

# The Challenges Facing Palm Oil in the 21<sup>st</sup> Century<sup>\*\*</sup>

James Fry\*

## ABSTRACT

*The palm oil sector is facing short-run as well as long-run challenges. The short-run challenges focus on the ability of the sector to counter the economic cycle, whereas the long-run challenges are associated with fundamental issues pertinent to the sector. Both short-run and long-run challenges are products of biological factors of the oil palm and its products, as well as the behaviour of substitute oils, vegetable and/or mineral. The Malaysian palm oil sector has little control over the economic cycle as the cyclical behaviour depends heavily on other substitutes used as vegetable oils or biofuels. The long-run challenges of the sector are the slower rate of improvement in oil palm yields than other oilseeds, low labour productivity mostly due to problems in the mechanization of the harvesting operation, functional obstacles to palm oil usage in temperate countries due to its lipid composition, and the non-tariff barriers against palm oil by the importing nations, particularly the European Union (EU) and USA. Some possible solutions are proposed.*

## INTRODUCTION

The oil palm is becoming one of the most important agricultural products in tropical regions. Its products and by-products are important raw materials for the food and chemical industries. Early entrants to the industry, such as Malaysia, enjoyed early mover advantage. Malaysia also invested heavily in upstream research and plantation development, and enjoys a sizeable contribution to her economy.

The increasing supply of palm oil from new producers, attracted by the profitability of the sector, is putting a downward pressure on prices. At the same time, countries producing other oils have responded to the increasing supply of palm oil, either through initiatives to lower costs, or by administrative measures, such as non-tariff barriers.

The behaviour of supply and demand for palm oil underlines the challenges facing the sector. In the short-run, demand is vulnerable to macroeconomic cycles; in the longer term, palm oil faces competition from other oils. On the supply side, the slow rate of improvement in oil palm yields and low labour productivity are two major barriers confronting the global palm oil sector.

This article discusses the challenges facing the palm oil sector in the short-run as well as in the long-run. Some possible solutions are also recommended. They are presented in the following two sections.

## SHORT-RUN CHALLENGES

### Hopes that Palm Oil Can Resist the Global Economic Downturn

The palm oil market has fallen back from its peak in the first half

\* LMC International Ltd,  
14-16 George Street,  
Oxford O12AF,  
United Kingdom.

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of 2008. Realizing the hope that the sector can resist the present recession and help the Malaysian economy to recover more rapidly than others depends upon the likelihood of a price recovery. To understand the long-term behaviour of palm oil prices, *Figure 1* has been prepared, showing the movement of real annual crude palm oil (CPO) prices in the European Union (EU) since 1950. The long-run trend shows that the real prices of CPO fell by 2.3% per annum.

Contrary to what many people seem to believe, current CPO prices are high not low. Despite the price tumble in the second half of 2008, CPO prices remain above their normal long-run trend values, as *Figure 2* reveals. Indeed, current prices are higher than any monthly average over the entire period from 1999 to the start of 2007. The CPO prices rose during 2007-2008 on South American crop fears and high palm oil exports. The outlook for CPO prices depends crucially on the behaviour of the crude (mineral) oil price, thanks to the role now played by biofuels in the vegetable oil market.

The vegetable oil prices move together with crude oil prices as a result of the substitution effect of biofuels. Biofuels have created a band for vegetable oil prices above crude oil prices (*Figure 3*). Even after a sharp fall, Brent crude oil prices, like CPO prices, remained above their own long-run trend (*Figure 4*).

The palm oil outlook depends heavily upon something totally outside of Malaysia's control: the ability of Saudi Arabia to support mineral oil prices despite recession. As an indication of the importance of Saudi actions: a USD 55/barrel Brent North Sea crude price in the latter part of this year implies CPO prices of RM 2400. However, if Saudi Arabia cannot stop prices falling to USD

