Economic impacts of low level presence of not yet approved GMOs on the EU food sector

Briefing document

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This report was commissioned by a coalition of like-minded European trade and industry organisations engaged in the food sector. Several members of these organisations also provided input in the form of knowledge and expertise. This report is intended to contribute to the body of information publicly available on this issue.
The coalition is comprised of CIAA, represented by several individual members, COCERAL, EUROMAISIERS, FEFAC, FERM, and GAM.[1]

[1] CIAA European Food and Drink Industry
COCERAL Representing the European cereals, rice, feedstuffs, oilseeds, olive oil, oils and fats and agro supply trade
FERM Federation of European Rice Millers
GAM European Association of Flour Milling
EUROMAISIERS European Maize Industry Association
FEFAC European Feedstuffs Producers

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Executive summary

This paper explored the economic impact of the zero tolerance policy for the low level presence (LLP) of genetically modified organisms (GMOs) not yet approved in the EU[2], on the food sector.

1. To date, the operation of a zero tolerance policy for the LLP of GMOs not yet approved in the EU has already had a negative impact on parts of the EU food sector. In particular, the rice sector has experienced trade and market disruption, a significant cost burden (of up to €111 million by early 2008) and commercial difficulties for many operators in the rice supply chain (see section 2).

2. With the discrepancy between the timing of new GM trait approvals in the EU compared to major supplying countries of crops (eg, soybeans) to the EU, and the rapid 'pipeline' of new traits and combinations of existing/new traits 'stacked' being approved for use outside the EU, the negative impact is likely to get progressively worse and include a wide range of sub-sectors.

3. In particular, the EU soybean and derivative usage sector is likely to experience market disruption starting in late 2008 and the immediate costs of dealing with the aftermath of the first incidents in LLP of not yet EU approved GMOs in this (food using) supply chain are likely to be between €1 billion and €2.8 billion (see section 3). The market disruption and associated costs can be expected to get progressively worse into 2009/10 and beyond.

4. There are a number of other 'knock on' negative effects. The main ones are:

   - Additional cost burden on the EU food industry: eg, the immediate cost of switching away from soy oil into rapeseed oil would add at least €155 million to raw material costs;
   - Reduced profitability: eg, the costs incurred by the rice sector are equal to between three and five years worth of total net profitability in the EU long grain rice sector;
   - Disruption to EU processing activities, increased reliance on imports and possible re-location of EU processing facilities outside the EU (ie, lower levels of income and employment generation as jobs and investment are exported);
   - Those at greatest risk are small/medium sized businesses that dominate the EU food sector;
   - Legal uncertainty, which reduces business confidence, adding to negative economic impact;
   - Possible reduction in consumer product choice and higher prices;
   - Contributing to increases in world prices for alternative (substitute) sources of raw materials, at a time of historic 'highs' in world agricultural commodity prices;
   - Reduced willingness of third country suppliers to supply the EU with raw materials due to increased risk of cargo refusal and legal disputes.

5. Due to the bulk nature of trading for most grains and oilseeds and the sophistication of testing equipment, there remains a possibility of spill over negative impact into unrelated sectors of the food industry (ie, positive test results for LLP of not yet EU approved soybean traits might arise in imported supplies of other grains and oilseeds).

[2] It is practically impossible to supply a crop with 100% purity, hence trade has historically used the principle of tolerances for the presence of unwanted materials. Tolerances exist for a wide variety of unwanted materials, including materials that may be damaging to human health (eg, mycotoxins, heavy metals). This practice of setting tolerances to reflect levels of risk was not applied (ie, there is a zero tolerance) in the case of LLP of GMOs not yet EU approved. It is therefore illegal to use or supply products derived from or containing not yet approved GMOs in the EU food and feed sectors (even in minute traces)

General summary

This paper explored the economic impact of the asynchronous nature of GMO approval procedures, coupled with the operation of a zero tolerance threshold for the low level presence (LLP) of GMOs not yet approved in the EU[3], on the directly consumed food sector.

It complements the study by DG Agriculture (July 2007) on the economic impact of EU unapproved GMOs on EU feed imports and livestock production[4] which concluded that the asynchronous nature of the EU's GMO approval procedures will have a substantial negative impact on the EU livestock production and animal feed sectors (eg, under the worst case scenario poultry meat production could fall by between 29% and 44%).

Due to the potentially complex and wide ranging impacts across different agricultural commodity using sectors, the approach focused on crop and derivative-specific case studies. These were:

a) The EU rice sector. A sector which has had to deal with impact of LLP of the unapproved GM herbicide tolerant (LL 601) event being found in long grain rice supplies entering the EU from the US since August 2006.

b) The soy derivatives of soy oil and soy lecithin relating to second generation GM herbicide tolerant (GM HT) traits in soybeans that have been approved for commercial planting in the US[5] but which are unlikely to have completed the EU approvals process by the time of commercialisation in the US. As soy derivatives are used in a wide range of food and feed products, the analysis focused on the use of these two widely used derivatives[6].

The analysis draws significantly on information provided from interviews with representatives of companies and organisation in the rice milling and soy processing and using sectors.

Rice case study (see section 2)
The EU rice milling and user sectors have been dealing with the consequences of LLP of an EU unapproved GMO in long grain rice supplies from the US since August 2006. Against a background in which there are no GMO rice traits commercially, currently, available to rice farmers anywhere in the world, the identified presence of an unapproved GMO event in rice shipments to the EU has resulted in trade and market disruption, a significant cost burden and commercial difficulties for many operators in the EU rice supply chain. Following the identification of the LL601 unapproved trait in long grain rice supplies in the US, the US authorities began a formal approval process for the trait and this was subsequently given approval a few months later. However, this trait remains unapproved for importation and use in the EU.

3 As it is practically impossible to supply a crop commodity with 100% purity, agricultural commodity trade has historically utilised the principle of thresholds or tolerances for the technically unavoidable presence of unwanted materials in traded commodities. These thresholds/tolerances exist for a wide variety of unwanted materials, including the presence of materials that may be damaging to human health (eg, mycotoxins, heavy metals). This practice of setting and relating threshold/tolerances to reflect levels of risk was not applied (ie, there is a zero tolerance) in the case of LLP of GMOs not yet approved. It is therefore illegal to use or supply products derived from or containing even LLP of not yet approved GMOs in the EU food and feed sectors

4 http://ec.europa.eu/agriculture/envir/gmo/economic_impactGMOs_en.pdf,

5 Likely to be commercially available to farmers for planting in 2009, although seed crops will be harvested in 2008

6 Lecithin is used mostly as an emulsifier in products such as confectionery, chocolate, bakery products and ready meals

More specifically:

- The operation of a zero tolerance threshold for the presence of unapproved GMO traits has caused major disruption to the EU long grain rice market and sector. This has lasted 20 months and is ongoing;

- At the company level (rice miller), the average cost of dealing with LLP of unapproved GMOs has been between €3.5 million and €7.4 million;

- At the industry level (across about 15 rice millers), the cost, as at early 2008, was between €52 million and €111 million. This is probably a conservative estimate given the ongoing nature of the problem and the impact on users further down the supply chain (eg, manufacturers of ready meals);

- These costs are equivalent to between 6% and 13% of the total value of the EU long grain rice market and between 27% and 57% of the total market gross margin. In net profitability terms, the costs are possibly equal to between three and five years worth of total net profitability;

- This degree of negative impact on profitability will have an adverse impact on future income and employment generation in the sector, as some operators move out of rice milling and/or cease trading rather than make losses;

- Those at greatest risk are small and medium sized businesses that make up almost all operators in the sector;

- There has been major trade diversion away from the US. In effect, supplies of husked long grain rice from the US have virtually stopped, with import volumes in 2007 being some 95% below pre August 2006 levels. Other sources such as Uruguay, Thailand and the EU domestic sector have taken up the shortfall in US supplies;

- The process of trade diversion (ie, EU rice millers looking to replace US supplies with other origins) has probably made a small contribution to the upward pressure on world rice prices that has occurred in the last year;

- At the consumer level, the GMO LLP issue resulted initially in shortfalls of US origin long grain rice (including some empty supermarket shelves). These were subsequently replaced with other origins and probably adequately met the requirements of most consumers;
- For some consumers, however, who specifically purchased US origin long grain rice for US-specific quality attributes, lack of access to this rice or replacement with alternative (perceived to be inferior) rice has resulted in a loss (unquantifiable) of consumer welfare;

- The incidence is likely to have had a negative impact on overall consumer confidence in the food supply chain that supplies rice.

