



## Medium-term Supply and Demand Projections for the Oilseeds Complex <sup>1</sup>

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### **Abstract:**

*Based on the latest FAO/OECD medium term projections for agricultural commodity markets, the paper analyzes the prospects for oilseed and derived products. Overall, the projections suggest that the markets for oilseeds and oilseed products should continue expanding at rates well above those seen for other crops, but at a slower pace than during the previous decade. Throughout the next decade, strong demand for vegetable oil for food consumption and protein meals used in livestock feeding is projected to sustain global trade. Market developments over the projection period are driven by increasing productivity, slower but continuing expansion of area planted to oilcrops and rising demand as incomes rise and populations grow in most countries. Central issues in the projections for oilseeds and products continue to be the potential for further expansion in South America and the rising demand in China, India and other developing countries, which play a dominant role in the overall expansion of the market. The projections remain subject to important uncertainties. The evolution of the macroeconomic environment and of agricultural policies, disease outbreaks, the adoption of new crop production techniques based on genetically modified varieties, changing consumer preferences and emerging biofuel utilization all have the potential to significantly affect the market. Modelling such factors and emerging trends in the context of projections poses particular challenges.*

## **I INTRODUCTION AND BACKGROUND**

The paper discusses the current status and medium term outlook of the global oilseeds, oils and meals economy. It is based on the latest comprehensive medium term assessment of future prospects for agricultural commodity markets jointly prepared by the Food and Agriculture Organization of the United Nations (FAO) and the Organization for Economic Cooperation and Development (OECD). The assessment has been conducted at the beginning of 2006 and the main results have been published in June 2006.

The objective behind undertaking model-supported projection exercises at regular intervals is to generate a consistent set of projections that covers the whole agricultural sector, simulating complex interactions that go beyond the capabilities of individual commodity analysts. Such exercise allows (i) to enhance the understanding of the functioning of commodity markets and of the role of policies, (ii) to support studies and enrich the discussions on the impact of

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<sup>2</sup> The paper draws on the results of a major joint FAO-OECD project and is based on the contributions of a large number of staff from the secretariats of the two organizations. The assistance of Mr Milo in the preparation of this particular paper is acknowledged. The text reflects the views and opinions of the author and so should not be attributed to FAO or its members.

policy reforms on agriculture and trade, (iii) to study the implications of market changes and policy reforms for food security, and (iv) to conduct timely assessment and analysis of emerging issues.

## **II GENERATING THE PROJECTIONS**

In what follows, some basic information about the architecture of the model underlying the projections is provided.

The projections are obtained through a partial equilibrium world agricultural model. The model consists of country and region modules; it is linked to in-house and external databases, and is driven by elasticities and technical as well as policy parameters. The model encompasses 48 countries (with the remaining nations modelled as regional aggregates) and 18 commodities (see Fig. 1).

All important bulk commodities of the temperate climate zones, plus palm oil and some tropical roots and tubers are covered - and the various linkages between the respective markets are consistently modelled. However, as far as the oilseeds sector is concerned, it is important to note that only selected oilseeds and products are covered (see Fig. 2).

The model generates projections, not forecasts. A forecast attempts to predict as accurately as possible a future situation, based on the prediction of coming events and conditions. By contrast, a projection does not necessarily predict what is most likely to happen; it concentrates on extrapolations from past trends, is based on rigid assumptions and its primary use is to provide a baseline for comparative purposes, which allows to analyze the effects of new policies or other events and unexpected changes in conditions.

The model is based on detailed assumptions regarding each country's macro-economic environment, demographic profile, level of agricultural technology and policy measures. As to policies, these are held constant for the entire projection period. Only those policies that were legally enacted in early 2006 have been considered; all likely changes are ignored. Finally, emerging issues like biofuel production and trade in GMO products are not explicitly modelled.

## **III PROJECTION RESULTS**

In this chapter interrelated sets of results for the three sub-sectors oilseeds, oilmeals and oils are presented. The focus is on the market for oilseeds and the market for oils. Less detail will be provided on the oilmeal market; however, also the outlook for global oilmeal consumption shall be mentioned briefly in that it has a direct influence on oil supply via the crushing of oilseeds.

The assessment covers the 2006-2015 period, and the base-year for the projections is the marketing year 2005/06. Although the model is fed with individual commodity data as far as historical years go, projections are generated for oilseeds, oils and meals as aggregates.

Overall findings applying to the oilseed, oil and oilmeal sector as a whole are as follows:

- ✦ world oilseed, oilmeal and oil markets are expected to continue expanding during the period 2005-2016, though at a slower pace than during the previous decade;
- ✦ main factors driving this development are (i) improvements in productivity, (ii) continuing rise in area planted to oilseeds, (iii) rising demand for oils and meals as population and incomes grow, especially in developing countries, and (iv) below average supply and demand growth in developed countries;
- ✦ compared to other basic food crops (rice, wheat, coarse grains), trade in oilseeds, meals and oils is projected to continue expanding at a faster pace (see Fig. 3);
- ✦ the portion of global oilseed, meal and oil production that enters trade remains well above that recorded for other basic food crops (see Fig. 4);
- ✦ regarding prices, the projections lead to the expectation of a moderate long-term rise in nominal prices for oilseeds and vegetable oils, while oilmeal prices are projected to stagnate at the relatively low level recorded around the year 2000. In real terms, this translates into a progressive slight weakening of prices for oilseeds and oils, and a more pronounced fall for meal prices (see Fig. 5).

## 1. Oilseed projections

### (a) Global oilseed production

Global oilseed production is projected to rise by about 25% between 2005 and 2015. Crushings follow more or less the same path. It should be noted, however, that, compared to the past decade, growth in global production and crushings is anticipated to slow down markedly during the next ten years (see Fig. 6).

The area and yield paths underlying the production estimates as well as the respective growth rates are shown in Fig. 7 and 8 respectively. The projected slow-down in area expansion is partly compensated by a steady improvement in average yields. While across developed nations the growth pace is expected to fall by almost half compared to the past decade, yields are seen to continue growing at 2% per year among developing countries. Consequently, over the next decade, the gap between average yields in developing and developed countries is anticipated to narrow down considerably (see Fig. 9). Among other things, this estimate is based on the assumption that developing nations are going to have increased access to advanced genetic engineering techniques.

Projected yield growth rates vary among individual countries, with relatively low rates expected among, for example, African producers as well as in Argentina and China<sup>3</sup>, as opposed to higher rates in Brazil and India (see Fig. 10).

By 2015, the share of developing countries in global oilseed production is anticipated to reach about 60%; conversely, the developed countries' share in global output will fall (see Fig. 11).

Among developed producers, North America is expected to maintain the lead, followed at considerable distance by the EU-25 and then Eastern Europe (see Fig. 12). No significant changes are expected in this regional pattern, with the exception of the EU's slowly increasing share – at the expense of the United States. Among developing countries, the dominance of Latin America is expected to increase further (see Fig. 13).

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<sup>3</sup> In this paper China always refers to China Mainland.

A closer look at the world's key producing regions follows:

South America: The region is expected to remain the world's leading oilseed producing area, which also drives growth in global production. Fig. 14 shows that the region's anticipated expansion is well above the global growth rate as well as that estimated for the group of developed countries. In absolute terms, the output of Argentina and Brazil is projected to increase by respectively 34% and 58%. In Argentina, total land sown to oilseeds should continue to expand and the country's production is estimated to grow by 3% per year on average. In Brazil, after an initial period of stagnation, area growth is expected to resume, leading to an annual increase in output of over 4%. Also Paraguay plays a significant role in Latin America, with an expected rise in production of over 70% between 2005 and 2015.