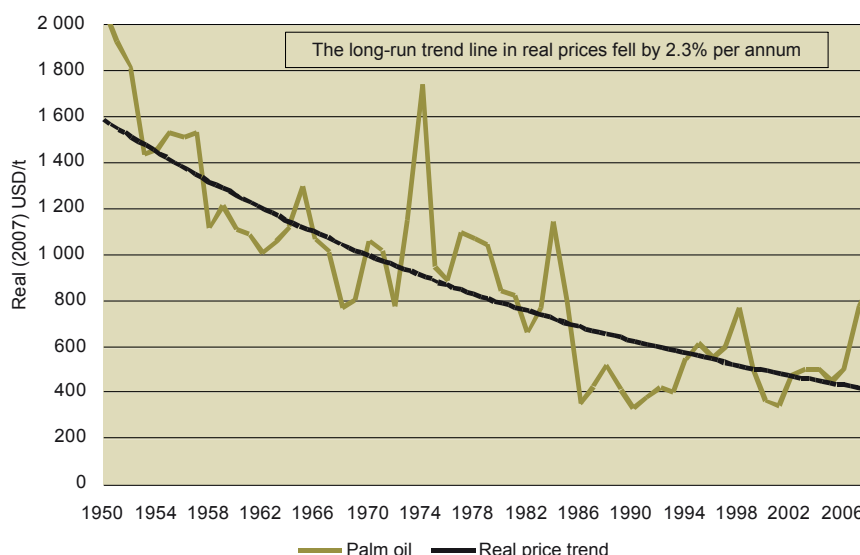


Figure 1. Behaviour of real (inflation-adjusted) annual prices of crude palm oil (CPO) in the European Union (EU) since 1950.

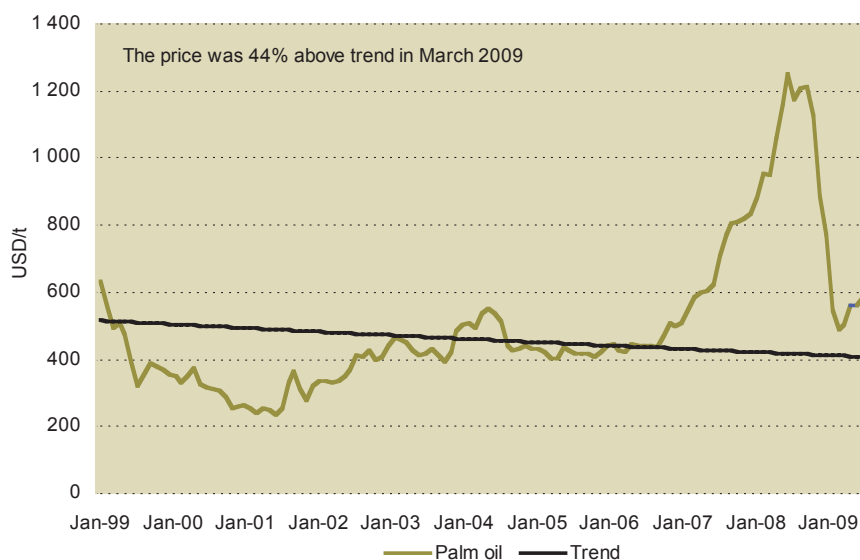


Figure 2. Comparing monthly crude palm oil (CPO) prices with trends, 1999-2009.

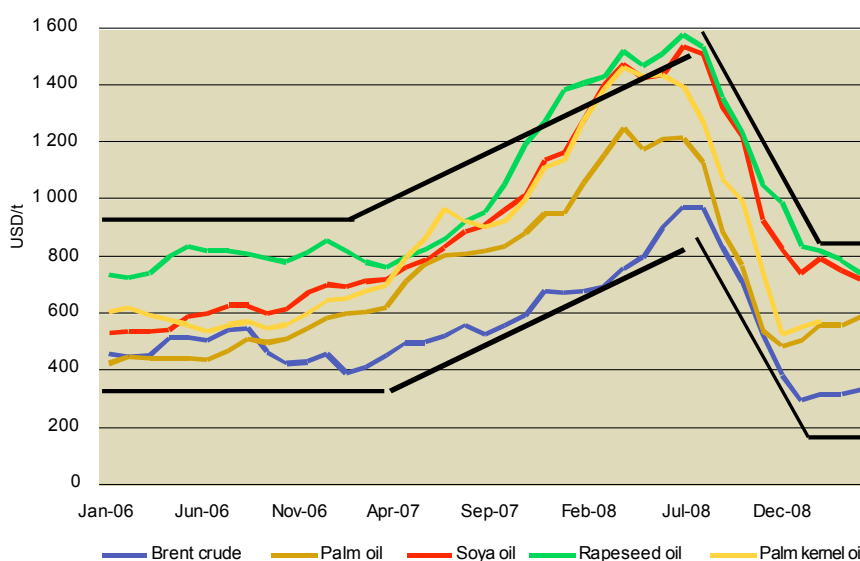


Figure 3. Biofuels have created a band for vegetable oil prices above crude oil prices.

