expanding soybean oil imports (USDA, 2005). Land-use competition from other crops constrains area planted to vegetable oil crops in China. In India, relatively lower tariffs on soybean oil (held in check by WTO tariff-binding commitments) compared with those for other vegetable oils will favour continued strong imports of soybean oil. India accounts for an increasing share of world soybean oil imports, due to burgeoning domestic demand for vegetable oils and limitations in domestic production of oilseeds. Low yields associated with erratic rainfed growing conditions and low input use limit oilseed production in India (USDA, 2005). In North Africa, the Middle East region, and Latin America (particularly Central America and the Caribbean), income and population growth drive strong gains in soybean oil imports (USDA, 2005).

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2.3. Global soybean grains and oil exports

Between 1990 and 2007, the world soybean export was dominated by three countries (USA, Brazil, and Argentina) that presently account for over 80% of the world soybean export. Projection indicates that together, these three countries will account for >90% of the world soybean trade by 2014 (USDA, 2005). With continuing area gains, Brazil maintains its position as the world's leading exporter of soybean and soybean products in the projection. Over the projection (ending in 2014), while the overall share (%) of soybean export by Argentina more or less remains stagnant, that of Brazil shows continuous growth, while the USA share is set to decline. Argentina's soybean grains exports holds steady at about 7 million tonnes.

Argentina is the leading exporter of soybean oil, reflecting the country's large crush capacity, its small domestic market for soybean oil, and an export tax structure that favours the exports of products rather than soybean grains (Smaling *et al*., 2008). Increases in crush and soybean oil exports are supported by gains in Argentine soybean production due to extensive double-cropping, further adjustments to crop-pasture rotations, and the addition of marginal lands in the northwest part of the country (USDA, 2005). Brazil's expansion of soybean production into new areas of cultivation enables it to increase both its volume of soybean oil exports and its share of world trade. A strong emphasis on exporting soybean products pushes the combined share of Argentina and Brazil in world soybean oil exports from about 80% in 2004 to a projected proportion of about 86% (USDA, 2005). The USA remains the world's third largest soybean oil exporter after Argentina and Brazil. However, the share of the USA in the world soybean oil trade is expected to continue a downward trend to <5% by 2014 (USDA, 2005). Similarly, the EU remains a small exporter of soybean oil, although EU's soybean oil export volume and share of world soybean oil trade has continued to decline.

3. Past Trend (Export and Import) in Global Soybean Marketing and Trade

Rising unabated since the early 1990s, global trade in soybean grains and soybean products has surpassed than that of wheat – the traditional leader in agricultural commodity trade (USDA, 2005). The world's soybean grains trade grows at an average annual rate of 3.8% compared with 2.9% for soybean oil and 2.3% for soybean meal (USDA, 2005).

Post World War II, the USA, followed by Canada, dominated the soybean industry. Soybean attained global significance shortly after World War II, when the USA made soybean exports part of its negotiated assistance packages in the reconstruction of Europe. This allowed the USA to establish a dominant position for this emerging commodity and to rule global soybean markets for two decades as the crop's sole exporter. As late as 1970, the USA accounted for two-thirds of the world's 44 million tonnes of soybean. Canada was the second largest producer, followed by a number of European countries (Perez *et al*., 2008)

Brazil entered the soybean industry in the early twentieth century with initial focus on family farms and domestic use, prior to commercializing. Commercial production then began in the 1960s and by 1976 it had gained a significant share (16%) of the world market. After a brief decline in the 1980s, soybean production in Brazil grew again dramatically (Perez *et al*., 2008). Bolivia started growing soybean in the 1950s with production steadily growing, then taking off in the early 1990s. The area planted expanded nearly six-fold from 1985–1995, with exports rising from $20 million to $143 million (Perez *et al*., 2008). Like other countries in the region, Bolivia's soybean boom coincided with trade liberalization.

Increase in income has differential effects on the consumption of traditional soybean foods, fats and oil as well as livestock products. The results of income elasticity of demand estimated in Japan for certain soybean products shows that *miso* (a processed soybean product) had a negative income elasticity of less than –1.0 (meaning that with a 1% increase in income the quantity purchased decreases by more than 1%). *Shoyu* (another soybean product) had an income elasticity ranging between 0 and –0.5. The income elasticity of demand ranges for the other soybean products were estimated at: 0 to +0.5 (for *tofu*), +0.5 to +1 (soybean as a whole), and above +1 (for fats, oils, and livestock products). These estimates indicate that as the income of Japanese consumer increases, consumption of traditional soybean foods decreases, while consumption of fats, processed oils, and livestock products increases more rapidly than the rate of income increases (Nakamura, 1961).

Sometimes, some buyers indicate preference for soybean from particular sources or countries. For instance, some European mills preferred USA soybean from the Manchurian (Primmer, 1939). Soybean oil imports normally stand high above the imports of soybean grains or of other soybean products. For dependable delivery, Japan had also continued to import most of its soybean from the USA instead of then potential sources such as mainland China (Nakamura, 1961). Most of the domestic consumption of soybean oil was in the form of food products, such as cooking and salad oils, and most of the soybean meal used domestically was in the high-protein portion of feed rations for poultry and livestock (Rausser and Carter, 1983).

The dramatic growth in Brazilian production and export of soybean grain and soybean products during 1973–1983 eroded the USA dominance in the world market (Williams and

Thompson, 1984) in the mid 1980s. From less than 1% in the early 1960's, Brazilian soybean output has grown to over 24% of world production. In Brazil, soybean has replaced other arable crops (Smaling *et al.*, 2008). In India, the expansion in area under oilseeds has occurred mainly through an increase in the cropped area as also through displacement of low-yielding coarse cereals (Acharya, 1993).

4. Drivers of Global Soybean Market and Trade

The key driver of soybean market growth is the macro-economy of the suppliers and consumers of soybean and its products (Informa economics, 2005). Market demand for soybean and its value is derived from soybean meal and soybean oil (Rausser and Carter, 1983). Global processes such as bio-fuels, functional foods, and the increasing replacement of protein sourced from fishmeal with that sourced from soybean meal in livestock (pig, chicken, rabbit, etc.) feed formulations have been driving the global soybean marketing and trade, leading to drastic price increases that are not likely to fall and/or stabilize soon. This may benefit large scale soybean producers and increase economic incentives for emerging soybean producing countries such as Argentina (Perez *et al*., 2008). Some of these driving factors are further discussed below.