Table 1: EU long grain rice market & cost of the LL601 GM unauthorised presence incidence

Cost of incidents to date	€52-€111 million
Total EU market for long grain rice (milled equivalent)	1.1 million tonnes
Sales value of long grain market (ex rice mill)	€838 million
Gross margin	€193 million
Net profit	€19-€29 million

Notes: 1. Gross margin assumed to be 30% to cover overheads and profit. Net profit based on an estimated average of 10% to 15% of gross margin

Soy derivative case study (see section 3)
The operation of a zero tolerance threshold for the presence of GMO traits not yet EU approved, coupled with the asynchronous nature of the EU's GMO approval process is likely to cause significant disruption to the EU soybean and derivative processing and user sectors (notably the EU food industry). First incidence of disruption can reasonably be expected in late 2008 and can then be expected to get progressively worse during 2009, potentially causing significant problems by 2010[7]. The main negative impacts likely to occur are:

- The most vulnerable part of the supply chain is likely to be the EU soybean crushing sector, which currently uses a significant volume of US origin soybeans for crushing. Drawing on the experiences of the rice sector and with supplies of maize derivatives (notably maize gluten for use in the feed sector) from the US in 2007/08, that could not be guaranteed to be 100% free of the presence of GMO traits not yet EU approved, it is highly likely that similar difficulties will arise for the EU soybean crushing sector;

- Initially (2008/09) EU crushers may look to switch sources of supply (of soybeans) away from the US to other origins (notably in South America) but once soybean farmers in these countries begin to access second generation GM HT traits soybeans (likely to begin in 2009/10 and increasing into 2010/11), this alternative will potentially be as problematic as using US origin. Also, the global nature of trade in grains and oilseeds means that vessels shipping soybeans from South America to the EU in 2008/09 may have previously been used to ship US origin soybeans to export markets and may therefore retain trace levels (eg, in dust) of not yet EU approved GMO soy traits when used to transport soybeans from South America to the EU;

- Faced with difficulties in guaranteeing that supplies are 100% free from the presence of GMOs not yet EU approved, this may result in short/medium term inactivity in the crushing sector as crushers see little option but to shut down processing facilities. This will have a negative impact on income and employment generation in the sector;

- All users of soy derivatives in the food (and feed) sector(s) will be faced with increased risk of incidence of LLP of GMOs not yet EU approved being found in supplies of soy-based raw materials. Initially, users of first derivative products like soy oil (especially if derived from EU crushed beans imported from the US) probably have the highest risk, with the levels of risk being less for users of secondary processed derivatives like soy lecithin, especially where the bulk of supplies currently come from certified conventional soybeans supplied through an identity preserved supply chain;

- The increased risks result in legal uncertainty for businesses (eg, possibilities of legal actions being bought, fines imposed, etc). This has a negative impact on business confidence, re-enforcing the negative economic impacts;

[7] Drawing on the experience of adoption of the first generation of GM HT soybeans, the second generation is likely to be equally fast in being adopted by soybean farmers with significant plantings in US from 2009 (seed crops in 2008) and the first plantings in South America in 2009/2010

- Whilst the cost of dealing with a single incident of not yet approved GMO LLP will vary by sector and company, the cost in a single user sector (eg, lecithin users) could be between €82 million and €156 million. Given there are many uses of soybeans and derivatives, these costs can reasonably be expected to replicated across several user sectors, possibly pushing the cost up to between €492 million and €936 million[8];

- Drawing on the experience of the rice sector, a first identified positive test for not yet EU approved GMO LLP in supplies of soybeans entering the EU will likely trigger systematic testing of all import shipments and additional positive tests can be expected. This suggests a wider range of businesses will be affected than in the case of a single incident, resulting in additional costs. The total cost of dealing with several incidents of not yet approved GMO LLP could therefore rise to between €1 billion and €2.8 billion[9];

- Given the bulk commodity nature of trading for most soybeans (ie, in transport and ships that also carry other grains and oilseeds), coupled with the sophistication of GMO testing equipment, it is possible that positive test results for LLP of not yet EU approved GM HT soybean traits could be found in supplies of other grains and oilseeds imported into the EU. Therefore there remains a possibility of spill over negative impact into unrelated (to soy using) sectors of the food industry;

- Following an incident of not yet EU approved GMO LLP being found in supplies of raw materials, it is likely that some food sector businesses will look (initially) increasingly to replace soy derivatives derived from EU crushed soybeans (that could be from the US) with additional imports of the derivatives. This will probably result in upward pressure on the prices of these products adding further to the costs incurred by the EU food sector;

- In the long term, the combination of costs incurred by the food sector (which adversely affects profitability) and probable increased import dependence will have a negative impact on future income and employment generation in the sector. As in the rice sector, those at greatest risk will be small and medium sized businesses that make up the majority of the EU food sector;

- At the consumer level, the initial impact of finding LLP of a not yet EU approved GMO in supplies of soy derivatives used in many food products is likely to be limited. At the product availability/choice level, it is possible that in the immediate aftermath of a product withdrawal, some consumers might find a short term unavailability of a specific product (as occurred in the rice example). The low incorporation rates of soy derivatives in many food products means that even if the cost of finding replacement supplies is higher, such additional costs are likely to be absorbed by the supply chain rather than passed on to the end consumer. Where soy derivative ingredient incorporation is higher (eg, cooking oils, some yellow fat spreads), it may result in these additional costs being passed onto consumers in the form of higher prices;

- In the longer term (2010 onwards), availability and choice of products for consumers could become more problematic once all of the mainstream global supplying countries of soybeans begin to adopt the second generation of GM HT soybeans and the EU food sector has to seek alternative raw materials (see below);

- One avenue open to the food sector faced with increased incidence of LLP of not yet EU approved GMOs being found in supplies of soy derivatives is to consider switching ingredient use away from soy in favour of other oils and derivatives. This policy was initiated by some businesses in the late 1990s when GM avoidance policies were first adopted and therefore may be extended in the face of new problems associated with LLP of not yet EU approved GMOs. The scope for switching will depend upon the functionality of the alternative and its impact on attributes such as taste, texture, appearance and shelf life, together with price and availability.

[8] Based on application to six important use sub-sectors, see section 3
[9] Based on two to three 40,000 tonne shipments being affected from which derivatives were supplied and used by all of the six soy using sub-sectors in the food industry

Where soy derivatives are mostly utilised for price reasons, substitution will be relatively easier than where the soy derivative has a product-specific functionality role. Thus it is likely to be relatively more straightforward to replace soy oil with alternatives than soy lecithin;

- The impact of the EU food (and feed) sector(s) looking to replace important volumes of derivatives like soy oil with alternatives is likely to result in price rises for competing oils. The primary source of alternative oil that might realistically take up any significant demand from the EU is probably rapeseed oil[10]. At current price differentials between EU rapeseed oil and soy oil (uncertified and certified conventional), replacement of the current volume of soy oil used by the EU food industry with rapeseed oil would add €155 million to raw material costs. A major move into rapeseed oil and away from soy oil by the EU food sector would, however, create upward pressure on the world and EU price of rapeseed oil, adding further to raw material costs of the EU food industry (and making the €155 million additional costs referred to above look conservative).

Concluding comments

To date, the operation of a zero tolerance policy in the EU for the LLP of GMOs not yet approved in the EU, but approved in exporting countries as safe for food and feed use, has already had a negative impact on parts of the EU food sector.

With the discrepancy between the timing of new GM trait approvals in the EU compared to major supplying countries of crops (eg, soybeans) to the EU, and the rapid 'pipeline' of new traits and combinations of existing/new traits 'stacked' being approved for use outside the EU, it is to be expected that the negative impact will broaden to include a wide range of sub-sectors. Whilst the scope for economic damage will vary by sector, new disruption to EU markets is likely to begin to occur in late 2008 and become progressively worse thereafter.

The primary negative impacts are:

- Additional cost burden on the EU food industry;
- Reduced profitability;
- Disruption to EU processing activities, increased reliance on imports and possible re-location of EU processing facilities outside the EU (ie, lower levels of income and employment generation as jobs and investment are exported);
- Increased legal uncertainty;
- Possible reduction in consumer product choice and higher prices;
- Contributing to increases in world prices for alternative (substitute) sources of raw materials, at a time of historic 'highs' in world agricultural commodity prices;
- Reduced willingness of third country suppliers to supply the EU with raw materials due to increased risk of cargo refusal and legal disputes.

[10] The EU food sector uses 1.1 million tonnes of soy oil annually. World trade in rapeseed oil is about 4.1 million tonnes

1 Introduction

1.1 Background

The regulatory approval procedures in the European Union (EU) for genetically modified organisms (GMOs) have both important differences to, and take significantly longer than, the approval procedures in some of the major agricultural commodity trading partners of the EU. As a result, GMOs tend to be approved for commercial use in food and feed products in countries such as the US before approval is granted in the EU. This 'asynchronous authorisation' process can result in trade disruption, where agricultural commodities and derivatives that may contain GMOs approved in an exporting country are exported to the EU before the EU grants authorization for importation and use. The extent to which trade disruption may occur depends on a number of factors including the rate of adoption of a newly approved GMO in the exporting country and the scope (and financial incentives in form of differentiated prices) for initiating segregated or identity preserved supply chains in the exporting countries and subsequent international transportation systems (separately into products with approval for importation into the EU and products without EU import approval). Of crucial importance, however is the nature of rules relating to adventitious (or accidental) presence of not yet EU approved GMOs in consignments or shipments of agricultural commodities and derivatives exported to the EU.