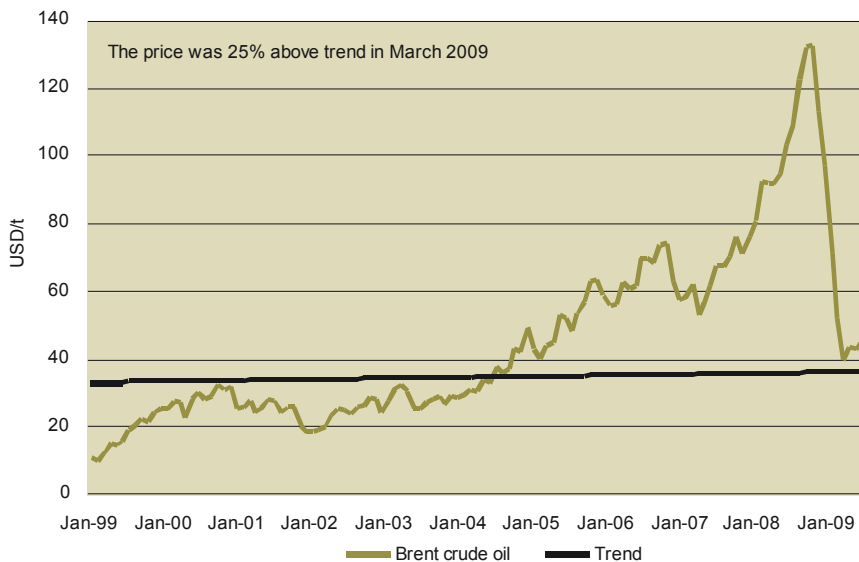


Figure 4. Brent crude oil prices compared to long-run trend.

35/barrel, CPO will tumble to RM 1500. On the other hand, a Brent price of USD 80/barrel would imply a Malaysian CPO price of RM 3500 at an exchange rate of RM 3.65 per US dollar.

These figures assume Malaysian stocks are above 1.7 million tonnes in October. If the sector can boost local demand (the justification for the B5 programme) or exports, then stocks will be lower than this – and prices will be higher within the price band. As an illustration, a 100 000-t lower level of stocks at the end of October would translate into 5% higher prices.

## LONG-RUN CHALLENGES

The palm oil sector has four main long-run challenges in this century. They are:

- the poor rate of improvement in yields in relation to other sources of vegetable oils;
- the difficulties of raising labour productivity in the sector, in large measure a result of the problems of mechanization of the harvesting operations;
- the functional obstacles to palm oil's use in cooler climates; and
- the presence of non-tariff

barriers, in the form of sustainability and life cycle analysis criteria that restrict the use of palm oil in high income markets.

## Increasing Yields

A leading determinant of the competitiveness of any crop is its productivity. Among oil-bearing crops, oil palm is the star performer, consistently achieving oil yields per hectare far ahead of those recorded by any other crop. The existence of two products from oil crops, namely oil and meal, makes the comparison of the productivity of different oil crops more difficult than it is for crops such as those producing grain, where there is an unambiguous measure (tonnes per hectare) for defining productivity. Nevertheless, it is striking that average oil yields per hectare from mature Southeast Asian estates exceed the combined oil and meal yields from soyabean, and that the yield, if expressed in calories per hectare, from oil palm is roughly double that of soyabean.

This productivity gives oil palm a wonderful head-start when contrasted with annual oilseeds; but it cannot rest on its laurels. Oil palm yields are improving

appreciably slower than those of the other oilseeds.

Figures 5 and 6 compare oil palm yield trends with those of two sets of crops: annual oilseeds (soyabean and rapeseed) and the main grains (maize and wheat), and sugar-producing (cane and beet) crops. The scales along the Y-axis are indices, with the average values in 1975-1980 set at 100 in both figures. The oil palm data are published by MPOB, the most highly regarded source of official data on the Malaysian oil palm sector. Food and Agriculture Organization (FAO) data are used for the analysis of yields for the crops that are compared with oil palm. Information on the areas planted with the annual crops using FAO data is likely to be more reliable than that for tree crops, for which mature area estimates inevitably have a potentially significant margin of error.

It is evident that Malaysian oil palm yield trends have lagged behind those of the other crops, with sunflower and sugar-cane the only crops with yield performance not much better than that of oil palm. This is not coincidental; for most crops with a poor performance in raising productivity, this is a consequence of the nature of the plants themselves and/or the poor returns to be expected from the development of improved varieties.

One reason sometimes given to explain the low pace of yield improvement for oil palm is that it is a tree crop, and so any individual year's plantings will have only a very limited impact on overall yields. This, however, is not an insuperable barrier to rapidly rising yields. What is required is the steady incorporation of improvements into each year's new plantings, and if these occur at a steady rate, the overall increases will be compounded into an impressive number.