4.1. Biodiesel

Soybean is one of the major booming oil crops in the world and is one of the products presently being used as biodiesel, with an increasing trend in response to the growing demand for bio-fuels, especially in the USA (Smaling *et al*., 2008). This is being driven by the high and unstable fossil fuel-derived energy prices. Several countries (e.g., Brazil, USA) have created programmes for biodiesel development. As a result, a new market was opened for soybean oil in Brazil in 2006/07. In Brazil, the biodiesel programme allowed inclusion of 2% of biodiesel in diesel from petroleum since 2006. This proportion will become compulsory in 2008 and increase to 5% by 2013 (Smaling *et al*., 2008). Demand for vegetable oil for biodiesel was estimated at about 500,000 tonnes for 2008 (Smaling *et al*., 2008). It has also been estimated that the energy sector will absorb about 1.5–3.0 million tonnes of vegetable oil in 2–5 years (Smaling *et al*., 2008).

4.2. Surging demand for soybean foods, vegetable oil, and animal products

The increasing global demand for animal products and vegetable oil in developed countries (e.g., Japan, USA) and emerging markets (China, India, Brazil, etc.) has continued to exert pressure on the soybean value chain, resulting in drastic price increases (Smaling *et al*., 2008). In China, growing demand for high-quality vegetable oils outpaces domestic oil production and stimulates expanding soybean oil imports (USDA, 2005). There has also been a steady change in tastes and preferences towards greater consumption of vegetable oils and reduced consumption of animal fats (Vandeborre, 1966). There is an ever-growing demand for soybean products in China. For instance, overall demand for vegetable oil was estimated at about 1 million tonnes in 2008 and at about 2.5 million tonnes in 2013. The various and increasing uses of soybean and its products have made it to gain a key place in the American industrial scene. In response, increasing numbers of manufacturers in the USA (and elsewhere) now primarily engage in production of soybean oil, soybean cake, soybean meal, and other soybean products.

4.3. Continuous investment and expansion in oilseed crushing capacity

Many countries (e.g., China, some countries in North Africa, the Middle East, and South Asia) with limited opportunity to expand oilseed production have continued to invest in crushing capacity (USDA, 2005). Expansion in oilseed crushing facilities in the importing countries also accelerated the expansion of the soybean industries in Brazil and Argentina (Uri *et al*., 1993), causing oilseed import demand to be maintained above the import demand for protein meal (USDA, 2005). China has a policy of expanding its crushing capacity instead of importing protein meal and vegetable oil. This policy influences the composition of world trade by raising international import demand for soybean grains and other oilseeds rather than import demand for processed products.

4.4. Increased demand for livestock feed protein from soybean

The increased sourcing of livestock feed protein from soybean has been associated with increased commercialization of pork and poultry production that demands a higher minimum quality of feedstuffs in terms of energy and protein content (USDA, 2005). As the livestock industry grows rapidly to meet the increasing demand for livestock products, the use of soybean meal in feed (especially pig, chicken, and rabbit) manufacturing is also becoming more and more important in response to changes in dietary habits and shifts in tastes and consumer preferences (Nakamura, 1961; USDA, 2005). Protein for animal feed manufacturing is increasingly sourced from soybean meal instead of fish meal, as has been the case in the past (Nakamura, 1961; Mwasha, 2006; Zulu, 2005). The problems with sourcing livestock feed proteins from fishmeal include high levels of bacterial (e.g., salmonella) contamination which cause serious production problems in poultry (e.g., diseases that can lead to 100% mortality in poultry farms, about 50% reduction in egg production, and about 30% reduction in hatchability), usage of drugs which have residual effects, huge livestock medical bills, fishy smell in eggs and meat, short shelf life due to high moisture, depressed growth in broilers (due to diseases) (Mwasha, 2006; Zulu, 2005), and likelihoods of mercury contamination.

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4.5. Economic growth, rising per capita income and urbanization in developing countries

The changing world food demand for high-value agricultural products (including livestock products) and processed foods has mainly been attributed to strong economic growth and rising per capita income in developing countries (USDA, 2005; ASARECA, 2008). With economic growth, urbanization and changing diets, world demand for plant-derived oils and their derivatives has been soaring (Smaling *et al.*, 2008). In North Africa, Middle East region, Central America and the Caribbean, income and population growth drive strong gains in soybean oil imports (USDA, 2005). North Africa and the Middle East are projected to experience continued growth in import demand for grain and high-protein meals through 2014, as rising populations and incomes sustain strong demand growth for animal products (USDA, 2005). Strong income and population growth in developing countries generate increasing demand for vegetable oils for human food and high-protein meals are used in livestock production. In India, cereal consumption remained unchanged between 1990 and 2005, while consumption of oil almost doubled (ASARECA, 2008).

4.6. Profit and high price

Profit is the single most important driver of soybean production in Brazil where, although combating soybean rust disease increases the costs of producing soybean, soybean remains more profitable than the other crops (USDA, 2005). Similarly, though generally profitable for direct food and feed uses, soybean for those purposes expand into such highly competitive markets that more profit seems likely through its utilization as factory raw material (Primmer, 1939). Higher price for soybean in the early 1970s is the result of substantial increases in the demands for soybean grains and soybean products in the world markets (Uri *et al*., 1993).

4.7. Global increase in human and livestock population and expansion of trade

Population, a demand shifter, is a significant factor driving the overall growth in demand for agricultural products (Vandeborre, 1966). Ever increasing global human and animal population, especially in developing countries, will likely lead to increase in demand for soybean in the future. A major factor in the oilseed sector for the past several years has been China's large soybean imports due to its huge population (Plato and Chambers, 2004). The demand surge from China was further triggered by its WTO membership since 2002 (Smaling *et al*., 2008). Increase in domestic demand due to marginal increase in China's population will drive world demand and prices. Increasing global demand for animal products also increases demand for soybean due to its desired feed traits. Demand for food and feed is expected to double in the next half century (Gowing and Palmer, 2008), which, in turn, pushes the demand for soybean and its products.