With regard to oilseed crushings, Fig. 15 suggests that the region's processing capacity will continue to expand. However, as in the past, oilseed production should grow at a faster pace than crushing capacity and the gap between the two is anticipated to widen – a situation expected to lead to more marked rises in oilseed exports relative to shipments of oil and meal.

European Union: The region is anticipated to be the main engine of oilseed production growth among developed countries. Its production of oilseeds is projected to rise by 35% over the next ten years due to both area expansion and yield improvements. In the last few years, the use of rapeseed oil for biodiesel production has increased significantly. This is anticipated to continue, thus providing the incentive for further expansion of domestic production and crushing. Area planted is expected to increase by 17% over the projection period, at the expense of the area planted to cereals. These projections are influenced by the EU's biofuel directive of 2003, which has introduced non-compulsory targets for biofuel use in member states; however, they do not reflect the potential market impact arising from mandatory blending requirements which might be introduced in the EU during the next decade.

United States: Production is expected to expand by less than 1% annually. In the coming years, expansion in soybean area is likely to be limited by rising demand for maize for ethanol (i.e. biofuel) production. Part of the land currently planted to soybeans is projected to shift to maize due the anticipated steady rise in ethanol consumption. As a result, by 2015 the US oilseed area could fall by about 3% relative to the 2000-2004 average.

India: Oilseed production has reached a new record in 2004, thanks to both favourable growing conditions as well as higher support prices for oilseeds relative to other crops. This has encouraged some shift of land from grains to oilseeds. During the coming decade, further, moderate growth in oilseed production is expected, mainly thanks to yield improvements stemming from the application of modern biotechnology. However, projections for India tend to be accompanied by a considerable degree of uncertainty as the country's commodity-specific production support policies and import measures tend to change over time, thus altering the allocation of resources among crops.

China: Oilseed production is projected to expand by 2% per year.

The developments described above are resumed in Fig. 16. The diagram shows that, with regard to the global pattern of production, the outstanding change consists of the rising importance of Latin America at the expense of the United States.

#### (b) Global oilseed trade

World oilseed trade is projected to expand by about 27 million tonnes or 36% over the outlook period. Although lower than during the past decade, the implied annual growth rate of 3% exceeds that of most other agricultural commodities.

## Exports:

Fig. 17 illustrate the outlook for the global pattern of exports, showing the path anticipated for the main players in the oilseed export market.

The picture emerging for the key players is as follows:

Latin America: Almost 95% of the growth in global import demand should be supplied by producers in Latin America, led by Brazil, Argentina and Paraguay. By 2015, Brazil is projected to be exporting 2.5 times the amount that was shipped during the 2000-2004 period, and Argentina almost twice as much. Although the crushing capacity of both countries is expected to grow, seed processing will continue to lag behind the growth of seed production, especially in Brazil. In Argentina, this trend continues in spite of the country's differential export tax system, which is meant to encourage domestic crush of seeds and the exportation of oilseed products.

United States: In the long term, competitive pressure from Latin American exports is anticipated to depress US soybean shipments. Exports are in fact anticipated to fall as a result of steadily rising domestic consumption.

Canada: Oilseed exports from Canada are estimated to continue growing, although at a modest rate of 1.4% per year.

Commonwealth of Independent States: Exports by the CIS - which dropped markedly over the last decade - are anticipated to resume growing, eventually returning to the levels recorded in the mid 1990s.

## Imports:

Virtually the entire projected rise in global oilseed imports originates in developing countries. Within this group of nations, countries in Asia-Pacific account for the bulk of the rise in purchases. China remains by far the most important and indeed dominant player in Asia. Latin American countries account for most of the remainder, while African importers continue to play a very limited role.

Fig. 18 clearly shows the four outstanding features of the outlook: (i) a steadily declining role for Japan and the EU, (ii) the stagnation of import demand in Africa, (iii) the continued dominance of Asian purchases, and, in particular, (iv) the continued surge of China's share in the global import market.

The situation in China deserves to be discussed in more detail (see Fig. 19). By the end of the outlook period, China's combined oilseed imports are estimated to exceed 50 million tonnes, which is more than double the current volume of purchases. Accounting for almost half of the world's oilseed imports and close to one fourth of global oilseed consumption, the country shall continue to play a crucial role in the global market. China's reliance on the world market could increase further: in 2015, close to 60% of the oilseeds consumed in the country (and almost 70% of the oilseeds crushed) should be covered by imports. These imports will be necessary to satisfy the country's strongly rising demand for feedstuffs and reflect the relatively weak growth in domestic oilseed production. In line with recent trends, a large part of feedstuff demand will be met by oilseed rather than oilmeal imports - a result of the country's policy to capture the value added in processing. Fig. 20 depicts the anticipated surge in the country's crushing capacity; over the outlook period, capacity is projected to expand by over 70% or 4.5% annually. It should be noted, however, that there is a considerable element of uncertainty in these projections. China's domestic demand or supply could easily differ

from the projected levels, and given China's weight, even small deviations would have major repercussions on the global market.

(c) Global oilseed crushing

The projections imply that the bulk of the rise in world crushings will continue to occur in the developing world, where, by 2015, more than 60% of the world's oilseed crush is anticipated to take place (see Fig. 21). This development is supported by the strong expansion in demand for oilseed products in these countries and by their growing integration in global trade of seeds. The developing countries' average annual growth in crushings is projected to be double that of developed countries.

Fig. 22 provides an overview of the anticipated installation of additional crush capacity in selected countries. In absolute terms, crush capacity is expected to increase everywhere except in Japan. A look at the growth rates reveals that, in many countries, growth could see a deceleration compared to the past decade; this applies to Latin American producers, the CIS, Japan and other parts of Asia. By contrast, expansion in crush capacity is expected to accelerate in North America, the EU, India and South Korea.

## 2. Oilmeal projections (consumption)

A worldwide increase in livestock production is expected to result in a 32% rise in world oilseed meal consumption. Higher world demand for livestock products is caused by rising income and population. While global meal demand is anticipated to continue expanding, annual growth rates are expected to fall short of their historical rates.

Future growth in meal consumption is expected to increasingly originate in developing countries. During the next decade, this group of countries is expected to account for 70% of global demand increase. Consequently, the developed countries' share in global consumption is expected to fall below 50%.

It is important to note that considerable uncertainties remain due to the recent incidence of animal disease outbreaks – notably FMD in South America and shocks caused by the progressive movement of Avian Influenza. Such shocks have not been explicitly modelled in this exercise and therefore do not impact our baseline projections for the oilmeal market.

## 3. Vegetable oil projections

It is important to remember the following: (i) the projections consider only four oils: soy-oil, rape-oil, sunflower-oil and palm oil; (ii) although the model uses historic data for the four individual oils, projections are generated for oils as a whole, and (iii) due to the lack of disaggregated data no distinction is made between oil consumption for food and non-food purposes.

(a) Vegetable oil production

Global vegetable oil production is projected to increase by around 30% during the outlook period. The calculated average growth rate is 2.5%, compared to 5.8% during the previous

decade. Continued production growth is a result of increasing demand for vegetable oils, based on global population and income growth.

The developing world plays a crucial role. Developing and developed countries account respectively for three quarters and one quarter of the expected expansion in oil production. Fig. 23 illustrates the developing countries' growing dominance of global production; their share in global output is anticipated to grow further and their average annual growth rate will continue to exceed that of developed countries (see Fig. 24).