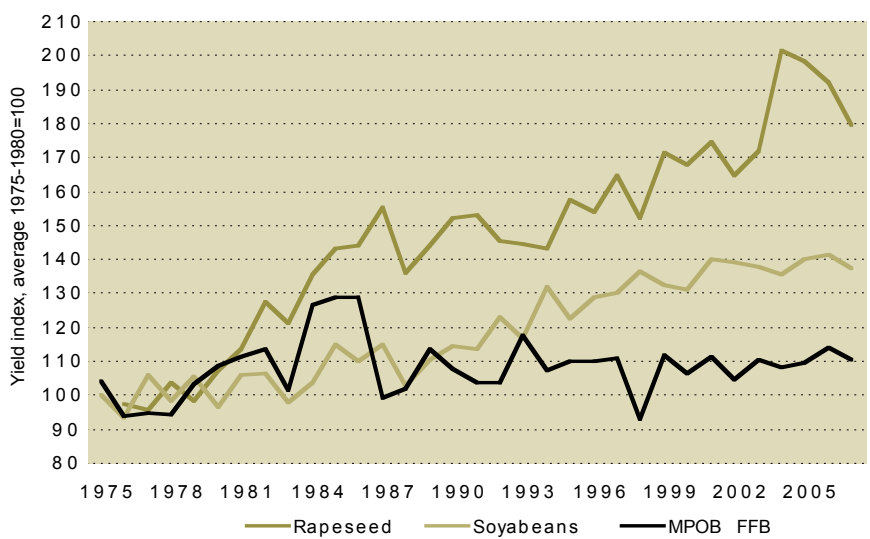


Figure 5. Time series for average global yields of soyabean and rapeseed vs. Malaysian fresh fruit bunch (FFB) yields (values as indices, with average 1975-1980 = 100).

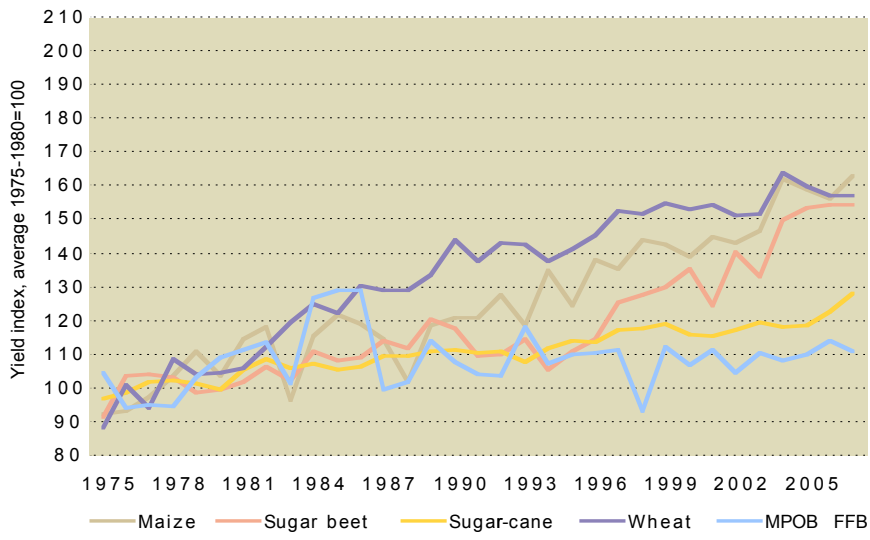


Figure 6. Time series for average global yields of wheat, sugar crops and maize vs. Malaysian fresh fruit bunch (FFB) yields (values as indices, with average 1975-1980 = 100).

Annual yield increases of 1% mean that a palm planted after 25 years to replace one at the end of its economic life-span would yield almost 30% more than the palm it was replacing. A 2% annual yield increase would lead to new palms yielding 64% more than the ones planted 25 years earlier. These are not unattainable increases for tree crops. Average global natural rubber yields have increased at an average annual rate of 1.8% since 1975, as a result of improved clonal varieties and more frequent rounds of tapping in Indonesia.

A more realistic partial explanation for the slow progress made in raising oil palm yields is the contrast between the low commercial returns to be gained from the development of improved planting materials for crops like oil palm (and also from sugar-cane) and the higher returns from the development of improved seeds for annual crops, such as soyabean, rapeseed, maize, wheat and sugar beet. However, one must not forget that there are successful plantation companies that achieve impressive yield increases, not just by using

the right seeds, but also by adopting the best management practices in the use of fertilizers, in planning the harvesting rounds, efficient fresh fruit bunch (FFB) delivery to the mills, and so forth.

In the oil palm industry, it is sadly all too well-known that planters are often short-sighted in their choice of seeds, preferring to save a few tens of dollars per hectare when planting, even if it is at the expense of the yields obtained throughout the palm's subsequent life. The use of *dura* and  $F_1$  seeds is all too often the reality – a false economy by any reckoning. A vicious circle emerges, in which developers of new seeds are rewarded with incomes of at most tens of millions of dollars, and so invest relatively small sums in R&D. The sugar-cane and cassava sectors are similar. These crops are propagated vegetatively, and so it is difficult for the developer of a new variety to capture a large share of the economic benefit that such varieties may provide.