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4.8. Technological development, trade liberalization and involvement of multinationals

Due to technological improvements and favourable price policies, production of oilseeds recorded a jump during the eighties (Acharya, 1993), bringing about land use changes. Scientists have continued to find new uses for the versatile soybean (Sonnedecker, 1942; Greenberg and Hartung, 1998). In Argentina, advanced research capacities have greatly contributed to increase in soybean production, marketing and trade (Perez *et al*., 2008).

The adoption of broad commercial and financial liberalization measures was instrumental to the development of soybean market and trade in South America (Brazil, Argentina, Bolivia, etc.). Such policy environment made soybean take off in Brazil, leading to annual growth of 4.8%, especially on large properties that dominate Brazil's soybean sector (Perez *et al.*, 2008). With the capital-intensive and technologically advanced farming of vast land, agribusiness has been driving the growth in commercial production of soybean in Brazil where 85% of farms are larger than 1000 hectares in the largest soybean producing municipality. Multinational agro-food firms and companies have begun to displace the state as the principal financiers of soybean production. In 2005, just four firms accounted for 59% of soybean processing and 61% of soybean-based exports, showing how agricultural trade liberalization brought about growth for the large farms that dominate the soybean sub-sector in Brazil (Perez *et al*., 2008). Similarly, Bolivia's soybean boom coincided with trade liberalization in the country, assisted by significant state investment in infrastructure, subsidization of fuels used by the soybean sector, debt relieves, and large tax exemptions to attract investment and promote exports (Perez *et al*., 2008).

4.9. Transgenic soybean boom and policy support

The transgenic soybean boom has pushed Argentina towards specializing in the production and export of a small number of primary products. For most of the last century, Argentina was one of the world's most important producers of meat and cereal grains and was nearly self-sufficient in food production for its population. Now, the country has lost that self-reliance as it has moved decisively towards soybean monoculture (Perez *et al.*, 2008). Argentina's double-harvest of wheat and soybean in rotation has replaced cattle ranching and other important food crops, negatively affecting food security. Nearly half of all land in cereals and oilseeds (46%) was on soybean in 2002/03, up dramatically from 9% in 1980/81. While soybean production increased to 20 million tonnes from 1997–2004, production of fruits and cotton declined, as did the production of rice by 500,000 tonnes (Perez *et al*., 2008). The Argentine soybean model has caused near-disappearance of small-scale and family farming. Between 1988 and 2002, Argentina lost 87,000 farms, 86% of them smaller than 200 hectares. Argentina's agricultural sector became one of "farms without farmers" (Perez *et al*., 2008). Strong policy support – policies supporting the industrial soybean sector – was amply demonstrated in South American countries (Brazil, Argentina, and Bolivia). In Argentina, there is widespread legalization and adoption of transgenic soybean. In Brazil, soybean producing states offered tax breaks to stimulate production while in Bolivia, the state subsidized energy costs. In Brazil and Argentina, public funds were used for research that benefits the private sector.

5. Changing Profile of Global Soybean Trade

At the global level, soybean is the largest source of protein for livestock feed and the second largest source of vegetable oil in the world after oil palm, accounting for nearly 65% of the worlds' livestock protein supply and for 20–30% of the world's vegetable oil supply (Ash *et al.*, 2006; J.M. Mahasi, Kenya, 2008, personal communication).

5.1. Changing pattern of soybean production and export as demand increases

As the demand for soybean increases, the pattern of its production, export and import has been changing. This change has been the result of reactions of producers, exporters and importers to market incentives and domestic demand situations. Brazil and Argentina are emerging as the new world players in soybean production and export. Brazil is the second largest exporter of soybean after the USA (Fig. 20.1). Assuming no subsidies, Brazil has a comparative advantage over the USA in producing soybean due to the relatively fertile virgin land and the generally lower production costs in the country (Ash *et al*., 2006). China's significant role as an importer of soybean only came recently when the country relaxed a number of trade restrictions in compliance with the WTO, which it joined in 2002. The other emerging exporters of soybean are Paraguay, China, and Canada (Fig. 20.1). The export of China has, however, been declining mainly due to the fast increasing domestic demand. Overall, China is a net importer and its import accounts for 40% of the world soybean trade (Ash *et al*., 2006).

During recent years, the export of soybean by the USA has also been declining due to the alternative uses of soybean as a biodiesel and the recent policy changes that have given tax

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breaks or subsidies for production of biodiesel from soybean. Competition (with maize) for land for ethanol production is also likely to decrease the USA soybean production and export (Elobeid *et al*., 2006).

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5.2. Changing demand for soybean

Based on demand and importation, the developed countries are the major consumers of soybean produced in the world. In 2000, high income countries accounted for 46% of total soybean demand (165 million tonnes), 90% of which is for non-food use – mainly animal feeds and recently biodiesel.

Using International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT), developed by International Food Policy Research Institute (IFPRI) (Rosegrant *et al.*, 2002), it is estimated that the demand for soybean in developing countries is expected to increase significantly by year 2050. Such an increase will mainly come from the demand for livestock products in developing countries (Fig. 20.2).

Similar to the USA and Brazil, the demand for soybean biodiesel is increasing in the EU. Europe has set targets for bio-fuels in order to reduce petroleum carbon emission and dependence on fossil fuel (Ash *et al*., 2006). The demand for soybean products in East Asia and Latin America presents an interesting trend (Fig. 20.3). The East Asia and Pacific's share of the world demand for soybean will increase from about 0.2 (or 20%) in 2000 to about 0.25 (or 25%) in 2020, driven mainly by China. The region's share of the world demand for soybean will then start falling and reach about 0.2 (or 20%) again in 2050. Latin America and Brazil show a decreasing share of the global soybean demand. India presents a unique case in its soybean trade policies. The country's production does not meet its large demand, yet the country has set prohibitive taxes to limit importation of oilseeds (Ash *et al*., 2006). With its large population and rising incomes, India is unable to meet its vegetable oil needs. Despite its increasing demand for animal products and the consequent demand for soybean meal, India is a minor importer of soybean meal.