As it is practically impossible to supply (outside a laboratory) a crop commodity with 100% purity[11], agricultural commodity trade has historically utilized the principle of thresholds or tolerances for the technically unavoidable or adventitious presence of unwanted materials in traded commodities. These thresholds/tolerances exist for a wide variety of unwanted materials, for example, off types, weed material, dirt, different seeds or grains to the mainstream product supplied, and include the presence of materials that may be damaging to human (or animal) health (eg, mycotoxins, heavy metals). The tolerances are more restrictive (ie, lower) for unwanted materials of a dangerous (to human and animal health) nature[12] than those that are 'undesirable but less damaging to health'. In the case of the adventitious presence of GMOs not yet approved for importation and use in the EU[13], this historic practice of setting and relating threshold/tolerances to reflect levels of risk was not applied, and the threshold/tolerance applied is zero (ie, there is no tolerance).

This paper explores the economic impact of the asynchronous nature of approvals procedures coupled with the operation of a zero tolerance threshold for the adventitious presence of not yet approved GMOs in the EU on the food sector including food importers, manufacturers, retailers and end consumers. It also complements the study by DG Agriculture (July 2007) on the economic impact of unapproved GMOs on EU feed imports and livestock production
(http://ec.europa.eu/agriculture/envir/gmo/economic_impactGMOs_en.pdf.

1.2 Objectives

The main objective was to examine the economic impact and costs associated with the operation of the EU zero tolerance policy for the adventitious presence of not yet approved GM material and the asynchronous approvals process on the EU food industry. This included examination of both past/current impact and explored the potential future impact.

[11] As acknowledged by the EU Commission – see Questions and Answers on Regulation of GMOs (page 16) by DG Sanco
[12] Usually set as maximum residue levels in terms of micrograms per kg
[13] This effectively applies to both GMOs approved for use in an exporting country and GMO events that may be experimental (and not approved) in an exporting (non EU) country

The analysis was focused on the following issues:

- Securing adequate access to raw materials both to service product/consumer markets that currently demand certified conventional content and markets where no such (conventional status) is required;

- Impact on raw material prices;

- Costs of any discovery of adventitious presence of not yet EU approved GM material in products including blockage of stock, possible non-production due to raw material shortage, product withdrawal or recall, product reformulation, alternative raw material search and sourcing, possible non availability of alternative raw materials, obsolete labels and packaging, additional costs for testing, damage to brand or product;

- Possible impact on consumers including perception of product/general confidence in the European food supply.

1.3 Approach

Due to the potential complex and wide ranging impacts across different agricultural commodity using sectors, the approach focused on crop and derivative-specific case studies. These were:

a) A current/recent example case study: the EU rice sector

This quantified and reported on the impact of GM adventitious presence of the EU unapproved herbicide tolerant (LL 601) event being found in long grain rice supplies entering the EU from the US, in and after August 2006.

This analysis drew on a combination of existing information collected by the Federation of European Rice Millers, together with information collected from EU rice millers affected by the incidents.

b) A future example – second generation herbicide tolerant soybean traits

Three GM herbicide tolerant (GM HT) soybean traits were approved for commercialization (planting) in the US in 2007, and can be expected to be grown commercially in 2009. In order to provide a focus for the analysis of a crop that has a number of derivatives that are widely used in the food chain, the case study concentrated on usage of some key soybean derivatives.

This part of the analysis was largely based on interviews with companies in the EU soy derivative and food manufacturing sectors.

2 Rice case study

2.1 Size of market and usage of rice

2.1.1 EU trade and usage of indica rice

In 2005/06, the EU 25 consumed about 1.1 million tonnes of long grain rice (in milled rice equivalents: Table 2. Domestic EU production accounted for the largest share of this market (55%: 619,000 tonnes), with imports accounting for the balance: 513,000 tonnes of long grain rice. If basmati is included the import volume was 848,000 tonnes (milled rice equivalent).

Table 2: EU 25 long grain rice imports and usage 2005-06 ('000 tonnes)

	'000 tonnes milled equivalent
Imports	
All long grain (of which basmati)	848 (335)
Non basmati imports	513
Domestic EU production	619
Total supply availability	1,132
Exports	23
Domestic usage	1,109

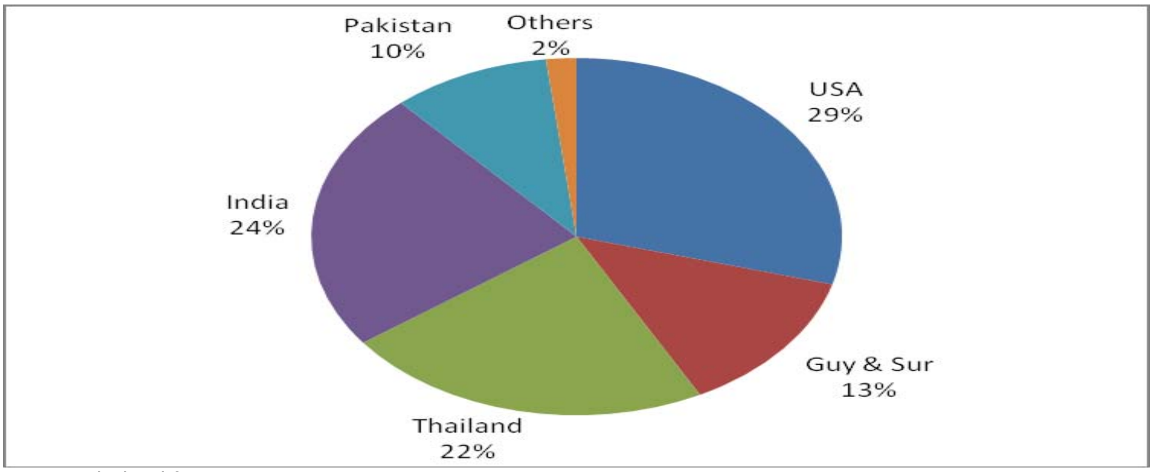
Sources: EU Commission, Eurostat

In terms of origins of the imports, the primary sources of supply (based on 2005: Figure 1) were:

- The largest share came from the USA, 29%, followed by India 24% and Thailand 22%. Other important sources of supply were Guyana and Surinam (13%) and Pakistan (10%);

- In respect of the non basmati imports, the USA accounted for 44% of total supplies followed by Thailand (34%) and Guyana/Surinam (19%).

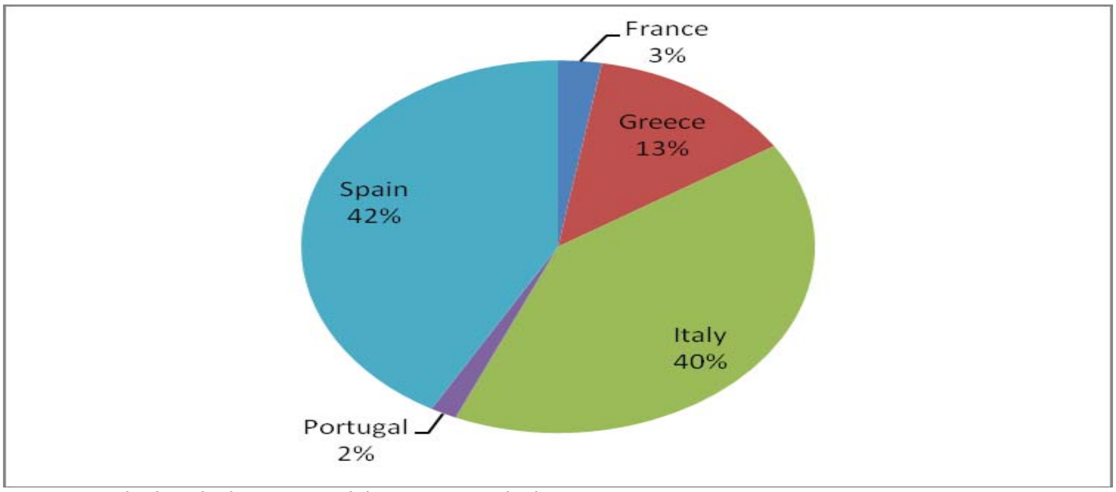
Figure 1: EU long grain rice imports 2005 (total 0.83 million tonnes: milled equivalent)



Source: derived from Eurostat

In respect of domestic production, the majority derives from Spain and Italy which in 2006 accounted for 42% and 40% respectively of total production (Figure 2). The other producers were Greece, France and Portugal which accounted for 13%, 3% and 2% respectively.