The world of crops may be divided between those with large returns for seed companies, who are able to capture a significant share of the extra revenues they help to generate for farmers, and those for which the returns for such companies are small.

This is highlighted in Figure 7. Oil palm, sugar-cane and cassava appear at the lower end of the range of yield increases among the major crops, with only sunflower seed for company; but sunflower is a special case. Its yield performance has been hit hard by the collapse of the Soviet Union and the sudden switch in agricultural practice away from relatively intensive, high input/high output farming systems to one that is much more extensive, because of restrictions on the availability of farm credit.

The challenge is to devise payment systems for new planting materials that reward the developers

of highly productive crops for their innovation. One possibility that comes to mind is the use of aerial photography or genetic markers at the mills to identify the actual varieties that have been grown and processed, so that a small royalty may be paid on each tonne of the crop to the developers of these varieties.

The royalty could be small per tonne, but the returns to the developers could be large over the life-span of the oil palm. For example, if we suppose that an improved variety is able to supply 5% of world oil palm output; this would correspond to 10 million tonnes of FFB per year. A royalty of, say, USD 1 per tonne of FFB delivered each year would, over the life-span of the palms, at a discount rate of 10% generate a discounted return of over USD100 million.

One attraction of this approach is that royalties would be paid only when a crop was harvested, not when it was planted; therefore, it would reward success and give strong incentives for further success, attracting large seed companies into the sector. Also, it would not discourage those planters who balk at spending even small sums on buying seeds when establishing new estates. They would only have to pay for seeds; via such royalties, when they start to obtain output and revenue, they would only pay in proportion to their output. Unless something can be done to harness the skills of the seed industry, oil palm will find itself losing its advantage over other crops.

**Labour Productivity and Mechanization**

The productivity of labour, measured in vegetable oil output per worker, is not only lower in the oil palm industry than it is in the annual oilseeds sector, the gap between the two industries is

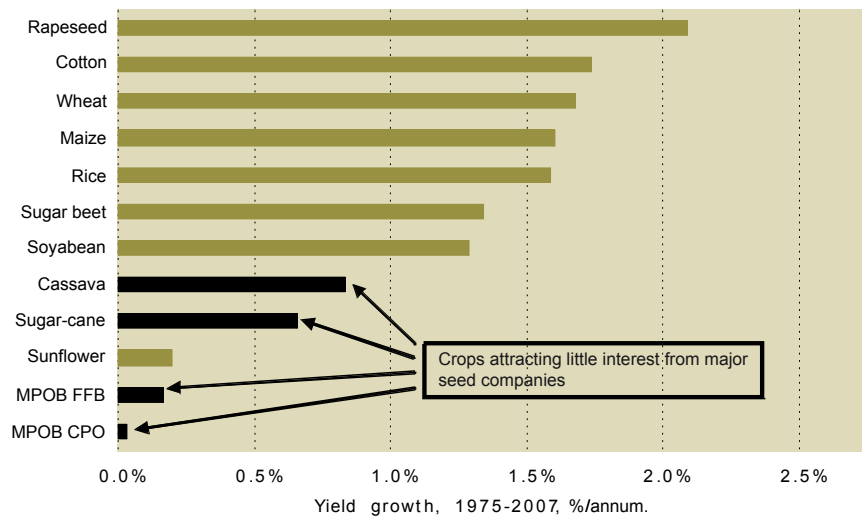


Figure 7. Average growth in agricultural yields for a range of crops, 1975-2007.

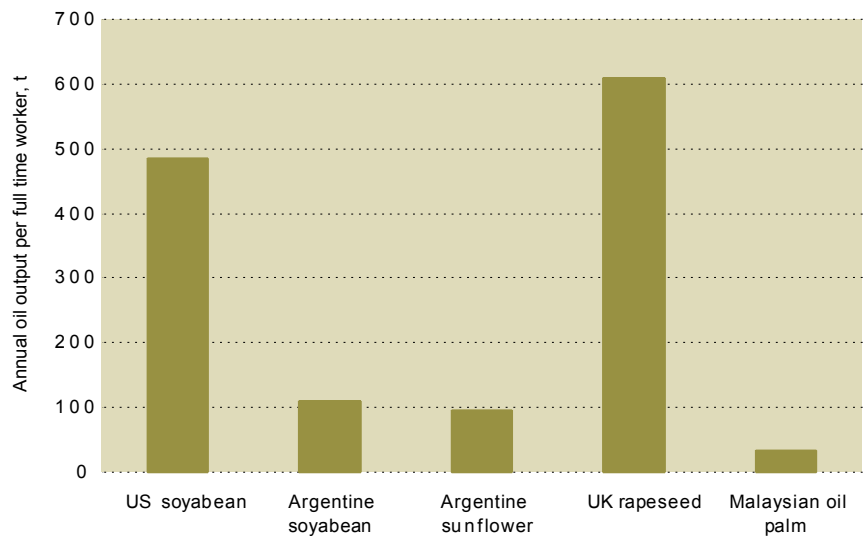


Figure 8. Oil output per full time worker in different industries, mid 2000s.