The European Union and the United States will remain the two key players in the developed world. They are expected to produce, respectively, 12.8 and 11.3 million metric tons of vegetable oil in 2015. In the EU, significant expansion of domestic seed production and crush capacity should result in sustained growth in vegetable oil production. Rising demand for biodiesel will be the driving factor.

The pattern of production within the group of developing countries is shown in Fig. 25. In this group, production is dominated by just five producers: Brazil, Argentina, China, Malaysia and Indonesia will continue to account for more than 80% of the group's total output. The graph shows that China's share could rise further, mainly at the expense of Malaysia.

The picture emerging for these five producers is as follows:

China: Domestic oil production stems from the crushing of both domestically produced as well as imported seeds. Due to the strong increase in the volume of crushings, total oil output is projected to rise markedly, exceeding today's level by over 50%. In 2015, domestic production is expected to satisfy about 70% of the country's total demand with the remainder being covered by imports.

Brazil & Argentina: These two export-oriented countries are expected to increase their vegetable oil output by more than 2 million tonnes each. The implied annual growth rates fall short of the historic ones, reflecting a slowdown in the expansion of both domestic oilseed production and domestic crushing capacities. Soybean oil from South America will be competing with palm oil from Southeast Asia for many of the traditional and emerging markets.

Malaysia & Indonesia: The combined production of these two countries is projected to expand by 9 million tonnes. Malaysia has been the leading producer in the world for many years, but Indonesia is posting higher growth rates in recent years. This trend is expected to continue and the projections suggest that Indonesia will become the world's largest palm oil producer during the year 2009 (see Fig. 26). In 2015, Indonesia and Malaysia are projected to produce, respectively, 21 and 18.6 million tonnes of palm oil. In Indonesia, 75% of this is expected to be exported, compared to 90% in Malaysia. However, projections for Malaysia and Indonesia remain tentative. They are conditional upon a stable, growth-oriented political and economic environment in the region, in the absence of which the investments required for the sector's sustainable expansion might not be forthcoming.

#### (b) Vegetable oil consumption

Rising population and income growth will stimulate global vegetable oil demand, propelling consumption in 2015 to increase by about 30% relative to 2005. However, the projected annual growth rate will be only half that observed during the past decade - a trend that can be explained by the projected firmness in prices for vegetable oil.

Three quarters of the projected expansion in global demand are expected to originate in developing countries. Fig. 27 suggests that the strong demand growth in this group of countries is due to higher growth rates of population and per caput GDP. In absolute terms, Fig. 28 shows that total consumption is anticipated to rise fastest in developing countries; however, on a per caput basis, consumption in developing countries remains way behind and is catching up only very slowly.

For the major regions and countries the following details emerge:

The Asian and Pacific countries are the leading users of vegetable oil. The region, which includes many import dependent countries, is anticipated to expand its consumption by 37%. China contributes greatly to this rise. However, the pace of growth in Asia and Pacific is expected to slow down, a development that applies to total as well as per caput consumption. As a result, per caput consumption levels are only slowly approaching those of developed countries (see Fig. 29). In India, per caput utilization is estimated to remain below the 10 kg mark throughout the next decade. The diagram shows that also in Africa, average consumption levels remain very low. By contrast, in Latin America, consumption levels are envisaged to rise.

Among developed countries, consumption in the United States is projected to continue growing at about historic rates. In the European Union, demand for vegetable oil has risen markedly during recent years due to the rising use of rapeseed oil for biodiesel production. In 2005, the non-food use of rapeseed oil was reported to have exceeded - for the first time - that for food use. The potential market impact of biofuel could rise further, notably in case biofuel utilization was made mandatory. Therefore, the 2% annual growth rate anticipated for EU vegetable oil production and consumption - under the assumption of no change in policies - should be viewed as a conservative estimate that tends to underestimate the real growth potential.

### (c) Vegetable oils trade

World trade in vegetable oil is anticipated to expand by almost 30% over the outlook period. Annual growth could be considerably lower than during the past. Factors contributing to this slow-down include the following: (i) the anticipated price firmness on world markets for vegetable oils; (ii) constant or only slightly increasing import demand in two important players - the EU and China; and (iii) markedly slower growth in shipments of all major exporters (Brazil, Argentina, Malaysia and Indonesia).

As to the different oils traded, over the last decade, palm oil has become the most widely traded vegetable oil (surpassing soybean oil). Palm oil is expected to further consolidate its position over the coming years.

Fig. 30 shows that the developing world will continue to dominate the import as well as export market for vegetable oils; its share in global imports and exports is anticipated to reach 80 and 90% for imports and exports respectively.

#### Imports:

The development emerging for the world's three leading importers is as follows:

China: Although vegetable oil consumption is anticipated to increase faster than domestic oilseed production, oil imports are anticipated to stay around today's level throughout the projection period. This will be possible thanks to the country's sustained expansion in

crushing capacity, which allows a rising portion of domestic oil demand to be covered by imported oilseeds. Fig. 31 shows that the country's import dependence remains high when both oil and oilseed imports are considered.

European Union: The level of imports is anticipated to remain close to the 2000-2005 average because future incremental demand for biofuel is anticipated to be met primarily by increased domestic rapeseed production rather than imports of vegetable oil (see Fig. 32). These production and trade projections would imply that the EU's dependence on imported oils (looking at both, oil imports per se as well as the oil obtained from imported seeds) could fall - as shown in Fig. 33. However, as indicated above, these projections would need to be revised upward the moment more stringent legislation regarding biofuel utilization was introduced. In that case, most likely the EU's net imports of vegetable oil would continue to increase.

India: The world's fourth largest buyer of veg. oils, has seen its imports rise strongly during the last decade, because oil consumption grew about three times as fast as oil production. Consequently, foreign purchases accounted for almost 60% of domestic oil consumption. In the coming decade, India's imports are anticipated to rise further due to sustained growth in domestic demand. Even though the projected annual growth in imports is projected to slow down, the deficit of domestic output over domestic demand is expected to persist and the country's dependence on imported oils should remain around 60% (see Fig. 34) (note that in the case of India no oil contained in imported seeds needs to be added as hardly any seeds are imported).

Exports:

The prospects emerging for the key vegetable oil exporting regions are as follows:

South East Asia: Indonesia and Malaysia, are expected to maintain and further strengthen their dominant position in the world market. In 2015, the two countries should jointly supply over 60% of total trade. Malaysia's current lead over Indonesia is projected to gradually diminish and in 2005, both countries are anticipated to export around 16.5 million tons of palm oil annually.

South America: In Argentina and Brazil, veg. oil shipments should continue to expand, although at a much reduced pace compared to last decade.

Developed countries play a much less important role. The combined share of Canada and the United States in global exports is anticipated to remain below 5 percent. The European Union is expected to virtually cease exporting vegetable oils by 2015 (due to the anticipated surge in domestic demand coming from the biodiesel industry). And in the only important supplier from Eastern Europe, the Ukraine, the volume of exports is anticipated to remain unchanged.

#### IV AREAS FOR FURTHER ANALYSIS

Projection exercises are subject to various sources of uncertainty. In the preceding chapter it has emerged that a number of newly emerging trends or potential policy changes require particular attention. However such changes are difficult to capture in model-based projections. Furthermore, projections tend to get outdated quickly.

As mentioned in the introductory section, the projections are driven by a set of rigid assumptions on - country by country - yield improvements, crushing capacity expansion, population growth, agricultural and trade policies etc. These assumptions are based on past trends and reflect expert views about the most plausible development paths, but often they are

constrained by modelling requirement. In other words, many of the complexities found in real markets are very difficult to reproduce in a model.