Figure 2: EU long grain rice production 2006-07 (total 0.625 million tonnes milled equivalent)



Source: Agricultural Directorate of the EU Commission

2.1.2 Rice usage

As indicated above, domestic usage of long grain rice in the EU amounts to about 1.1 million tonnes per year. The EU also consumes about a similar volume of short to medium (japonica) grain rices that derive almost entirely from EU production.

Whilst the largest share of this consumption is in a directly consumed form (as dry, ambient or chilled rice, which is usually part of a meal), rice is also used in a variety of products (Table 3[14]). Other important user sectors for rice include ready meals, breakfast cereals, rice cakes and rice/vegetable mixes.

Table 3: Estimated value and breakdown of rice usage market (at retail level) in the UK: 2005/06

Market Segment	Value of rice component (Euros)
Ambient/Chilled	280
Frozen rice & vegetable mix	73
Rice puddings	8
Rice cakes	75
Cereal bars	34
Breakfast cereals	202
Ready meals	168
Total	**840**

Source: TNS Worldpanel

2.2 The issue of EU unauthorised GMO adventitious presence found in long grain rice imports from the US

2.2.1 The incident and issue

In August 2006 transgenic material in rice from the LL601 event (conveying herbicide tolerance to the herbicide glufosinate ammonium), developed by the biotechnology company, Bayer Crop Science was confirmed as having been found in shipments of long grain rice exported to the EU[15]. The level of adventitious presence identified was reported to be at the limits of detection (ie, trace level).

[14] Although this table provides a breakdown of the rice usage markets in the UK only, similar wide ranges of usage occur in other member states. Other usage sectors not included in this analysis which are also important include rice flour and the brewing sector

[15] Bayer Crop Science notified the USDA that it had found trace levels of LL601 in commercial long grain rice samples

Subsequent testing of some US long grain rice shipments entering the EU also identified trace levels of LL601 in samples.

At the time, this event had not been approved for marketing and use in the US (ie, using US legal terminology it had not been ‘deregulated’), although similar events conveying tolerance to the herbicide glufosinate ammonium in rice had been deregulated (eg, in relation to the events LL62 and LL06), but not made commercially available to US rice farmers. Events conveying tolerance to glufosinate ammonium had also been deregulated and commercially used by US cotton and maize farmers for several years. The EU had also granted approval for the importation and use of maize containing the trait conveying tolerance to glufosinate ammonium. Following the identification of the LL601 unapproved trait in long grain rice supplies in the US, the US authorities began a formal approval process for the trait and this was subsequently given (ie, ‘deregulated’) a few months later.

The identified presence of an unapproved GMO event in rice shipments to the EU resulted in trade disruption and commercial difficulties which are detailed in the sub-sections below.

2.2.2 Impact at the company (EU rice miller) level

On learning that some imports of long grain rice from the US may contain low level presence of the unapproved GMO event LL601, EU rice millers were faced with having to assess the following:

- Identify (through testing) if the unapproved event is in any stocks of rice awaiting processing/milling, in stocks of milled rice and in derivative products containing rice;
- Notify customers that products supplied may contain the unapproved event and therefore may need to be tested. As indicated in section 2.1 above, due to the wide range of uses and products containing rice, this potentially involved contacting a significant number of customers in the food manufacturing and food usage sectors;
- If tests identify a positive result (for the presence of the unapproved event), isolate, remove all stocks and products that may contain the unapproved event and arrange for destruction of the products;
- Possibly recall milled rice and other products containing rice (eg, instant/easy cook products) supplied to customers in the food manufacturing, retail and catering sectors;
- Seek assurances from US suppliers that future supplies of long grain rice would be guaranteed to be free from the presence of the unapproved event or seek alternative supplies of long grain rice (from other countries).

The time, processes, impact and costs involved in initiating these actions varied by businesses. More specifically:

- *Testing*. At first sight this appears to be a fairly straightforward issue; test supplies and isolate and remove material from the supply chain containing the unapproved event. However, reality was more complex. What products are tested? (eg, rice in stocks awaiting milling?, milled rice in stock?, product supplied to customers?, testing of material supplied after what date?, which test is applied (an event-specific one for LL601, or a more general one that may pick up the GM glufosinate tolerant trait but which may not be event-specific to LL601 and could be from, for example an approved event in maize?), was the test conducted in an EU approved laboratory?, following approved test procedures?, what level of GM adventitious presence have tests been conducted to (eg, to 0.1% or 0.01%) and what confidence is attached to the test results?, what is the possibility of a ‘false’ positive test occurring?, especially as the minute levels of GM adventitious presence being picked up are at the limits of reliable detection? Initially, due to the lack of reference material being made available in the EU, tests undertaken were not event-specific and therefore it was probable that a significant number could have contained an event conveying tolerance to glufosinate ammonium that was legally permitted for import into the EU but which was not the specific unapproved event LL601.

Some companies took action to isolate and remove supplies based on the results of these non-event-specific tests, whilst some others insisted on subsequent event-specific tests being undertaken before taking action. Laboratories testing in the US were also generally testing to the limit of 0.1% (widely perceived to be the limit of reliable detection), whilst some laboratories in the EU were testing to the limits of any detection (a 0.01% threshold). As a result, it was possible to obtain some negative results for tests on a shipment out of the US that subsequently tested positive on arrival at an EU port;

- *Product withdrawal*. The volumes of products withdrawn from the market (and associated time and costs involved) varied not only by the incidence of positive test results being found but by the testing regime applied (see above). Where product was required to be withdrawn on the basis of non event-specific testing (ie, no subsequent event-specific testing), the volumes withdrawn and costs involved were clearly greater than would have been the case if event-specific testing had been the standard applied;

- *Replacement of withdrawn US supplies and future raw material supplies*. In the immediate short term (of weeks/one-two months), the scope for continuing to mill and supply US origin rice to customers was affected by stock levels held by rice millers. Those with low levels of stocks were in a more difficult position for maintaining continuity of supply than those with larger stock levels. Secondly, the scope for obtaining future supplies of US origin long grain rice certified as being free from the LL601 unapproved GMO event depended on suppliers being willing to supply with this guarantee. As the vast bulk of US long grain rice is supplied via the ‘commodity-based’ supply chain in which there is considerable co-mingling of supplies during storage and transportation, it was evident that US suppliers were generally not able to provide such assurances and alternative (non US origin) supplies had to be explored. Thus for many EU rice millers there was significant disruption to supplies/imports of raw material, necessitating having to identify and procure alternative (non US origin) supplies of ‘equivalent’ long grain rice. This impacted not only on costs, but affected ability to supply customers with existing contracts, future continuity of supply and had negative quality/brand image issues. Where customers specifically required US origin rice only, this could no longer be fulfilled, where this required the supply of US origin supplies because of specific cooking and/or other characteristics it necessitated researching the blending, milling and cooking characteristics of alternatives before being able to supply produce. During this period, sales were lost. In addition, where alternative (non US) supplies were established this necessitated the changing of labels/re-design of packaging away from statements or images that were associated with the US origin of the rice;

- *Impact of inconsistent responses at member state authority level*. The responses by member state authorities varied. For example, in France rice mills were effectively ‘shut down’ for a period, whilst in some other member states mills were allowed to operate whilst testing of stocks were undertaken. As a result the levels of disruption at the rice miller level varied;

- *Legal costs*. These have been incurred for breach of contract/non supply, cost of testing and disposal/return of recalled produce, preparing cases against suppliers and failure to fulfil import licence commitments,

- *Adverse impact on brands and product/company image*. Brands of milled rice and products containing rice and general reputations/goodwill are perceived to have been negatively impacted as a result of product recalls and disruption to supplies. This is most tangibly identified through loss of sales and profits. Additional costs incurred included having to cancel promotional and marketing activities (eg, having to pay for advertising space reserved but not used, preparation of marketing material no longer used). Lastly, in the longer term it is possible that future sales and profits may be lower than they might otherwise have been if the GMO adventitious incident(s) had not occurred;

- *Claims for compensation from customers not covered by insurance.* Where claims for compensation against rice millers within existing supply contracts were settled but not covered from existing insurance policies, this will have added costs to businesses;

- *Financial charges*. Where companies incurred loss of sales, profits and additional costs associated with addressing the LL601 adventitious presence issue this may have resulted in additional borrowing requirements having to be sought from lenders. This may have been granted on less favourable terms (eg, higher interest rates) than existing borrowing. Where compensation claims were made by customers and these were covered by existing insurance policies, the premiums associated with renewal of these policies have subsequently increased as a direct result of having made a claim (ie, loss of a no claims bonus);

- *Staff time*. Dealing with the issues of possible presence of the unauthorised GMO LL601 event in rice and associated consequences (as summarised above) involved the considerable input of staff time (including senior management) that would otherwise have been utilised on business activities that aim to develop sales, profits and development of business;

- *Loss of sales and profits*. Disruption to both the supply of raw material and sale of milled rice (and products containing milled rice), as well as additional costs incurred; as indicated above resulted in important reductions in sales and associated profits for many rice millers, many of whom are small and medium sized enterprises.