widening. Figure 8 illustrates how the overall productivity of labour in the field and mill combined compared in the mid 2000s across a range of leading vegetable oil industries. Productivity is measured per full-time equivalent worker, assuming that 2000 hr of work are performed in a year.

The productivity of United Kingdom rapeseed producers and processors is approximately 20 times higher than that of Malaysian palm oil producers on this measure, and they (United Kingdom rapeseed producers and processors) are slightly over 20% more productive than US soyabean farmers and crushers. This is less impressive than it

may appear to be at first sight, because rapeseed has over double the oil content of soyabean. Thus, a US soyabean farmer and crusher can be shown to produce roughly 50% more oilseed in a year than a United Kingdom rapeseed producer and processor. Argentinian producers are three times as productive as their Malaysian oil palm counterparts on the same basis.

A good indication of the changes occurring in labour intensity and in labour costs over time is provided by Figure 9. This depicts the average annual rates of change (these were declines in the case of all oils other than palm oil) in the real, inflation-adjusted,

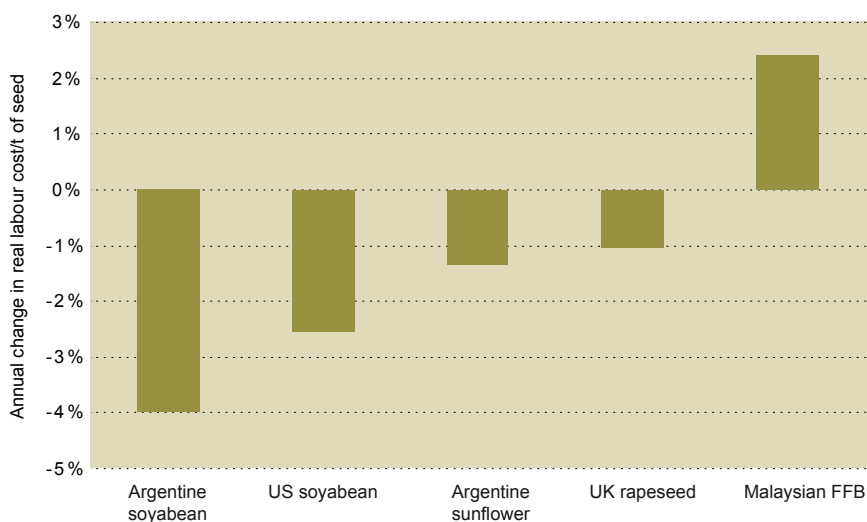


Figure 9. Average annual percentage change in real labour costs per tonne of oilseed production since the mid 1980s.

labour component of the cost of production of vegetable oils.

Soyabean, in both the US and Argentina, led the way in reducing their real production costs. It is likely that the rapid acceptance of GM soyabean crops played an important role in lowering costs, because chemicals like glyphosate do much of the hard work formerly undertaken by manual labour for weeding.

Boosting labour efficiency in the oil palm sector is a major challenge. The most important revolution in labour productivity occurred immediately after the introduction of the pollinating weevil. Since then, the average area per worker has barely changed in over 25 years. Meanwhile, competing oilseed crops continue to benefit from mechanization and economies of scale, both in farm equipment and in processing.

To achieve a breakthrough, one idea would be to create a large fund, specifically dedicated to research into the mechanization of harvesting, using robotics or an alternative technology. If the funds were large enough (many tens of millions of US dollars would probably be needed), leading international institutes could be invited to bid for half this money,

and the two best bids could be selected to undertake the research on a competitive basis, with the promise of a share in future revenues from the development of the most suitable machines for commercial sale.

**Functional Barriers to the Use of Palm Oil**

The cold weather properties of palm oil can, in theory, be improved in at least two ways: (i) through conventional breeding and the use of biotechnology to change the oil’s lipid composition, or (ii) by adapting fractionation and distillation technologies to derive oils with a lower saturated fat content.

Other oilseeds have succeeded in introducing new varieties that meet specific functional and technical needs. Among those with the greatest success have been mid- and high oleic sunflower, high oleic/low linolenic canola/rapeseed, and low linolenic soyabean. Low linolenic varieties of rapeseed and soyabean give the resulting vegetable oils a degree of natural stability that is lacking from the conventional oils that exceed the 3% linolenic acid threshold above which stability is inadequate. The

high oleic seeds bring the resulting oils closer to the goal of low cloud points and an ability to be used as biodiesel all year round.