Out of the many sources of possible inaccuracy and uncertainty hidden in the projections the factors listed below appear to be particularly relevant. Some are rather obvious and straightforward, others less so; and some concern specifically the oilcrops economy, whereas others apply also to other crop sectors as well.

1. weather conditions
2. macro-economic environment
3. demographic challenges
4. plant and animal diseases (Asian rust, avian influenza, FMD)
5. freight costs (IMO-MARPOL)
6. agricultural policies (including multilateral negotiations)
7. growing importance of China and India
8. changing consumer preferences (e.g. trans fatty acids)
9. technology leaps and their implications (non-GMO markets)
10. emerging biofuel markets

Changes in the above listed areas require particular attention and would need to be simulated separately in the context of market projections. In order to be properly modelled, the response of supply and demand to changes in the areas identified needs to be studied in-depth. A detailed discussion of the ten factors identified above clearly goes beyond the scope of this paper. In the box below, some of the aspects arising from emerging biofuel markets are briefly discussed.

#### The emergence of biofuel markets

Considering the current interest in and, possibly, growing markets for vegetable oil based biofuel, the following observations are offered on the place of biofuels in the projections as well as on general market and policy implications:

- In recent years, rising mineral oil prices, national energy policies (and related subsidization schemes) and technological advances have raised the profile of ethanol and biodiesel as alternatives to gasoline and diesel. As a result, biofuels now represent a significant and growing source of demand for agricultural commodities.
- Currently, the main feedstocks used are sugar crops and starch for ethanol and vegetable oils for biodiesel. Studies looking into the mineral oil price that would allow national biofuel production to become profitable (without subsidies) suggest that parity prices tend to vary greatly between countries and across feedstocks.
- Recently, several major vegetable oil producing countries - among them the United States, the European Union, Canada and Brazil, China, India and also palm oil and coconut oil producers in Asia - started shifting resources into biofuel production. This development is only partly captured in the projections. Further growth in biofuel demand has been considered only for a few countries - such as Brazil, the US, Canada and the EU - where consumption is assumed to follow the recent growth path. But biofuel demand remains included in total demand, i.e. is not modelled separately - although it is known that biofuel demand has started to influence oilseed and cereal production in the EU, the US, Brazil etc.

- Modelling the development of biofuel markets remains a demanding task because of the complex interdependencies of external variables such as crude oil price, environmental policies and technological improvements. The degree to which markets will change would strongly depend on parameters that are yet unobserved. It is yet unknown how quickly and how strongly biofuel industries would increase production following improved profitability.
- Another problem faced is lack of data or difficult access to them: for many countries, the required detail - for instance on the production, consumption and trade of biodiesel - is not readily available in official statistics and can only be obtained from private sources, if at all.
- The future development of mineral oil prices, a key parameter, is difficult to predict. When these baseline projections were generated, it was assumed that prices would decline from their 2005 peak, but more recent developments suggest that prices could remain high. Persistently high mineral oil prices can be expected to further stimulate biofuel production.
- It should be noted that mineral oil prices also affect agricultural production costs: firm oil prices can be expected to lead to supply reductions and thus a rise in prices of agricultural commodities - and the latter effect might well be larger than the one resulting from increased biofuel demand.
- Finally, biofuel markets are strongly influenced by political decisions. At present, the commercial viability of vegetable oil-based biofuel closely depends on various forms of subsidization. Specific future government policies in this area remain difficult to predict and have not been anticipated in the projections. In the event that policy shifts were to occur on a larger scale, for instance in the form of stringent national or global biodiesel utilization mandates, the additional demand for vegetable oils has the potential to affect markets in a substantial manner. Whether demand would be satisfied using domestic sources or imported feedstocks will depend on future levels of support granted to domestic producers.
- Rising biofuel demand affects the allocation of limited resources to different crops used as feedstock; the resulting changes in commodity prices will have significant repercussions on agricultural incomes and food security in particular in developing countries.

FAO has initiated work on these various issues. The case of biofuel should be handled with increased accuracy in future projection exercises and the analysis of policy implications involved in possible market adjustments is going to receive increased attention.

## V MODEL OPPORTUNITIES

The preceding sections have revealed a number of the weaknesses in the projections work, from the model's limited commodity coverage to various difficulties encountered in accurately modelling complex and continuously changing agricultural markets.

To correct this bleak picture, a particular opportunity that is in-built into model-supported projection work needs to be mentioned. In order to address the type of concerns raised in previous sections and to overcome the limitations inherent in rigid assumptions, projection models offer the possibility to conduct tailor-made scenario analysis. Once a source of rigidity or uncertainty is identified and properly defined, specific assumptions can be changed by isolating and modifying the relevant variables in the model. Eventually, an alternative set of projections will be generated, and analyzing where the old and the new projections differ can

provide valuable results, for instance about where there is potential to influence the sector with political instruments or where there are particular risks for uncontrollable factors.

Recently, FAO has conducted a couple of scenario analyses and it is envisaged to further expand such work. In what follows an example for such analysis is provided.

Recently, work has been conducted on the expansion of the soybean sector in Brazil, Argentina and Paraguay and its implications for the domestic and global market. The simulation exercise revolved around the following sensitive economic and technical variables:

- a) in the three countries concerned: (i) upward/downward shifts for production cost scenarios; (ii) stronger/weaker expansion of soybean plantings; (iii) higher/lower projections for soybean yields; (iv) for Brazil, lower unit transportation costs for soybean following higher infrastructure investments; and (v) an increase in exchange rates (i.e. depreciation of currencies)
- b) outside shocks: (i) alternative growth paths of demand for soybean and products in China; (ii) higher soybean loan rates and target prices in the USA; (iii) alternative growth paths for world palm oil production (to explore substitution possibilities between competing oils).

The study has triggered interesting discussions with policy makers and other partners in Latin America and has enriched on-going work on the global market prospects for oilseeds and derived products. The possibility of undertaking similar simulation exercises to analyze other segments of the global market exists and specific projects could be developed together with interested partners.

*Appendix - diagrams and tables*

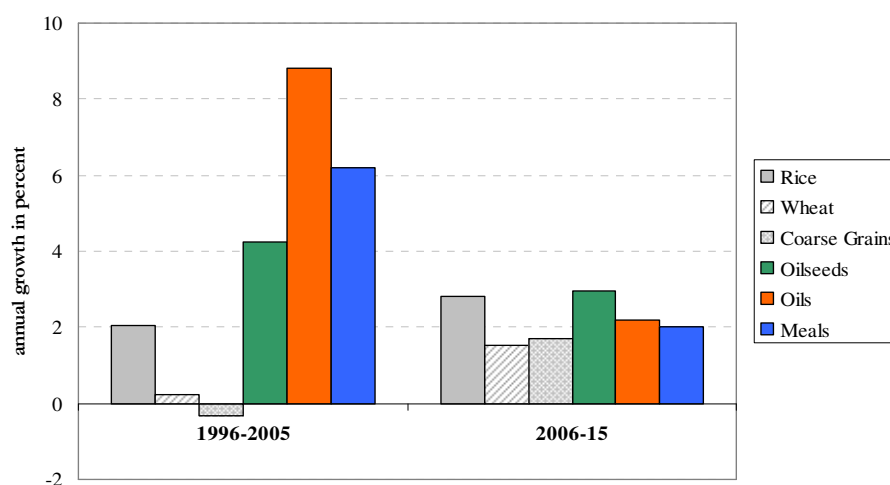
**Figure 1 : Commodity coverage - general**