Table 4 summarises the type and level of costs incurred by rice millers associated with dealing with the GMO event LL601 adventitious presence issue. These cost estimates are based on actual costs cited by companies in the EU rice milling sector and/or legal cases bought against suppliers. This shows the average cost to between €3.5 million and €7.4 million[16]. Across the EU, these levels of costs have been incurred by up to about 15 rice milling companies, putting the total current cost in the range of €52 million and €111 million. Given rice is also used as an ingredient in a number of secondary processed products (eg, ready meals, frozen rice/vegetable mixes) and some of these user companies have incurred costs in addressing the LL601 LLP issue, this cost estimate is probably conservative.

Table 4: Typical costs incurred by EU rice millers as a result of the GMO LL601 event adventitious presence issues arising post August 2006

Category of cost	Value (Euros: '000s)	Comments
Testing & cleaning of plant/equipment	20-40	
Product withdrawal	600-800	Returns of stock from customers, removal and disposal/destruction of stocks
Replacement of affected stock & arrangements for future supply	400-600	Identification of alternative supplies, costs of obtaining, procuring, testing. Having to pay higher prices for alternative supplies than those now replaced
Legal cost	20-100	For dealing with customer legal cases bought against companies and issuing claims against suppliers
Adverse impact on brands/company reputation	1,000-2,500	Withdrawal of advertising and promotional activities, loss of placement/listing fees paid for produce not subsequently supplied, payment of withdrawal/penalties, loss of

[16] At the time of writing (early 2008), this is a 'running' total, with costs still being incurred

		market share (lost in short term and not subsequently regained)
Financial charges	200-400	Payment of higher interest rates on borrowing, higher insurance renewal premiums
Compensation paid outside insurance policies	500-1,750	
Staff time	100-250	
Loss of profits	700-1,000	
Total	**3,540-7,440**	

2.2.3 Impact at the market and 'macro' level

The level of cost incurred by the EU rice milling and rice-using sectors should be placed within the context of the total EU market for long grain rice:

- In the year prior to the LL601 'issue' (ie, to the summer of 2006), imports of husked rice from the US into the EU amounted to about 215,000 tonnes (husked equivalent). In milled equivalent terms this is equal to about 186,000 tonnes. In addition, about 46,000 tonnes milled long grain rice were also imported. The immediate volume of 'stocks' affected when the LL601 adventitious presence issue first occurred was about 3 months stock of husked long grain rice (54,000 tonnes of husked rice, or 47,000 tonnes in milled equivalent terms);

- The annual import value of US husked rice prior to the LL601 'issue'[17] arising was about €69 million, with the import value of the immediately affected volume being about €17.25 million. At the wholesale level (ex rice mill before taking into account overhead costs and profits), the value of this US origin rice market in the EU prior to August 2006 was about €138 million (Table 5), with the value of the immediately affected rice about €34.5 million. Based on an assumed average gross margin of 30%[18], the total gross margin on this part of the rice market in 2005/06 was about €32 million, with the gross margin on the immediately affected volume about €8 million;

- The total EU (25) market for long grain rice (excluding basmati) in 2005-06 was about 1.1 million tonnes (milled equivalent; inclusive of rice imported as husked in the EU, imported in milled form and derived from domestic EU production). The value of this rice at the ex-mill level, inclusive of gross margin was approximately €838 million (gross margin of €193 million). On the basis of the estimated costs incurred to date (€52 million to €111 million), this is equivalent to between 6% and 13% of the total value of the long grain rice market in the EU and between 27% and 57% of the total market gross margin. Given that the net profit element within the gross margin is, in reality only a proportion of the total gross margin, it is evident that the costs involved in dealing with the LL601 adventitious presence issue have been greater than the level of total profitability in the sector. More specifically, if the average rice miller was operating on a net profit level of 10%-15% of the gross margin[19], then the total cost of dealing with the LL601 LLP issue has been equal to between three and five years worth of net profitability in the EU long grain rice market. At the company level, the precise impact will vary according to a number of factors (eg, size of business, importance of rice in total business, importance of US origin rice in the rice business), however, this analysis does illustrate how the costs of dealing with the issue will have pushed a number of rice millers into a loss making position, especially where US origin rice had played a significant part of total business activity;

[17] Based on 2005 import statistics (source: Eurostat)
[18] To cover overheads and profit
[19] For products like dry rice, a net profit margin of 10% is probably reasonably representative. For products that are subject to secondary processing/value adding (eg, ready meals, confectionery, biscuits), higher average net profit margins of up to one third of the gross margin might be achieved

- Businesses making little or no profit (or those making losses) are unlikely to continue in this position indefinitely. Whilst the author is unaware of any business casualties having yet occurred in the EU rice milling sector as a direct result of the LL601 adventitious presence incidence after 20 months and ongoing), no business in a loss making position will continue to trade in the long term. It is therefore possible that the negative impact on profitability arising from this (ongoing) incident will have an adverse impact on income and employment generation in the EU milling sector, as some operators move out of the rice sector and/or cease trading rather than make losses. Those at greatest risk are probably small and medium sized rice milling businesses (that dominate the sector). Including both those directly employed in rice milling and allied sectors this probably totals between 10,000 and 15,000 employees;

- The GMO adventitious issue has resulted in significant trade diversion away from the US as a source of supply of long grain rice. In effect, supplies of husked long grain rice from the US have virtually stopped, with import volumes in 2007 being some 95% below pre August 2006 levels. Other sources of supply such as Thailand, Uruguay and the EU domestic sector have taken up the shortfall in US supplies;

- At the consumer level, the GMO adventitious presence issue resulted, initially, in shortfalls of supplies of US origin long grain rice (empty supermarket shelves). These were largely replaced with other origins of supply and probably adequately met the requirements of most consumers. For some consumers, however, who specifically purchased US origin long grain rice for US-specific quality attributes (eg, some parts of the ethnic Chinese communities and operators of Chinese restaurants/caterers), lack of access to this rice or replacement with alternative (perceived to be inferior) rice has resulted in a loss (unquantifiable) of consumer welfare[20]. In turn this may have had a negative impact on consumer confidence in the food supply chain that uses rice;

- It is important to place the trade diversion impact in the context of the current world rice market. World rice prices have reached historic highs reflecting shortfalls in supplies in some key Asian producing countries. During this period, the addition of EU rice millers looking to secure alternative supplies of long grain rice to the US in countries such as Uruguay, Thailand, India and Vietnam will probably have made a small contribution to the global long grain rice price increases.

Table 5: EU long grain rice market & cost of the LL601 GM unauthorised presence incident

Cost of incident to date	€60-€70 million
Total EU market for long grain rice (milled equivalent)	1.1 million tonnes
Sales value of long grain market (ex rice mill)	€838 million
Gross margin	€193 million
Net profit	€19-€29 million
Sales value of US long grain market segment (year prior to incident)	€138 million
Gross margin on US market segment	€32 million
Net profit on US market segment	€3.2-€4.8 million

Note: Gross margin assumed to be 30% to cover overheads and profit. Net profit based on an estimated average of 10% to 15% of gross margin

[20] For example, some rice millers reported a significant number of consumer complaints about smell and taste of some early alternative supplies used

2.3 Conclusions from the rice case study

The main conclusions that can be drawn from the rice case study are as follows:

- The operation of a zero tolerance threshold for the presence of EU unapproved GMO traits has caused major disruption to the EU long grain rice market and sector. This has lasted 20 months and is ongoing;

- At the company level (rice miller), the average cost of dealing with LLP of EU unapproved GMOs has been between €3.5 million and €7.4 million;

- At the industry level (across about 15 rice millers), the cost, as at early 2008, was between €52 million and €111 million. This is probably a conservative estimate given the ongoing nature of the problem and the impact on users further down the supply chain (eg, manufacturers of ready meals);

- These costs are equivalent to between 6% and 13% of the total value of the EU long grain rice market and between 27% and 57% of the total market gross margin. In net profitability terms, the costs are possibly equal to between three and five years worth of total net profitability;

- This degree of negative impact on profitability will have an adverse impact on future income and employment generation in the sector, as some operators move out of rice milling and/or cease trading rather than make losses;

- Those at greatest risk are small and medium sized businesses that make up almost all operators in the sector;

- There has been major trade diversion away from the US as a source of supply of long grain rice. In effect, supplies of husked long grain rice from the US have virtually stopped, with import volumes in 2007 being some 95% below pre August 2006 levels. Other sources such as Uruguay, Thailand and the EU domestic sector have taken up the shortfall in US supplies;

- The process of trade diversion (ie, EU rice millers looking to replace US supplies with other origins) has probably made a small contribution to the upward pressure on world rice prices that has occurred in the last year;

- At the consumer level, the GMO LLP issue resulted initially in shortfalls of supplies of US origin long grain rice (some empty supermarket shelves). These were subsequently replaced with other origins of supply and probably adequately met the requirements of most consumers;

- For some consumers, however, who specifically purchased US origin long grain rice for US-specific quality attributes (eg, ethnic Chinese communities and Chinese restaurants/take-aways), lack of access to this rice or replacement with alternative (perceived to be inferior) rice has resulted in a loss (unquantifiable) of consumer welfare;

- The incidence is likely to have had a negative impact on overall consumer confidence in the food supply chain that supplies rice.