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5.3. Fundamental shift in Africa

There have been fundamental shifts in soybean enterprise in Africa – from being net exporter of oilseeds until mid-1970s to net importer afterwards (Diaz-Bonilla and Reca, 2000). There is a dramatic decline in world market share for African exports of processed products from oilseed. Less developed countries overtook developed countries in exports of oilseeds in the mid-1970s (Diaz-Bonilla and Reca, 2000). Sub-Saharan Africa (SSA) accounts for less than 1% of total demand and import of soybean. Our projection shows that SSA's demand for soybean will increase significantly and consistently to reach about 2% of the world demand (Fig. 20.4). Fig. 20.4 is an amplification of the crowded Fig. 20.3 though based on similar data just for SSA. It shows an increase from less than 1% to a bit more than 2%. As in other regions, this increase is mainly determined by the increasing demand for non-food soybean products.

5.4. South American soybean boom

The South American soybean boom began in earnest in the early 1990s to the point that Brazil and Argentina began to take market share from the USA and Canada. By 2007, the USA accounted for 37% of global production, with Brazil and Argentina accounting for 24 and

20% of the market share, respectively (Perez *et al*., 2008). In Argentina, transnational firms also control soybean processing and marketing, and even have extensive connections with the financial sector to form "planting pools".

6. Expected Future Trend (Export and Import) in Global Soybean Marketing and Trade

Several factors will work simultaneously to determine the future trends in global soybean trade. An example is domestic agricultural and trade policies in individual countries that have a role in soybean trade. Some selected details are given below.

All projections show that Brazil will soon surpass the USA as the world's largest producer and that South America will be dominating the growing soybean market. South America has already replaced the USA as the largest soybean exporter, with Brazil as the largest exporter of raw soybean grains and Argentina as the largest exporter of soybean oil (Perez *et al*., 2008). South America is also expected to surpass the USA in the predominance of transgenic soybean (Perez *et al*., 2008). Argentina produces virtually 100% transgenic soybean, while other producers in the region now grow at least half the soybean from transgenic seeds (Perez *et al*., 2008).

As scientists continue to find new uses for soybean, it is expected that per capita and total consumption of soybean (oil, meal, etc.) will continue to increase. This will also be accelerated by economic progress, rise in the income of consumers that create a stronger demand for fats, oils and livestock products. Besides, the ratio of consumption by the crushing and food industries is expected to further increase in the future in order to meet the increasing demand for soybean oil and soybean meal.

Various analysts have given their judgment regarding future developments related to the soybean industry. Some analysts have noted that continued strong growth in global demand for vegetable oil and protein meal is expected to maintain soybean and soybean-product trade well above wheat and coarse grains trade throughout the next decade (USDA, 2005). Strong competition in international protein meal markets is expected to influence oilseed crushing margins and shift some of the import demand for oilseeds to cheaper meals. The steady competitive pressure of new oilseed crushing capacity is expected to result in many inefficient crushers being edged out.

There has been some slow growth in the EU soybean meal and soybean grains import. Increases in grain and rapeseed meal feeding are expected to continue to slow the growth in EU soybean meal and soybean imports (USDA, 2005). Abundant EU grain stocks, lower internal EU grain prices due to Agenda 2000 price cuts, increased barley production due to Common Agricultural Policy (CAP) 2003 reforms, greater supplies of coarse grains from acceding countries, and more rapeseed meal available as a result of the bio-fuels initiative, combine to slow the growth of soybean meal consumption. These factors are partially offset by increase in dairy quota and increase feeding of soybean meal. Significant investments in oilseed crushing infrastructure by China drive strong gains in soybean imports as China seeks to capture the value added from processing oilseeds into protein meal and vegetable oil (USDA, 2005). East Asia's trade outlook is dominated by a continuing shift from importing feedstuffs to importing meat and other livestock products. As a result, this region's import demand for protein meal and oilseeds is expected to slow down. This process occurs most noticeably in Japan (USDA, 2005).

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There is intense within-region competition among the South American soybean producing countries. Although all the soybean producing countries in South America (including Paraguay and Uruguay) generally follow a similar production model and belong to the same regional integration association, each government follows policies to compete with its neighbors. Paradoxically, the region that is coming to dominate global production and exports of soybean and its various products is engaged more in within-region competition rather than coordinating national policies to maximize synergistic benefits (Perez *et al*., 2008).

Genetically modified (GM) and Round-up ready soybeans are increasingly becoming important in the major soybean producing nations of the world. Round-up ready soybean and genetically modified seeds have been in use in the USA and Argentina since 1996 (Qaim and Traxler, 2005). Most soybean varieties presently grown in Brazil are also genetically modified (Smaling *et al*., 2008). In the USA, GM soybean accounts for about 87% of the total area under soybean (Andino *et al*., 2005). The advent of Round-up ready soybean and GM soybean is expected to become more important in future – a situation that will demand institutional innovations to deal with potential health (safety) and environmental risks.

Significant expansion in domestic crushing in China and large imports of oilseeds will result in China exporting about 1 million tonnes of soybean meal in the future (USDA, 2005). Increasing soybean meal exports from other South American countries (especially Paraguay) is expected to contribute in keeping the international protein meal markets very competitive. The EU continues to be a small but steady exporter of soybean meal. India also remains an exporter of soybean meal, although this has been projected to decline in the future (USDA, 2005). According to USDA (2005), Brazil's rapidly increasing area planted to soybean enables it to gain a larger share of world's soybean grains and soybean meal exports, despite increasing domestic feed use. Its share of world exports of soybean grains plus the soybean equivalent of soybean meal exports rises from about 35% in recent years to 45% by 2014 (USDA, 2005).

7. Global Soybean Price Trends, Trade and Marketing Policies

The pricing system for soybean is complex because it involves interactions between the markets for soybean grain, soybean meal, and soybean oil (Uri *et al*., 1993). Since these are different products, their prices, though not completely disconnected, are determined differently. Soybean oil is a more basic and much more speculative commodity than soybean meal (Vandenborre, 1966). Since there are numerous substitutes for soybean oil on the world market, its price is determined residually (Rausser and Carter, 1983).

7.1. Reasons for increases in the price of soybean products

As a result of the increasing demand for livestock products and the derived demand for (from demand for animal products) soybean, prices of soybean meal have increased dramatically over the last decade. Prices of soybean oil and soybean-based foods have also increased, due mainly to increasing dietary health in high income countries. The increasing soybean prices have also been driven by the rising income and the consequent higher demand for livestock products and dietary health concern that increase demand for vegetable-based diets and fibre-rich foods.