The turn around time for the development and introduction of novel forms of annual oilseeds is inevitably much more rapid than for oil palm, but there are two main lessons that may be learnt from the experience with annual oilseeds.

The first is that the most successful and rapid adoption of novel varieties occurred with *NuSun*, the name given to mid-oleic sunflower. This was primarily because the novel variety was made available with ‘open source’ genetics, whereby all seed companies could use the variety for further development without having to pay any licensing fee. This, in turn, was the consequence of major USDA involvement in the research, and the US government insists that the results of such research be available without charge.

A second important lesson to be learnt is that a barrier to the successful commercialization of new varieties is identity preservation (IP) costs. To prevent adulteration and false claims, it is necessary to keep premium-priced products separate from basic commodity products.

Particularly during the early stages of development of novel varieties, the volumes of such oilseeds are low, and thus, the unit costs of IP are correspondingly high. Therefore, any attempt to change the functional properties of palm oil would need to set ambitious targets for output growth, specifically to reduce the costs of creating separate supply chains from the mill to export ports, separate tanks on board ships, and again separate tanks at the destination.

On balance, the advantages to oil palm from the development

of varieties with modified lipid profiles will be very limited, not only because of the extra costs associated with IP supply chains, but also because the developers of novel varieties of annual oilseeds can be much quicker on their feet, creating a much too fast moving target for the oil palm industry to catch up with.

Fractionation is the preferred way to proceed. It gives the supplier an instantly modified fatty acid profile, and at relatively little cost.

**Non-tariff Barriers to the More Widespread Use of Palm Oil**

It is a sad reality that non-tariff barriers are being erected against palm oil in many important export markets, most notably the EU and US. These barriers are linked to the issues of sustainability and life cycle greenhouse gas reductions in biofuel applications.

The barriers that are most effective are those in the biofuel sector, because governments provide explicit or implicit subsidies to the suppliers of biofuels, via tax breaks or the imposition of blending mandates, and thus they can decide which biofuels they would be prepared to support. In view of the strong vested interests from domestic biofuel producers in the EU and US, it is difficult to see the situation confronting palm-based biofuel exporters easing soon in these markets.

**The Implications for Palm Oil if Past Trends Continue**

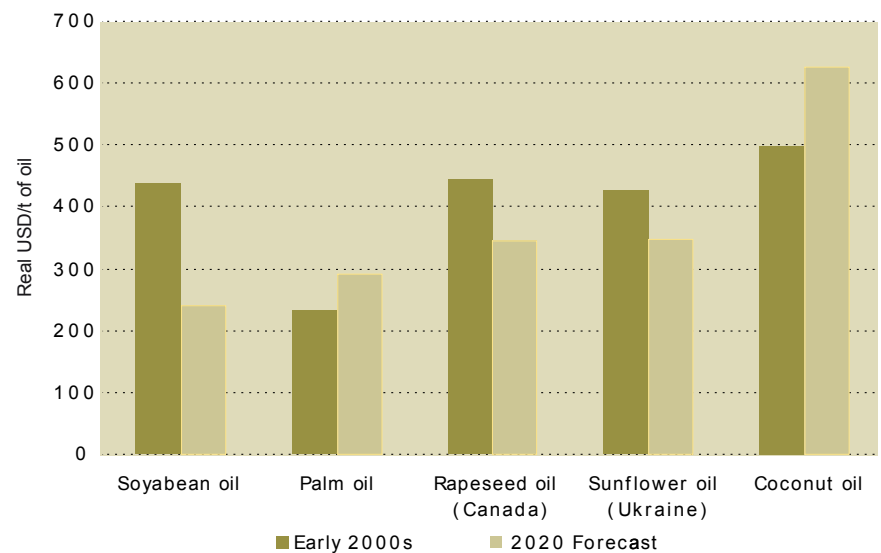
This article concludes by asking what would happen to the competitive position of palm oil if recent trends, described above, continue to drive the future behaviour of the sector. *Figure 10* reveals how the worldwide average real production costs of soyabean, palm and coconut

oils, and the corresponding production costs of the world's leading exporters of softseed oils, namely Canadian rapeseed oil and Ukrainian sunflower oil, would change between the first half of the 2000s and 2020, if past trends in (a) labour productivity, (b) rising real wages and (c) agricultural and processing yields continue to unfold at the same rates as those seen during the past 20 years.