3. Soybean derivative case study

In this section, the analysis focuses on soybeans and its many derivatives. As there are numerous uses (Table 6) for these derivatives, it focuses on two main ones:

- The first stage derivative soy oil;
- A secondary (further processed) derivative of soy oil, lecithin which is widely used in processed food products.

Table 6: Soybean & derivative food uses

Soy oil	**Whole beans**	**Protein products**
Refined soy oil	*Full fat soy flour*	*Soy protein concentrates or isolates*
Coffee creamers	Bread	Baby food
Cooking oils	Confectionery	Bakery ingredients
Salad oils	Doughnuts	Confectionery
Margarine/spreads	Frozen desserts	Cereals
Mayonnaise	Instant milk drinks	Diet foods
Sandwich spreads	Pancake flour	Food drinks
Shortenings	Pie crusts	Meat products
Ready meals		Noodles
	Roasted soybeans	Prepared mixes
Lecithin (emulsifier)	Confectionery	Sausage casings
Bread & bakery products	Crackers	Yeast
Confectionery	Dietary	Beer
Chocolate		Ready meals
Ready meals	*Derivatives*	
	Soy milk	
	Miso	
	Tempeh	
	Tofu	
	Baked	
	Cooked from frozen	

3.1 EU trade and usage of soybeans and derivatives

The EU 27 imported, in 2006, 14.85 million tonnes of soybeans, with the annual crush being 14.34 million tonnes (Table 7). This produced 2.7 million tonnes of soy oil and 11.34 million tonnes of soymeal.

Table 7: EU 27 soybean and main derivative use 2006-07 (million tonnes)

	Beans	Oil	Meal
Domestic production (or crush for oil and including from imported beans)	1.28	2.70	11.34
Imports	14.85	1.14	24.60
Domestic use	16.02	3.51	35.24
Exports	0.06	0.28	0.69

Source: derived from Oil World

Notes: Domestic use for beans = 14.85 m tonnes crushed plus balance used as whole beans

In terms of origins, the primary sources of supply were:

- For beans[21]: Brazil and the USA, which accounted for 62% and 24% respectively of total imports;
- For oil: about three quarters of the oil used in the EU derives from (imported) beans crushed in the EU. Of the oil imported, two thirds was from Brazil and 13% from Argentina;
- For meal, about a third is derived meal derived from imported beans crushed in the EU, with the balance imported. Of the direct imports, 62% was from Argentina and 37% from Brazil.

3.2 GM or certified conventional sources of supply

In 2006, GM plantings accounted for 61.5% of the global area planted to soybeans, dominating production in the leading soybean and derivative exporting nations of the world (89% of the US soybean area, 98% of the Argentine area, 55% of the Brazilian area, 85% of Paraguay's area and 100% of the soybean area in Uruguay).

Looking at the extent to which these leading GM soybean producing countries are traders (exporters) of soybeans and key derivatives, Table 8 and Table 9 show that in 2006/07, 30% of global soybean production was exported and 98.4% of this trade came from countries which grow GM soybeans. As there has been some development of a market for certified conventional soybeans and derivatives (mostly in the EU, Japan and South Korea), this has necessitated some segregation of exports into GM versus conventional supplies or sourcing from countries that do not use GM HT soybeans. Based on estimates of the size of the certified conventional soy markets in the EU and SE Asia (the main markets), about 5%-7% of global trade in soybeans is required to be certified as conventional, and if it is assumed that this volume of soybeans traded is segregated from GM soybeans, then the GM share of global trade is 91%-94%. A similar pattern occurs in soymeal where about 82%-83% of globally traded meal probably contains GM material.

Table 8: Share of global crop trade accounted for GM production 2006/7 (million tonnes)

	Soybeans	**Maize**	**Cotton**	**Canola**
Global production	235	703	26.5	46.41
Global trade (exports)	70	90.5	9.7	6.98
Share of global trade from GM producers	68.9 (98.4%)	70.0 (77%)	5.51 (57%)	5.72 (82%)
Estimated size of market requiring certified conventional (in countries that have import requirements)	4-5	Less than 1.0	Negligible	Less than 1
Estimated share of global trade that may contain GM (ie, not required to be segregated)	63.9-66.0	70	5.51	5.72
Share of global trade that may be GM	91%-94%	77%	57%	82%

Sources: derived from and updated - USDA & Oil World statistics, Brookes et al (2005)
Notes: Estimated size of conventional market for soybeans (based primarily on demand for derivatives used mostly in the food industry): EU 4 million tonnes bean equivalents, Japan and South Korea 0.2-0.3 million tonnes

[21] The relative importance of different origins varies by year depending on factors such as availability of supplies for export and price. Thus in 2007/08, the volume of imports from the US is expected to fall relative to 2006/07

Table 9: Share of global crop derivative (meal) trade accounted for GM production 2006/7 (million tonnes)

	Soymeal	Cottonseed meal	Canola/rape meal
Global production	156	19.8	27.3
Global trade (exports)	54.7	0.51	2.94
Share of global trade from GM producers	48.38 (88%)	0.14 (27%)	1.66 (56%)
Estimated size of market requiring certified conventional (in countries that have import requirements)	3-3.5	Negligible	Negligible
Estimated share of global trade that may contain GM (ie, not required to be segregated)	44.88-45.38	0.14	1.66
Share of global trade that may be GM	82-83%	27%	56%

Sources: derived from and updated - USDA & Oil World statistics, Brookes et al (2005)
Notes: Estimated size of certified conventional market for soymeal: EU 3 million tonnes, Japan and South Korea 0.1-0.5 million tonnes (derived largely from soybeans referred to in above table)

Focusing on the EU, the demand for certified conventional supplies of soybeans and derivatives has been concentrated in the human food sector, where soy-based derivatives are used in a wide range of food products; often at fairly low (less than 1%) incorporation rates. Some parts in the livestock production sectors, in some member states, have also required the use of certified conventional soy oil and meal in livestock rations (notably the fresh poultry and egg sectors). Overall, the current proportion of total soybean and derivative use in the EU required to be certified as conventional is probably about 10%.

3.3 Soy oil

3.3.1 Use of soy oil

During the crushing process of soybeans, oil is extracted by solvent extraction, and then may be subject to degumming and refining to separate the oil from other derivatives such as lecithin (see section 3.4), and glycerol (from which further processing may occur to produce sterols and fatty acids).

The refined oil has a wide range of uses in the food sector (Table 6). It is used as an ingredient in a range of products such as battering or breading of snacks, fish or vegetables, as cooking oil, in crackers, margarine, mayonnaise, crisps, salad dressings, sauces, shortenings (bakery fats), soups, stocks and taco shells. Usage levels in final products range from 100% when sold as a cooking oil or shortening, through 40% to 80% in margarines and 'yellow' spreads, down to traces when used as a carrier for flavouring materials or as an anti dust agent.

Soy oil is also widely used by the animal feed sector and in numerous industrial sectors (for technical uses including in disinfectants, fungicides, paints, cosmetics, putty, soap, detergents, vinyl plastics, wallboard, protective coatings, inks). Use in the bio-fuels sector has also become increasingly popular.

3.3.2 Size of market and origins

As indicated in section 3.1, the EU 27 used about 3.5 million tonnes of crude soy oil in 2006/07. Within this, about 1.1 million tonnes was used by the EU food industry (in a refined form). Of the balance, about 0.3 million tonnes were used for non food (technical) uses (eg, paints), 0.8 million tonnes in animal feed and the balance for bio-fuels.

The vast majority of the supplies used by the food and feed sectors derive from EU crushed soybeans, with the imports mainly supplying the bio-fuels sector.

3.3.3 GM or conventional sources of supply

As indicated in section 3.2, most of the demand for certified conventional soybeans and derivatives comes from the EU food industry. In relation to soy oil, about 0.3 million tonnes of total usage of refined soy oil is required to be certified as having been derived from conventional soybeans. Hence, a considerable volume of soy oil use is not required to be certified as conventional.