Increasing fossil fuel prices have prompted efforts by Brazil, Argentina, USA and EU countries to develop alternative energy sources, including soybean-based biodiesel. The increasing fossil fuel prices also increased soybean production costs, contributing to the increasing prices of soybean and other foods (Benson *et al.*, 2008). Policies in these countries have been designed to give incentives for production of bio-fuels. This has also led to increasing production of ethanol, which is maize–based. Import and export restrictions, in response to the increasing food prices, also had a net effect of increasing world food prices (Trostle, 2008). Farmers in the USA and other countries also substituted production of soybean with maize, leading to increase in soybean price due to reduced supply (Tyner, 2008). As shown in Table 20.3, soybean is the major crop used to produce biodiesel in Brazil, Argentina, and the USA.

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Table 20.3. Contribution of soybean to production of biodiesel in 2006/07 by major producing countries (Trostle, 2008)

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Country	Amount produced (million litres)	% of total global production	% produced from soy feedstock
Argentina	443	5	100
Brazil	398	5	66
EU-27	5004	65	16*
USA	1927	22	74
Total	8583		

* About two thirds of EU biodiesel production is derived from rapeseed

Soybean remains a favourable source of biodiesel for the major soybean producing countries and this has contributed to the increasing soybean price in the global market. However, production of biodiesel from soybean accounts only for a small share of the total consumption of petroleum diesel but its demand is likely to increase given its environmental advantage over fossil fuel. Compared to fossil fuel, biodiesel reduces gas emissions by 41% and less air pollutants (Hill *et al.*, 2006). As will be discussed below, these environmental advantages have appealed to soybean producing countries to subsidize production of soybean and biodiesel.

Demand for soybean is also driven by changing health concerns – as people in developing countries switch to more vegetable and fibre-rich foods. While Asian countries demand for animal products has sharply increased in response to the increasing income, the livestock product consumption in developed countries has remained stable and in some cases declined slightly in response to the increasing dietary health and livestock-related food safety concerns. Soybean is perceived as having health benefits that address these concerns. In USA, the Federal Drug Administration (FDA) allows food containing 5 g of soybean protein per serving to be labelled as reducing heart diseases (Ash *et al.*, 2006). Use of high soy protein (soy isoflavones) in fortified foods and supplements for prevention of osteoporosis is growing rapidly.

7.2. Effect of policy on pattern of soybean trade

The policies in the major players in the soybean production and trade in the world play a key role in determining the pattern of soybean trade. To help understand global policies and their impact on soybean trade, we shall review the policies in the USA, Brazil and Argentina as exporters of soybean and in the EU as importers. The USA recently enacted the Energy Policy Act of 2005 that set a goal of producing 28.5 billion litres of bio-fuel by year 2012. A more

ambitious Act is the Energy Independence and Security Act of 2007 that sets a goal of producing 136 billion litres of bio-fuel (of which, 4 billion litres will be biodiesel) by 2022 (Tyner, 2008). This has led to robust growth in biodiesel production from soybean. The Acts are accompanied with subsidies and other incentives for farmers, developers of technologies, and bio-fuel producers (see Tyner, 2008 for a complete review). Efforts to increase bio-fuel production have been driven by the need to reduce carbon dioxide and sulphur emissions. The USA enacted the Clean Air Act amendments in 1990, seeking to lower sulphur emission (Tyner, 2007). Assuming only soybean-based biodiesel is blended with fossil diesel to achieve the clean air Act, it will require 15% of USA soybean production (Ash *et al.*, 2006). Brazil and Argentina have also formulated policies to reduce dependence on foreign fossil fuel (Pousa *et al*., 2007). The 2005 Brazilian Federal Law 11097 and the Argentine Federal Law 26093 enacted in 2006, both seek to increase the blend of biodiesel in petroleum diesel (Nardi *et al*., 2008). The Brazilian law sets a target of 2% blend of biodiesel starting in 2008 and increasing the requirement to a 5% blend in 2013 while Argentina sets a goal of achieving 5% blend of biodiesel in petroleum diesel starting 2010 (Nardi *et al*., 2008). These policies have also contributed to increased soybean production in both the countries and development of new technologies for production of biodiesel from soybean. Unlike the USA, however, policies in both the countries do not give large subsidies to support soybean producers.

Unlike South America and the USA, production of biodiesel in the EU exceeds ethanol. In 2003, the region produced 1.5 million tonnes of biodiesel, which was 82% of bio-fuel production in the region (Bozbas, 2008). Such policy has undoubtedly increased demand for soybean in the region, contributing to the increasing soybean prices in the global market. Such concerted efforts to produce biodiesel are also driven by the need to reduce petroleum diesel dependence and reduction of CO_2 and sulphur emission. Given that the EU has lower comparative advantage to produce soybean, the region has reduced soybean import taxes, maintaining restrictions on GM soybean (Zepeda, 2006).

7.3. Practical use of trade and marketing policy (including subsidy policies)

Policies have commonly been used to engender agricultural commodity price support (to domestic producers) and promote exports in several countries, especially Western nations. It has also been a common practice in Europe to provide export subsidies for selected commodities. Between 1986 and 1997, export subsidy in EU amounted to 13% of combined value of all agricultural exports from Africa, Latin America, the Caribbean, and Asia (excluding China) (Diaz-Bonilla and Reca, 2000). Trade and marketing policies were used to support and artificially increase the competitiveness of soybean production, processing, marketing and trade in Brazil and Argentina (Williams and Thompson, 1984; Uri *et al.*, 1993) and were instrumental to the take off in soybean production in Brazil. In Japan, farmers who plant soybean on fields diverted from rice receive extra subsidies (Hamamoto *et al.*, 2002). Japan also has soybean price support, known as 'deficiency payments' (Hamamoto *et al*., 2002). The oilseeds sector generally has lower trade protection in Organization for Economic Cooperation and Development (OECD) countries than developing countries with higher trade barriers and tariffs in this sector (Elbehri *et al*., 2001). The good production and export performance of oilseed products by Least Developed Countries (LDCs) is due, in part, to the fact that oilseed production has been relatively less distorted by support policies in the developed countries, allowing its expansion in LDCs (Diaz-Bonilla and Reca, 2000). But still, there are import tariff escalation and stringent sanitary / phyto-sanitary measures by the West, playing against market participation by developing countries. Added to this, African oilseeds policies have largely been restrictive and characterized by export tax (Diaz-Bonilla and Reca,

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2000). Besides, overvalued local currencies, weak domestic demand for oilseeds and derived products as well as political instability have negatively affected the African oilseed sector.