Arable crops & products	Livestock products	
Wheat	Beef	Skim Milk Powder
Coarse Grains	Sheepmeat	Whole Milk Powder
Rice	Pigmeat	Cheese
Oilseeds	Poultry	Butter
Vegetable Oils	Eggs	Fresh Dairy Products
Oilseed Meals		
Roots and Tubers		

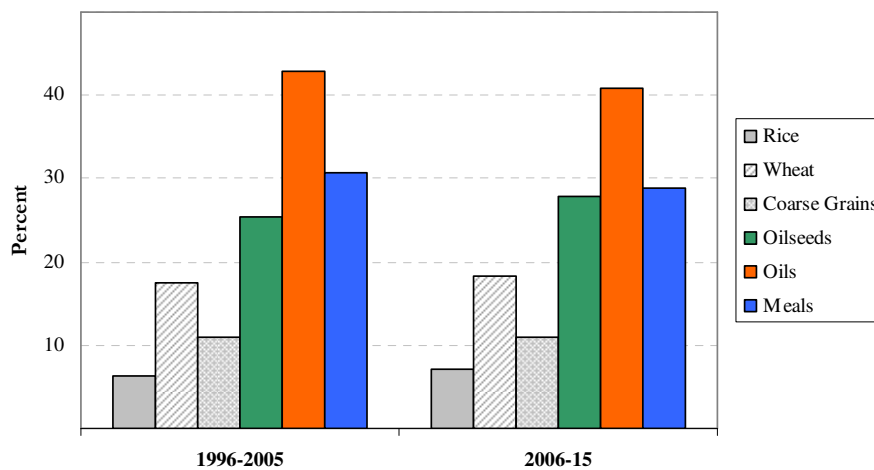
**Figure 2 : Commodity coverage - oilseed complex**

oilseeds	oils	meals
soybean	soy-oil	soya-meal
rapeseed	rape-oil	rape-meal
sunflowerseed	sunflower-oil	sunflower-meal
	palm oil	

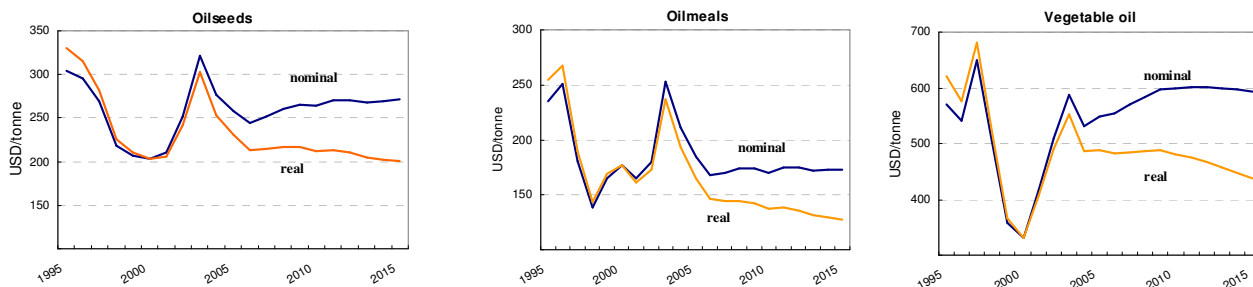
**Figure 3 : Trade growth**



**Figure 4 : Trade-to-production ratio**



**Figure 5 : Weighted average EU import prices**



**Figure 6 : World oilseed production and crush**

	Million tonnes			Annual growth rate (in percent)	
	1996	2005	2015	1996-2005	2006-15
<b>Production</b>	185	290	363	4.6	2.5
<b>Crush</b>	164	257	332	4.7	2.5

Figure 7 : World oilseed area and yield

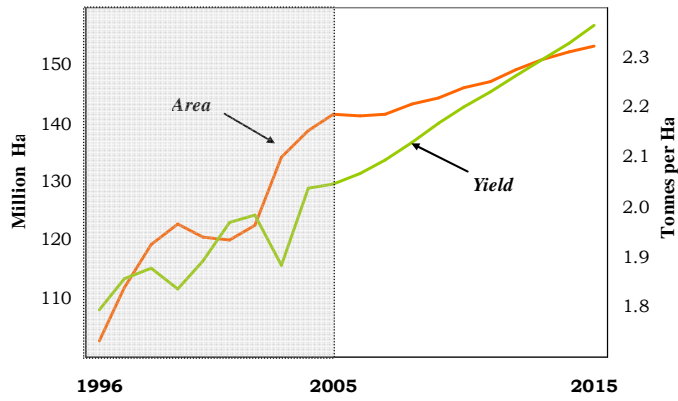


Figure 8 : Oilseed area & yield - annual growth rate

		1996-2005	2006-15
		in percent	
<b>Area</b>	<b>World</b>	3.0	1.0
	Developed	0.6	0.5
	Developing	4.2	1.3
<b>Average yield</b>	<b>World</b>	1.6	1.5
	Developed	1.7	0.9
	Developing	2.2	2

Figure 9 : Average yield

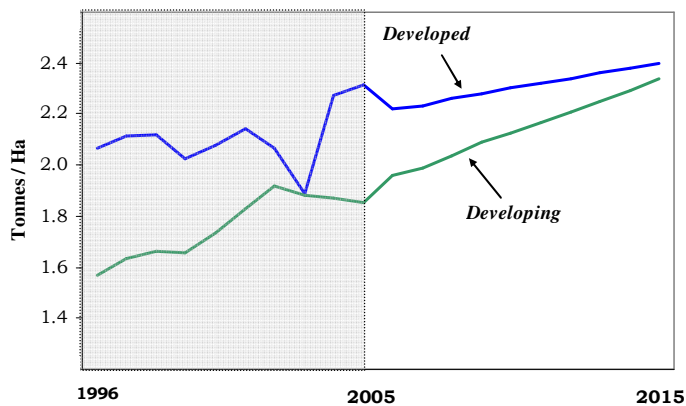


Figure 10 : Oilseed yield pattern

	Yield		Growth rate	
	2005	2015	1996-2005	2006-15
	mt/ha		percent	
<b>DEVELOPED</b>	2.32	2.40	1.7	0.9
CANADA	1.98	1.90	0.9	0.8
USA	2.84	2.93	0.8	0.9
EU(25)	2.90	3.36	2.9	1.9
EASTERN EUROPE	1.37	1.53	3.3	1.2
CIS	1.06	1.13	2.3	1.1
<b>DEVELOPING</b>	1.85	2.34	2.2	2.0
NORTH AFRICA	2.52	2.94	5.9	1.6
SUB SAHARAN AFRICA	0.76	0.87	1.3	1.4
ARGENTINA	2.59	2.97	2.8	1.5
BRAZIL	2.23	3.22	0.7	2.6
CHINA	1.66	1.86	0.8	1.0
INDIA	0.91	1.08	0.9	2.0