3.3.4 What competes with soy oil?

Soy oil faces competition from other oils in all markets where it is utilised. This means that the relative competitive position of soy oil with other oils can play an important role in influencing usage, especially where used in lower value segments of markets such as yellow fats/margarine and as a cooking oil.

Potential use of oils is also largely dependent on the characteristics of the constituent fatty acids, hence there is not complete substitutability between oils. There are also differences in taste and shelf life. Nevertheless, many products can re-formulated to use different types of oil highlighting the significant level of ingredient substitutability that exists between oils.

3.4 Lecithin

As indicated above, considerable volumes of soybeans and derivatives (notably soymeal) are imported into the EU. In addition, numerous derivatives may potentially be present in finished products imported from third countries for direct consumption, albeit in many cases at low levels of inclusion in recipes and/or in relatively small traded volumes.

3.4.1 What is lecithin?

Lecithin is a derivative of soybeans and is derived from soy oil after crushing. It is separated from crude (soy) oil at, what is known as the degumming stage when soy oil is separated into degummed soy oil and 'wet gums'. The wet gums are then subject to drying to produce a crude fluid lecithin. Crude lecithin is then subject to blending and addition of fatty acids in order to reduce its viscosity. The resulting product is known as standard or fluid lecithin. This product can be further refined by removing the oil to leave a granular or powder lecithin (known as deoiled or pure lecithin). It is legally classified as an 'additive'.

Standard (or fluid) lecithin comprises a mixture of phospholipids and is not soluble in water. Its production requires only physical operations (eg, use of centrifuges and degumming) which aim to extract the lecithin contained in the original seed. Standard lecithin can also be refined, fractionated or modified to different degrees according to intended end-use. For example, it can be made more water-dispersible by enzymic hydrolysis or alcohol fractionation and thus become suitable for a wide range of applications (still classified as the additive lecithin with its 'E' number E322). The alcohol-soluble and insoluble fractions act as oil-in-water or water-in-oil emulsifiers, respectively.

3.4.2 Use of lecithin

Lecithin use is dominated by the food industry, which accounts for about 60%-70% of total usage, followed by animal feed (about 20%-30% of total usage) and the balance used in pharmaceuticals and other non food applications. Its primary use is as an emulsifier in chocolate, ice-cream, margarine and mayonnaise and is also finding increased applications in ready meals and meat products:

- In ***chocolate***, it helps reduce the viscosity of molten chocolate during processing, so improving its fluidity and enabling thinner, and better-defined, coatings and chocolate bars. It prevents crystals forming when chocolate is stored at elevated temperatures ('blooming') and helps chocolate set where water is present (eg, chocolate-coated ice creams);

- It stabilises the fat and water emulsions in ***margarine and fat spreads***, improving spreadability. It also prevents water leakage, avoiding spitting, when frying. Plain lecithin is used in spreads containing >80% fat; hydrolysed lecithin when the fat content is between 60% – 80%; it tends to be replaced by E471 in spreads with less than 60% fat;

- In ***bread and bakery products***, it improves the crumb structure and contributes anti-staling properties, thereby extending shelf life. Soy lecithin has similar binding properties to egg yolk lecithin and is used to replace eggs in many products;

- It is used in '***instantised' powder*** mixes to enable them to disperse quickly and easily in milk or water.

Lecithin also acts as a synergist to antioxidants in fats and oils, and is often used in combination with them, e.g. to protect beta-carotene (Vitamin A). It is also sold in limited quantities through health food outlets.

3.4.3 Size of market and origins

The global market for lecithin is estimated to be between 200,000 tonnes and 235,000 tonnes, of which the EU 25 accounts for about 26%-37% of the total volume of use (60,000 to 75,000 tonnes). The majority of this EU use is in the food industry (45,000-55,000 tonnes).

Commercial lecithin is primarily derived from soybeans, with about 95% of the global market being derived from soybeans. Other sources of (generally lesser quality material) can also be obtained from rapeseed, maize, sunflower and peanuts. Global production from these sources is, however very limited. For example annual global production of lecithin from sunflower and rapeseed oil are about 2,000 tonnes and 5,000 tonnes respectively. Very limited, and expensive, alternatives can also be obtained from egg yolk (almost entirely for pharmaceutical use), and, in theory, from animal (brain) fat (in practice unacceptable due to BSE).

The EU market is dominated by soy lecithin (95% plus of total usage), with the requirement coming from a mix of lecithin derived from soybeans imported and crushed in the EU and imports of crude lecithin. The majority of EU soy lecithin use (80-85%) is derived from imports of crude lecithin (ie, from soybeans crushed in the country of soybean production origin) with the balance (15%-20% derived from EU crushed soybeans). The main non soy-based lecithin used is derived from sunflower oil (EU origin sunflowers crushed in the EU, notably Hungary).

3.4.4 GM or conventional sources of supply

The majority of food manufacturers initiated GM avoidance policies in the late 1990s and, as such introduced requirements for all lecithin used as a food ingredient/additive to be sourced from certified conventional sources of supply. Hence, the majority of lecithin used in the EU is derived from certified conventional sources of supply[22] (Table 10).

Table 10: Global and EU lecithin market

	Tonnes
Annual global production & usage	180,000-220,000
EU usage	60,000-75,000
EU requirement to be certified conventional	46,500-57,000
Equivalent volume of soybeans required to be certified as conventional	9.3-11.4 million tonnes

Notes: EU conventional requirement based on 100% of food usage plus 10% of feed usage

Looking at the origins of the lecithin, the vast majority derives from Brazilian grown soybeans, of which, as indicated above, 80%-85% derives from soybeans crushed in Brazil and imported into the EU as certified conventional crude lecithin. There are also some limited imports of certified conventional crude lecithin from the US and India. The balance of use in the EU come from imported (mostly Brazilian) certified conventional soybeans crushed in the EU.

[22] 90%-95% of which is from certified conventional soy and the balance from other crop origins of which sunflower lecithin is main alternative

3.4.5 What competes with lecithin?

Lecithin is the only 'natural' emulsifier used in the food industry although it technically competes with synthetic emulsifiers (eg, mono and di-glycerides). From a technical and economic perspective there is a reasonably high degree of substitutability, however, on the demand side, substitutability is limited – mainly on quality grounds. Most users in the food and feed sectors tend to be reluctant to replace lecithin with synthetic emulsifiers in most applications for the following reasons:

- Reluctance to incur the costs, the resulting uncertainty and time of adaptation that would arise from modifying recipes;
- Lecithin has functions aside from its role as an emulsifier. For example, it can affect flavour, taste and quality of a product;
- It is a natural product and this adds positively from a product marketing perspective (relative to a synthetic product);
- Its incorporation levels are typically low (0.3% to 0.5% in chocolate, dairy and instantised products) and hence accounts for less than 1% of production costs (see example products below).

This reluctance to change is borne out from examination of historic trends in use of emulsifiers in the EU, where lecithin is reported[23] to account for 20%-25% of the European emulsifier market, a level that has remained fairly constant for a number of years, even though the latter part of the 1990s was a period when most EU food manufacturers initiated GM avoidance policies for their food ingredients and introduced requirements to use only certified conventional sources of soy-based lecithin and ended up having to pay significant price premia for these supplies relative to the alternative, non certified (as conventional) sources of soy-based lecithin – see section 3.5.

3.5 Prices and cost implication of using certified conventional soy oil & lecithin

In the early years of GM avoidance policies operated by the EU food industry, the price differentials between GM and certified conventional soybeans were anywhere between 2% and 10% (certified conventional prices being higher than GM soybean prices) depending upon the year, season and specific requirement (notably whether a requirement was for the certified conventional status to be to the 0.9% labelling threshold or to a more stringent threshold for a maximum level of adventitious presence of 0.1% for GM material). For most food industry users in the EU, the requirement for a maximum accepted level for adventitious presence of GM material was the more stringent 0.1%; hence the typical price differentials paid by the food industry for certified conventional soybeans was in the +7% to +10% range. In terms of soy oil, the price differentials have typically been in the 15% to 25% range (certified conventional soy oil prices being higher than soy oil derived from uncertified soybeans that may be GM). For lecithin, certified conventional soy lecithin has typically traded at a premium of 60% to 90% of the price of soy lecithin that may have been derived from GM soybeans.

The cost implications of maintaining a GM avoidance policy by EU food manufacturers varied (and continues to vary) according to product recipes (eg, margarine, where 60% of raw material costs are accounted for by vegetable oils or chocolate coated biscuits where soy lecithin usage is no more than about 0.5% of total raw material costs)[24].