8. Constraints to Global Soybean Marketing and Trade

The most important constraints to global soybean production, marketing and trade in the long-run emanates from the negative externalities of the expansion of the soybean sector itself. These can be summarized under plant and biodiversity loss, carbon emissions, changing air circulation and increased frequency of drought, unlawful land acquisition and inequity, forced migration of forest inhabitants (e.g., in Brazil), deforestation in order to expand the land area under soybean (Smaling *et al*., 2008) and threats to staple food production. Some specific constraints are further discussed below.

Pest and disease problems still hamper soybean production in many countries, while extensive use of glyphosate pesticides in large commercial soybean monocrops in Argentina has led to polluted soils. Within the last decade, Argentina's agricultural production system became dominated by 14 million hectares of soybean monocrop, creating a highly production system that could be highly vulnerable .The massive production of Round-Up Ready (RR) soybean in Argentina also has its social consequences (TWN, 2005). This is also true of low soil fertility that is still a major problem, especially in sub-Saharan Africa. For instance, phosphorous which is particularly important for the growth performance is limiting in most soils of sub-Saharan Africa. There is also the problem of drought and limited access to improved soybean seeds for planting. Due to climate change, drought is increasingly posing a natural threat to agricultural production and productivity, especially in sub-Saharan Africa. This is especially serious given SSA farmers' lack of access to irrigation facilities. The problem of drought is compounded by farmers' limited access to improved soybean seeds in SSA.

Limited crushing capacity in developing countries and the GM-related constraints also pose some problems. This deprives farmers of adequate net returns and creates disincentives for them to continue to process soybean. This implies an incomplete value-chain development. GM soybeans are increasingly becoming more important but continue to generate issues about environmental and food safety concerns. This poses a challenge to the production, marketing, and trade of soybean. For instance, increased adoption of GM soybeans in the USA has been one factor for the decreased performance of the USA soybean exports due to lack of consumer acceptance (Andino *et al*., 2005).

The South American soybean sector model has inherent limitations. The three cases (Brazil, Argentina, and Bolivia) show the limitations of the South American soybean sector model. While liberalization and agro-export orientation have benefitted some producers, the strategy is based on undervalued natural resources, and foreign enterprises dominate all parts of the industry except the farming – financing, input supply, processing, marketing, and export operations. Despite dynamic growth in productivity and output, the soybean sector in South America has seen a significant drop in employment (Perez *et al*., 2008). Drop in employment, foreign dominance and capital intensive nature of this sector in South America raises a question on the role of this crop to the poor and equity implications. In this context, the governments of the soybean producing South American countries have in different ways adopted policies to support the industrial soybean sector. In Argentina we see the widespread legalization and adoption of transgenic soybean. The increased use of agrochemicals on soybean is also an environmental challenge. In Brazil, soybean producing states have offered tax breaks to stimulate production. Bolivia has subsidized energy costs (Perez *et al*., 2008).

Public funds in Brazil and Argentina have also gone to research that has benefitted the private sector (Perez *et al*., 2008).

Growth in the export of soybean meal and soybean grains is experiencing some constraints in selected countries. For instance, further growth in the soybean meal exports of Brazil is constrained by a strong growth in domestic consumption of soybean meal due to rapid expansion of the poultry and pork sectors (USDA, 2005). In the USA, projected declines in acreage planted to soybean and increased domestic crush limit exportable supplies (USDA, 2005).

9. Conclusions and Implications (Policy and Research) for the Soybean Sector

This chapter has attempted to examine the current situation and future outlook of global soybean marketing and trade based on the available evidence. To this effect, its methodology has been review of the literature, compiling the publicly accessible data and supplementing this information with the prediction of the IMPACT (International Model for Policy Analysis of Agricultural Commodities and Trade) model developed by IFPRI.

Soybean is an extensively processed and traded commodity with versatile uses. Since soybean is a crop mostly used in its processed form and since it is an input to manufacture various food and non-food products, crushers and manufacturing industries are the key users of this crop. Prediction of prices and understanding the soybean pricing system is a complex undertaking because it involves various products: soybean grain, soybean meal and soybean oil.

Results from the situation analysis indicate that the USA, Brazil, and Argentina are the three most important players in soybean export market. For soybean oil, the key exporters are Argentina, Brazil, United States, and the EU, in the decreasing order. China, the EU, and Japan are the major players in soybean import. As a block, the EU remains the world's leading importer of soybean meal. The increasing global demand for soybean has traditionally been met through a strong supply response from Latin America, namely, Brazil and Argentina. The prospect of export of soybean grains continues to be highest in Brazil and projections show that Brazil will soon surpass the USA as the world's largest soybean producer and that South America will dominate the growing soybean market.

Results from the outlook analysis (up to 2050) based on the IMPACT model show that demand for soybean in developing countries is expected to increase significantly, mainly driven by increasing demand for non-food soybean products. Global trade on soybean products has been on the rise since 1985 and is projected to continue to increase. This increase in demand will push soybean world market prices which will put Africa in general and SSA in particular at a disadvantage as a net importer region whose soybean demand is predicted to increase. Several factors drive global soybean trade. Global soybean imports have increased rapidly, due, mainly to the growing demand for soybean in Asia, especially China since joining the WTO. Global population growth, shifts in tastes, preferences and food habits, and supply of alternative animal feeds are the other important factors affecting global trade in soybean and its products.