Figure 11 : Shares in global oilseed production

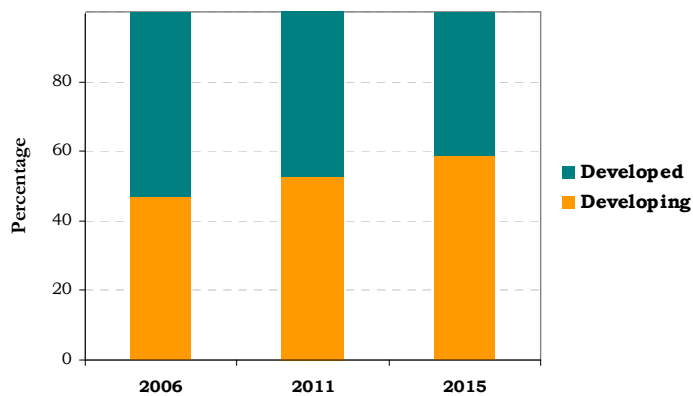


Figure 12 : Oilseed production - developed world

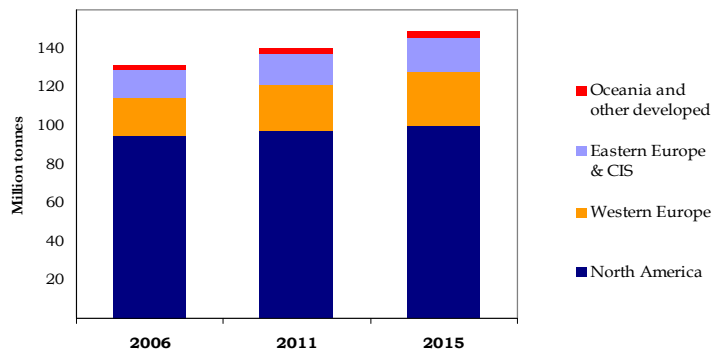


Figure 13 : Oilseed production - developing world

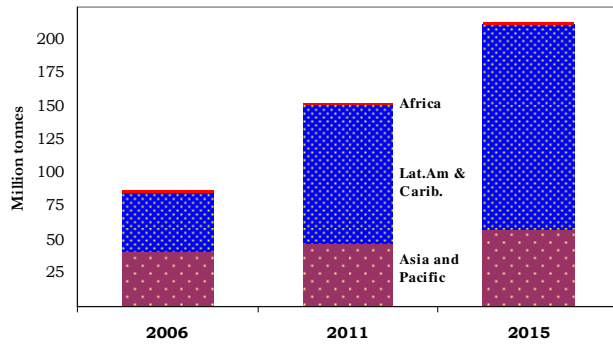


Figure 14 : Oilseed production - growth rate

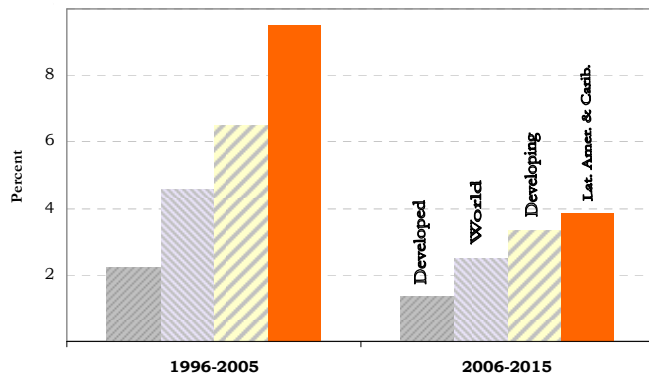


Figure 15 : Latin America & Caribbean: oilseed production and crushings

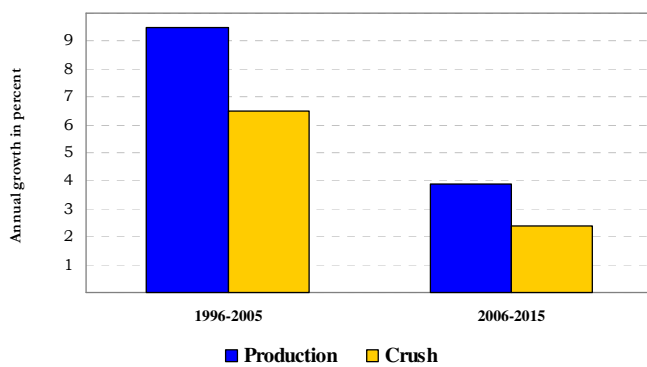


Figure 16 : Global production pattern

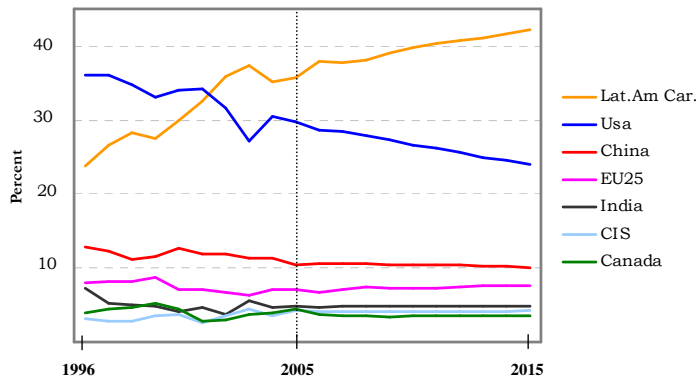


Figure 17 : Shares in global oilseeds exports

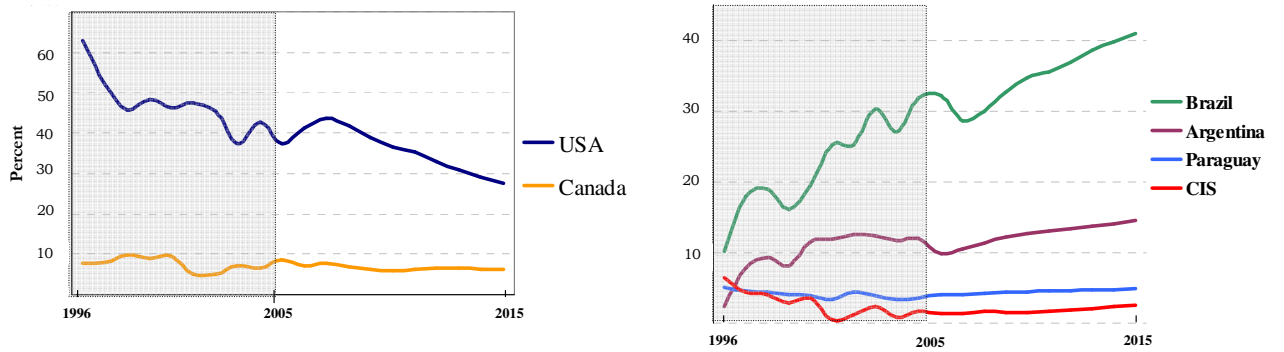


Figure 18 : Share of regions-countries in global oilseeds imports

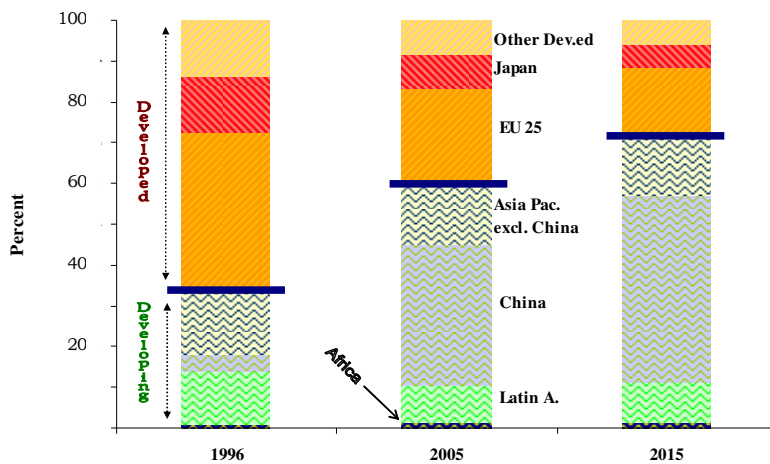


Figure 19 : China - oilseeds supply and demand