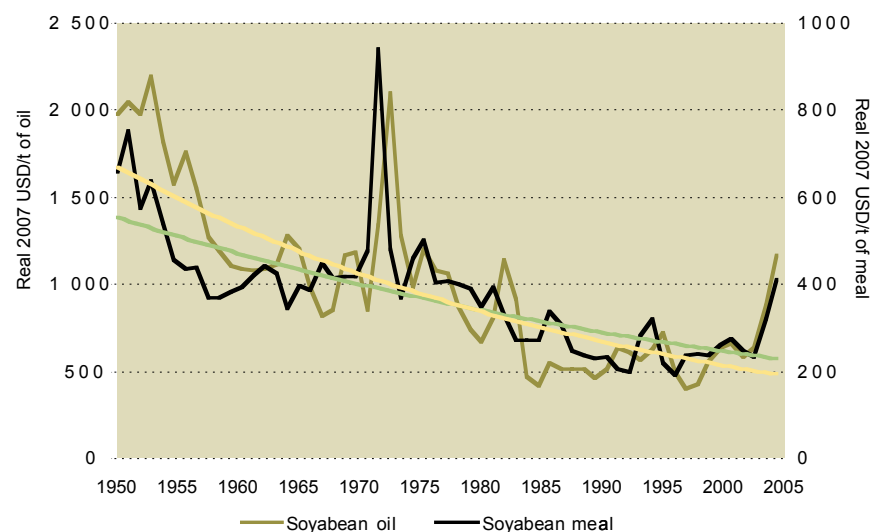
Following these trends, by 2020, palm oil would have been supplanted by soyabean oil as the most cost-competitive oil. In addition, production costs of Ukrainian sunflower oil and Canadian rapeseed oil would

have moved closer to that of palm oil, narrowing the gap by three-quarters.

A specific factor favouring crops such as soyabean is the way in which meal prices have fallen more slowly than vegetable oil prices (this may be seen in *Figure 11*). This means that, in relative terms, the meal by-product credits that are subtracted when calculating oil production costs have been rising as a proportion of the (declining) real production costs of soyabean and of soyabean crushing. They will continue to become a bigger factor in the overall economics of the soyabean sector over time, if past trends are maintained.



*Figure 10. Impact of increasing labour productivity, rising wages and trend growth in yields on oil production costs by 2020 (treating meal as a by-product credit).*



*Figure 11. Long-run behaviour of real soyabean oil and meal prices since 1950.*

The sharp decline in soyabean oil production costs, net of meal credits, between now and 2020 is the consequence.

If one projects production costs a further five years forward, to 2025 (by which date, one must not forget that oil palms that are planted in 2009 would still have one third of their overall economic life-span remaining), one discovers that palm oil would have been relegated to the fourth position among the five oil crop sectors compared in *Figure 10*. By that year, unless a sea change can be brought about in productivity, palm oil will become 'just another oil', and not the premier oil.

#### SUMMARY AND CONCLUSION

The Malaysian palm oil sector has little control over the short-term challenges because its behaviour depends heavily on other substitute products, either as vegetable oils or as biofuels. Malaysia may benefit randomly from transient shocks to any one or more substitute oils. Similarly, a good harvest of other oils introduces downward pressure on palm oil prices.

There are four long-term challenges facing the palm oil sector. The first is the poor improvement rate in yields compared with other oil crops. This is mostly a result of a lack of commercial incentives to develop improved varieties. This obstacle could be transformed by paying a small royalty on each tonne of the crop harvested to the developers of these improved varieties.

The second long-term challenge is low labour productivity, mostly due to problems in the mechanization of harvesting FFB. It is recommended that a large fund be created for research into mechanization, using robotics or other technologies. Leading international institutes could be invited to bid to undertake the research on a competitive basis, with the promise of a share in future revenues from the development of the most suitable machines for commercial sale.

The third challenge is the functional obstacles to palm oil use in temperate countries. Palm oil's properties can be improved through conventional breeding and the use of biotechnology to change the oil's lipid composition,

or by adapting fractionation and distillation technologies to derive oils with a lower saturated fat content. There are two main lessons to be learnt from the experience with annual oilseeds. First, novel varieties can benefit from open source genetics, as in the case of US sunflower seed, whereby all seed companies may use the variety for further development without having to pay any licensing fee. This was a consequence of major USDA involvement in the research; hence, the results of its research are available to the public without charge. A second important lesson to be learnt is that a barrier to the successful commercialization of new varieties is identity preservation costs, needed to avoid adulteration and false claims by keeping high-value products separate from basic commodity products.

The fourth long-term challenge facing the palm oil sector is the non-tariff barriers against palm oil in many important export markets, particularly the EU and the USA. These barriers are linked to the issues of sustainability and life cycle greenhouse gas reductions in biofuel uses.