Two main sources of challenges and opportunities are worth mentioning as far as the future of soybean is concerned. First is the growing global energy demand and soaring energy prices

that continue to increase the demand for alternative energy sources including soybean oil as bio-diesel. The second is China's ever-growing demand for soybean products. This is also true of the industrial uses of soybean oil and by-products to meet the expansion of manufacturers. These expected trends may benefit big soybean producers, but it will also prove to be a challenge unless there is a technological break-through in efficiently producing and marketing soybean internationally. There are, however, certain constraints in the soybean sector at the global level. One of these is the incomplete soybean value chain. There is a need to develop institutions to address the missing links along the soybean value chain and reduce transaction costs of doing business in soybean and its products. New and emerging uses of soybean and enhancing competitiveness throughout the soybean value chain will call for technological change to meet those new uses and the growing demand. The advent of genetically modified soybeans and their use will demand institutional innovations to deal with potential environmental and public health (safety) risks. To address the ever increasing demand for non-grain soybean, continuous investment in oilseed crushing capacity will be needed. Research is also needed to enhance efficiency in soybean production and utilization in the livestock sector and to enhance general soybean system linkages.

Import tariff escalation and stringent sanitary / phyto-sanitary measures by the West are still huge bottlenecks for Latin American developing countries to reap the benefits of this sector. For LDCs to benefit from their exports, they will have to enhance their capacity in trade negotiations against export subsidies and tariff escalation. In some cases, exporting countries will have to deal with their overvalued local currencies.

The review done in this chapter has finally generated some unanswered questions for future research. Due to its strategic importance in terms of foreign currency earning and its versatile uses, governments of the soybean producing countries (especially in South America) invest a lot in supporting the soybean sector. Are all the policy support interventions (like tax breaks, subsidies on energy costs, commodity price support to domestic producers, export subsidies, etc.) economically justified and worth implementing? Are they sustainable? Should they be replicated in other soybean countries / regions? The ever changing climate is expected to influence soybean production and thereby processing and marketing. Is the change in favour or against soybean production and how? What is the environmental impact of expansion of soybean production?

Increased unemployment as a result of expansion of soybean, relocation of large local populations to pave way for soybean production, forest clearance, foreign dominance and capital intensive nature of this sector have been experienced in South America. Meanwhile, the poor do not easily afford livestock diets. This raises a question on the role of this crop to the poor and the marginalized segment of the population. In the SSA, which is a net soybean importer, small-scale farmers' lack access to local soybean markets, which favours large stakeholders and importers. Approaches are needed to enhance local production and consumption, while enhancing smallholder access to markets.

Emerging soaring cost of energy has huge implications for production, processing, marketing, import and export of soybean crop. The need for alternative energy sources and the competition of soybean with other crops (such as maize and jatropha) for ethanol production has lots of ramifications that have to be revealed through further investigations. There is also a need to examine the demand and supply conditions for soybean substitutes to better understand the price trend and incentives for producers of soybean. All the above questions will definitely deserve critical examination in the future through forward looking research.

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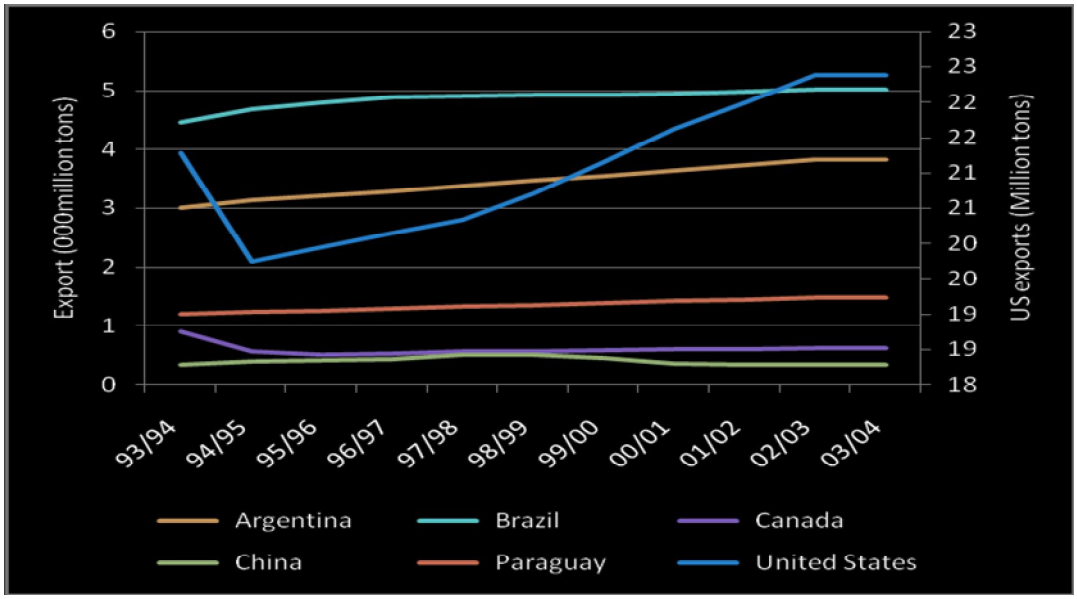

Fig. 20.1. Trend of global soybean exports (1993–2004)
[http://www.ag.iastate.edu/centers/fapri/tables/soybean.pdf (accessed in September 2008)]

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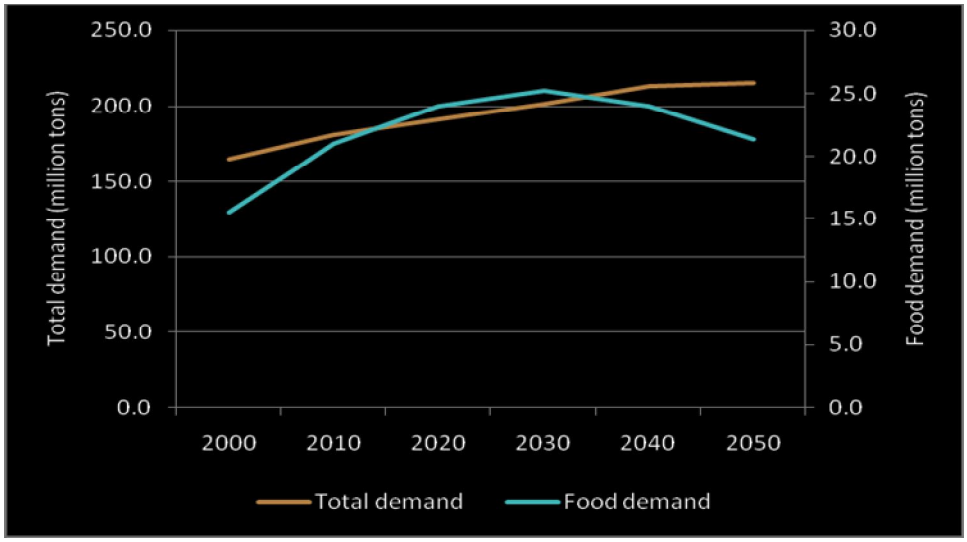