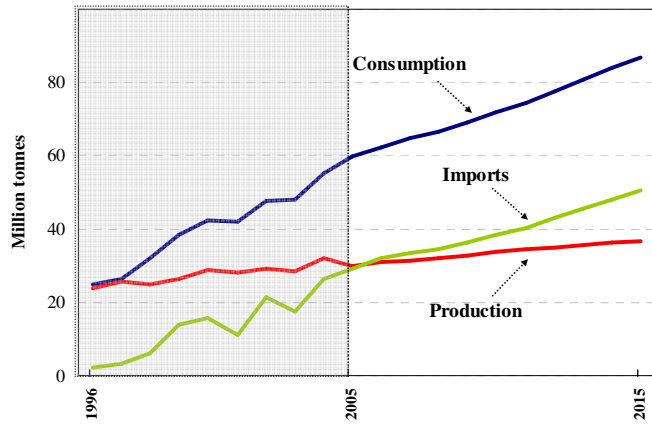


Figure 20 : China - oilseed production & crushings

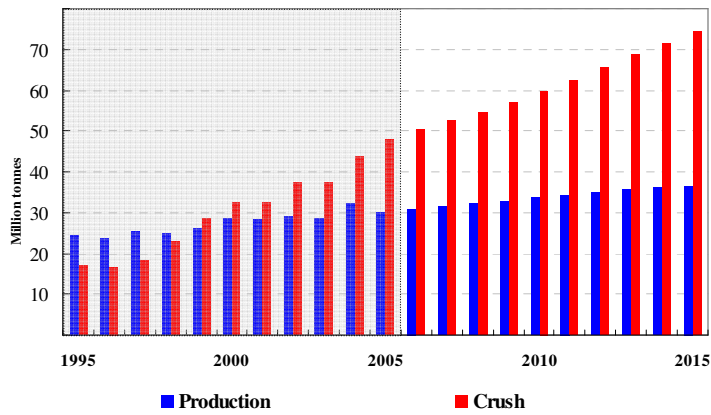


Figure 21 : Distribution of oilseed crushing capacity

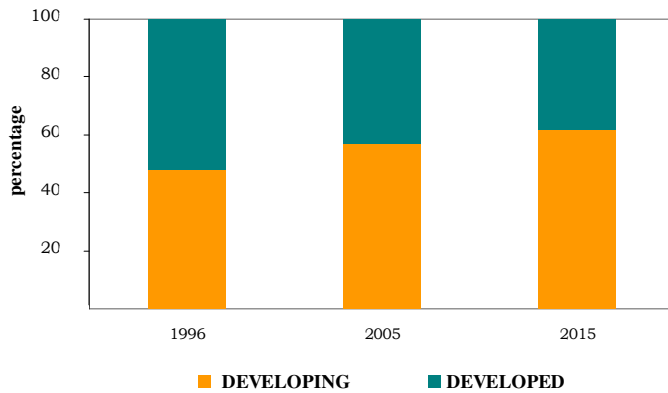


Figure 22 : National crushing capacities

	Change in million mt 2006-15	Annual growth (%)	
		1996-2005	2006-15
<b>NORTH AMERICA</b>			
Canada	1.5	0.7	2.6
USA	7.0	1.1	1.4
<b>WESTERN EUROPE</b>			
EU(25)	7.1	1.8	2.1
<b>CIS</b>			
Russian Fed	0.9	12.8	1.8
Ukraine	0.0	14.9	0.4
<b>OTHER DEVELOPED</b>			
Japan	-0.6	0.5	-1.4
<b>LATIN AMER &amp; CARIB</b>			
Argentina	10.2	8.4	2.2
Brazil	11.9	5.0	2.3
Mexico	1.3	3.1	2.4
Paraguay	0.7	8.8	4.3
<b>ASIA &amp; PACIFIC</b>			
China	26.6	12.2	4.5
India	2.8	1.5	2.4
Korea Rep	0.2	-0.7	1.2
Pakistan	0.3	9.0	2.7
Turkey	0.4	1.6	1.4