Fig. 20.2. Projections of demand for soybean (Authors' projections using IMPACT model)

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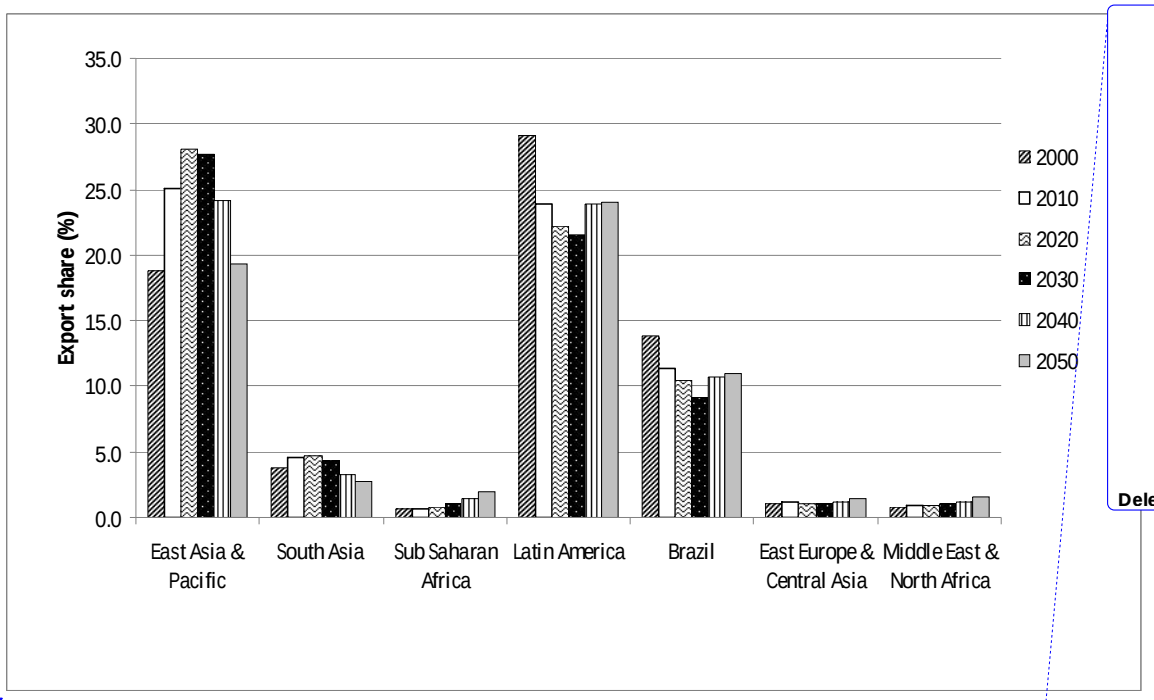

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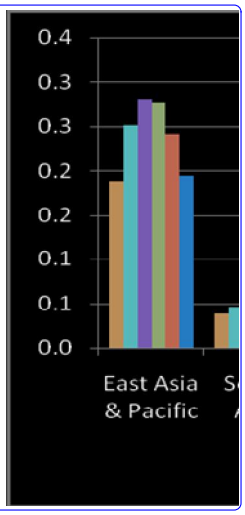

Fig. 20.3. Share of total demand of soybean in developing countries (Authors' projections using IMPACT model)

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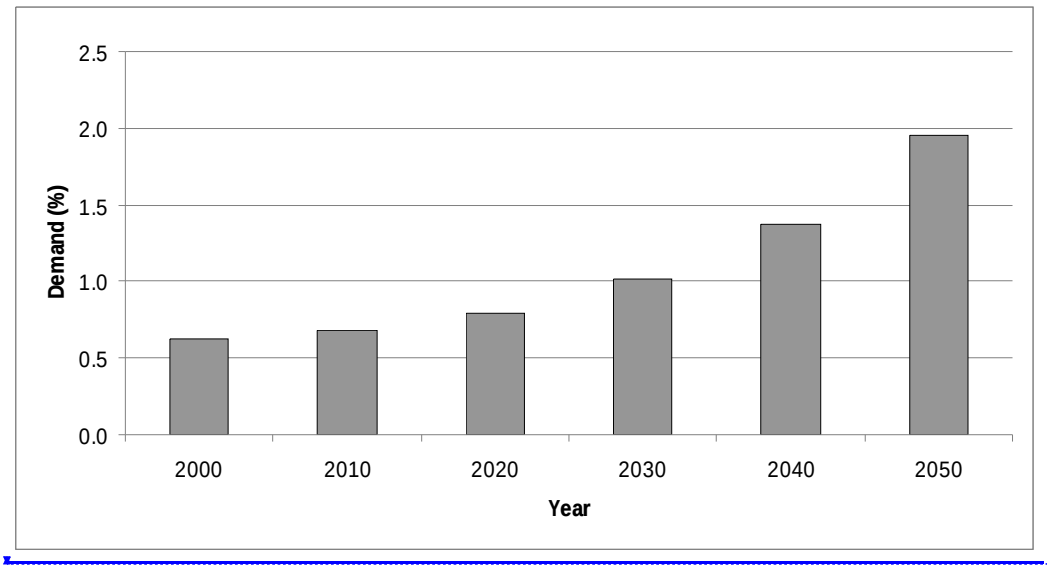

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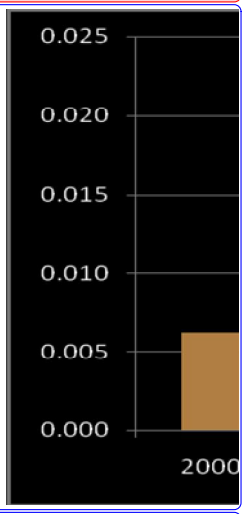

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Fig. 20.4. Demand for soybean in sub-Saharan Africa (Authors' projections using IMPACT model)

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