Figure 23 : Share in global oil production

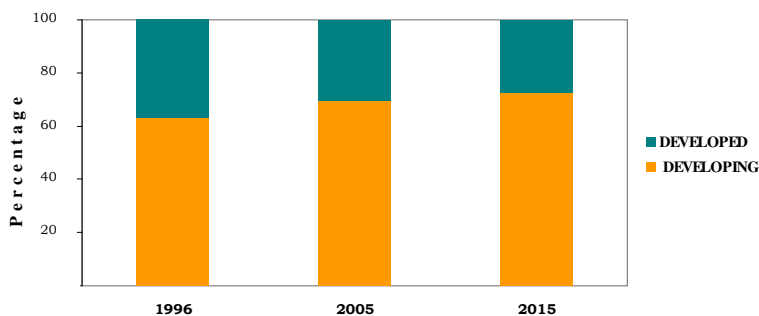


Figure 24 : Growth rate of oil production

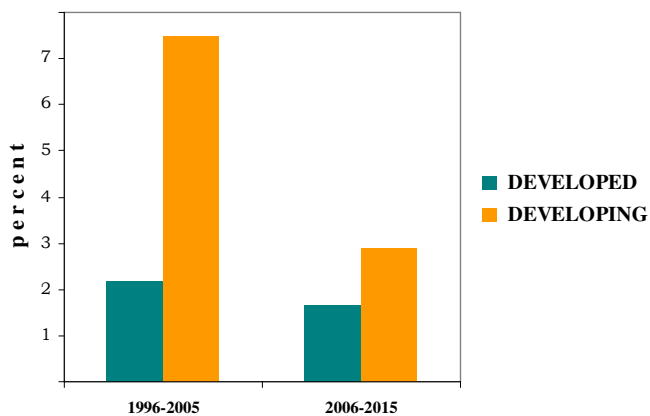


Figure 25 : Oil production pattern - developing world

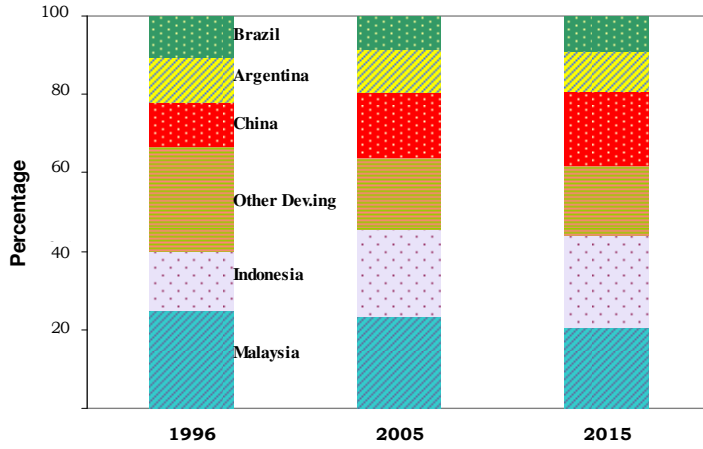


Figure 26 : Palm oil production in Indonesia & Malaysia

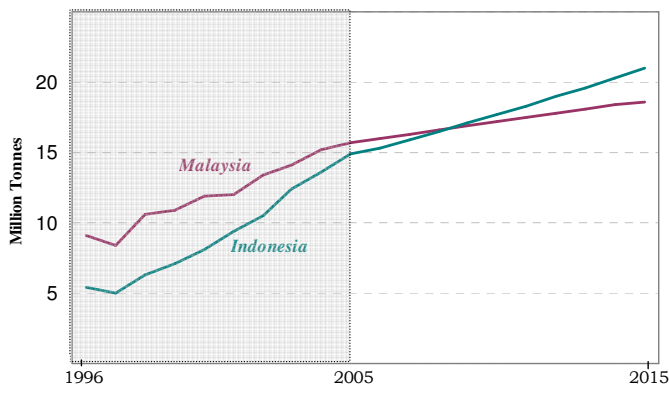


Figure 27 : Vegetable oil consumption - 2006-2015 growth rate

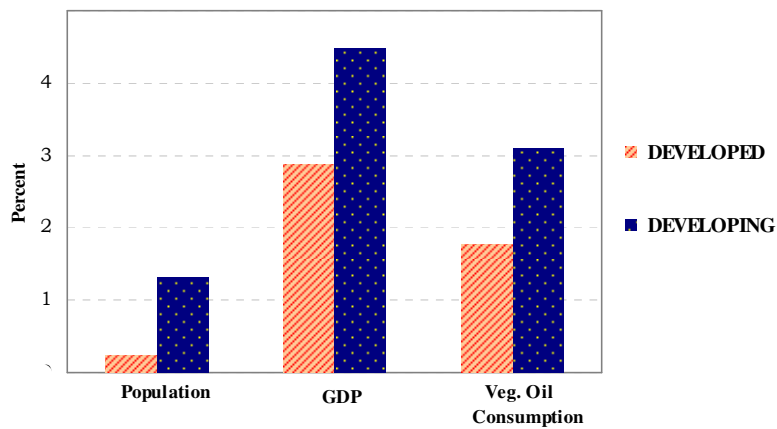


Figure 28 : Vegetable oil consumption

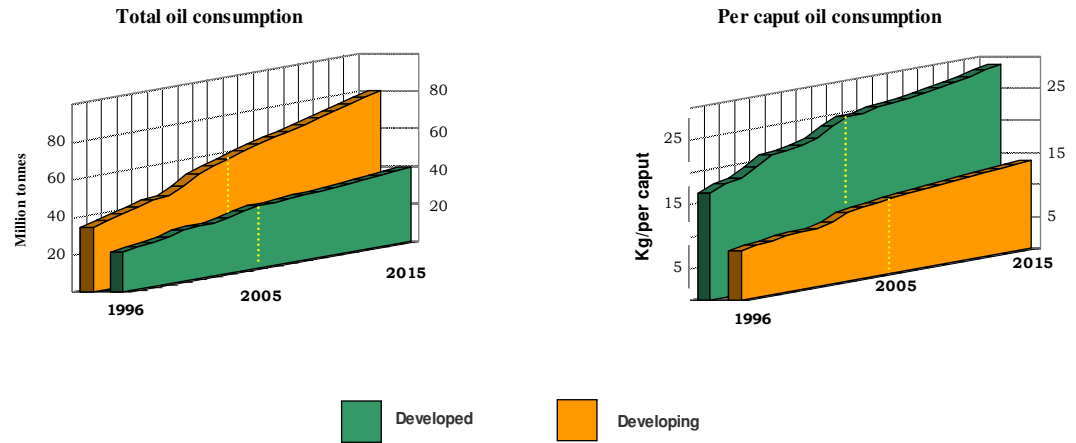


Figure 29 : Per caput oil consumption

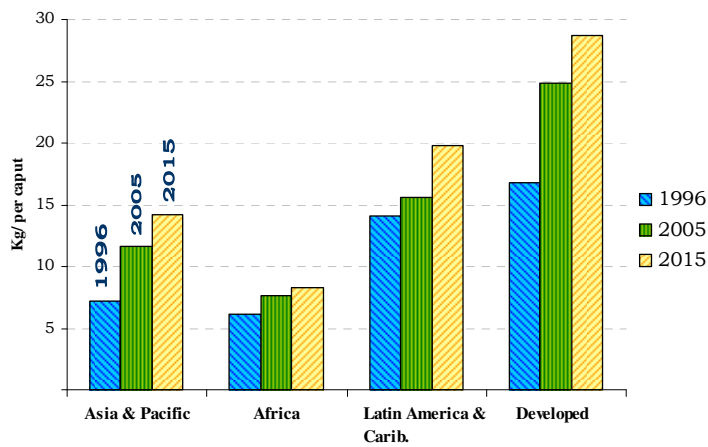


Figure 30 : Vegetable oil trade

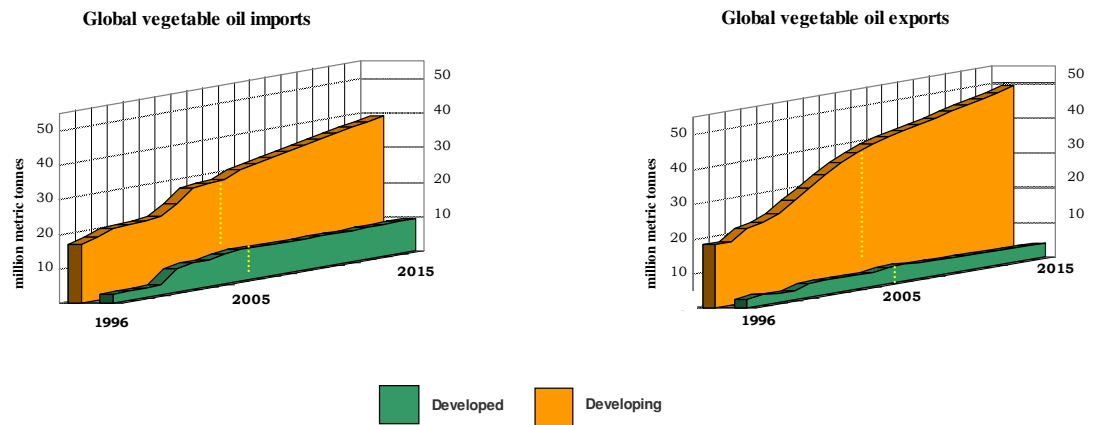


Figure 31 :China imports

Contribution of imports to domestic oil demand

oil imports			oil imports <u>plus</u> oil contained in imported seeds		
1996	2005	2015	1996	2005	2015
46	37	30	52	70	67

Figure 32 : EU 25 - vegetable oil supply and demand

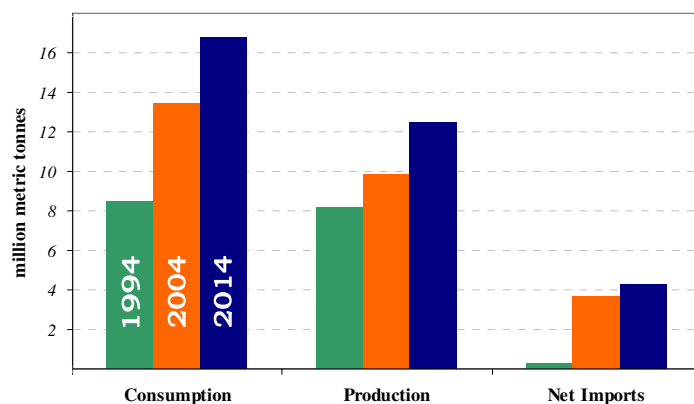


Figure 33 : EU imports

Contribution of imports to domestic oil demand

oil imports			oil imports <u>plus</u> oil contained in imported seeds		
1996	2005	2015	1996	2005	2015
30	33	25	81	69	47

**Figure 34 : India imports**

Contribution of imports to domestic oil demand

oil imports			oil imports <u>plus</u> oil contained in imported seeds		
1996	2005	2015	1996	2005	2015
46	56	63	--	--	--