[23] Source: Frost and Sullivan European Food Emulsifier Markets 2004
[24] See for example, Brookes, Craddock and Kniel (2005) The global GM market: implications for the European food chain. www.pgeconomics.co.uk for additional examples

The key point to note about the cost of implementing a GM avoidance policy[25] for most food products has been that where the soy-based ingredients incorporation rates have been low (eg, confectionery, bakery products, crisps, ready meals, pizzas, etc) the additional raw material costs of switching away from GM derived to certified conventional raw materials has been relatively small when compared with total raw material costs. This has been the case even when the price differential between GM derived and certified conventional derived ingredients such as lecithin have been significant (between +50% and +100%). However, for other products with higher incorporation rates (eg, margarine) the switch away from GM-derived products has added significantly (+16%) to raw material costs. In 2005/06 Brookes, Craddock & Kniel estimated that at an EU level this policy was adding possibly as much as €85 million to the annual raw material costs to the sector[26].

More recently the price differentials between GM derived and certified conventional soybeans have widened relative to the differentials discussed above (Tables 11-13). For example, in the first half of the current marketing year the price differential between GM and certified conventional soybeans widened threefold from about 5% to 17%. The price differential for soy oil has remained in a range of +€35 to +€70/tonne and the price differential for soy lecithin has been in a range of about +50% to +100%.

Table 11: Recent prices of soybeans (€/tonne)

	Soybeans: general Fob Brazil	Certified conventional	Differential %
2005/06	187	196	+4.8
2006/07	213	221	+3.8
2007/08 (5 months to Dec 2007)	301	352	+16.9

Sources: based on USDA, Oil World and industry

Table 12: Recent prices of soy oil (€/tonne)

	Soyoil: general cif Rotterdam	Certified conventional	Differential %
2005/06	573	646	+12.7
2006/07	590	624	+10.6
2007/08 (5 months to Dec 2007)	822	858	+4.4

Sources: based on USDA, Oil World and industry

Table 13: Recent prices of crude soy lecithin (€/tonne)

	Crude soy lecithin ex factory EU	Certified conventional	Differential %
2005/06	540	853	+58
2007/08 (5 months to Dec 2007)	600	1,100-1,200	+83 to +100

Source: based on industry

25 This excludes consideration of the impact on overhead costs. Additional overhead costs such diversions of staff time, employing additional dedicated staff, establishing and maintaining systems to deliver traceability and identity preservation, testing, fees for auditing and verification of IP systems etc occur and vary widely according to size of business, complexity of products and even customer portfolio. These cost are difficult to quantity but are likely to have been significantly higher than the raw material cost implications referred to above

26 Based on EU 15 margarine production of 2.19 million tonnes and an assumed 70% of this covered by a GM avoidance policy

3.6 Potential impact of LLP of a not yet EU approved GMO trait being found in supplies of soy oil or lecithin used by the EU food industry

This section examines the potential impact on the soy oil and lecithin manufacturing and using sectors if LLP of a not yet EU authorised GMO event were to be found in supplies. The analysis presents a scenario for these soy derivative using sectors that is similar to that recently experienced by the EU rice milling and using sectors.

An important point to note is that the analysis presented below covers two soy derivatives only and could equally apply to all of the other soy derivatives used in the food chain.

3.6.1 The soy oil & lecithin supply chain

The nature of the supply chain for soy oil & lecithin supplied to the EU food industry will have an important influence on how the presence of a not yet EU approved GM event in supplies may impact on the EU food (soy derivative-using) industry. Of relevance are the following points:

- The EU food industry obtains its supplies of soy oil and lecithin from a fairly small number of suppliers. These comprise a combination of EU-based crushers and importers with EU crushers dominating the supply of soy oil to the food industry and importers dominating the supply of lecithin. Some of the importers of crude lecithin are also companies with soybean crushing operations in leading soybean producing countries, notably Brazil;

- Where the derivatives are typically used at very low levels of incorporation (typically at or below 0.5%), the volumes used at the food manufacturer level are also fairly small. Supplies are typically made in drums containing 200 kg or containers of 1 tonne (for lecithin). At the import level, supplies of crude lecithin are typically supplied in tanks containing 16-20 tonnes/tank, although some traders also import in larger bulk containers. Similarly for soy oil, the volumes supplied can vary according to use, with typical loads being 28 tonnes, although large users of soy oil and/or traders/suppliers of cooking oils to the food service sector may buy in larger volumes;

- The scope for detecting and finding the presence of GM material in certified conventional soy derivatives diminishes the more processed the derivative. The relevant GMO DNA/protein becomes broken down in the process of crushing soybeans and therefore the chances of detecting GMO protein/DNA tends to be less in soy oil than soybeans. The additional screening and processing involved in the manufacture of crude lecithin (and onto refined lecithin, including deoiled lecithin) further reduces the chances of GMO DNA/protein being found in supplies. In crude lecithin it is possible that GMO DNA/protein could be found in a sample of certified conventional lecithin at very low levels although in the case of refined lecithin, it is extremely unlikely that even the most sophisticated testing equipment would be able to detect presence[27];

- Testing of certified conventional supplies tends to be undertaken by crushers and manufacturers of derivatives like lecithin. Importers/suppliers of lecithin to the EU food industry also undertake testing (the lecithin suppliers effectively guarantee food industry customers that their lecithin supplies do not and will not contain the presence of GM material).

3.6.2 Impact of an isolated incident of low level presence of a not yet EU approved GMO

The chances of LLP of a not yet EU approved GMO event being found in supplies of soybeans and/or soy-based derivates entering the EU market are widely foreseen as a possibility in the coming years. In 2007 the US authorities approved the planting of second generation GM herbicide tolerant soybeans from three biotechnology companies. Seed containing these traits is expected to be commercially available to US soybean farmers in 2009 (for the 2009 crop) and to South American soybean farmers in 2010.

[27] EU GMO legislation is not restricted to detectability. Even if a GMO is not detectable, a full traceability system has to be shown to operate so that EU labelling rules are complied with

Although commercial planting of seed containing these traits will not occur until 2009, the seed multiplication sector/seed companies are multiplying up seed for this commercial launch in 2008 and trade sources suggest a seed crop of up to 50,000 hectares containing these traits in the US will be harvested in 2008. As such, it is highly likely that traces of these traits will be commonplace in supplies of soybeans and derivatives from the US in the autumn of 2008, and in 2010 (possibly 2009), from South America[28].

Against this background, what are the possibilities for, and impact of traces of a not yet EU approved GM event being found in supplies of soy derivatives destined for use in the EU food sector in the coming few years?
Drawing on experiences both with the rice example, and supplies of maize and maize derivatives (notably maize gluten feed) from the US to the feed sector, that could not be guaranteed to be 100% free of the presence of not yet EU approved GMO maize traits, it is highly likely that similar difficulties will arise for the EU soybean crushing sector in 2008 due to the seed crops being harvested in the US. These difficulties will also extend to supplies of soybeans to EU crushers from South America in 2010 (possibly as early as 2009) and to import suppliers of soy derivatives like soy oil and lecithin sourcing from South America.

All users of soy derivatives in the food (and feed) sectors will be faced with increased risk of incidence of LLP of not yet EU approved GMOs being found in supplies of raw materials[29]. The probability of traces of not yet EU approved GM events being found in supplies of soybeans and derivatives used in the EU food sector will vary according to where users are in the supply chain and how processed the soy derivative is before usage:

- The sectors at greatest risk are those closest to the primary product of soybeans, namely the crushing sector, especially where supplies come via the ‘commodity’ based trading system that dominates the supply of most oilseeds and grains, including the supply of soybeans for crushing in the EU;
- Levels of risk are probably slightly less where supplies of (certified conventional) soybeans come to crushers via an identity preserved system because testing (for the not yet EU approved GM traits) will have probably have been undertaken more times than in a commodity based supply system. In addition, the requirements of the identity preservation system should reduce the likelihood of co-mingling of beans from different origins relative to a commodity based system;
- The possibilities of finding trace levels of a not yet EU approved GM soy trait are then likely to decrease as additional stages of processing occur and as additional operators in the supply chain become involved. Thus, the chances of finding trace levels of any unwanted GMO event (EU approved or not yet EU approved) tend to be lower in soy oil than the raw soybeans and lower in crude lecithin than soy oil, simply because the GM DNA/protein is broken down further and screened out as further processing occurs. Also, more importantly, testing typically occurs at each stage of processing; at the stages of (post) soy oil extraction and after production of a derivative such as crude lecithin or soy isolate/protein concentrate (to provide EU importers/buyers in the EU with the required certification for freedom from GM material (including not yet EU approved events)). Where certified conventional soy derivatives (eg, lecithin) are imported, importers also tend to conduct some (random) testing of supplies as an additional check in the system. Thus, in the case of identity preserved supplies of soy lecithin, testing is undertaken on the seeds prior to planting by farmers, of the beans prior to crushing and typically after oil extraction and on crude lecithin after production. This process is likely to identify and facilitate the screening out of not yet EU approved GM soybean events before imported derivative products enter the EU. It nevertheless remains possible that some such not yet EU approved material may enter the crushing phase and subsequently be detected in soy oil and possibly even in crude lecithin imports.

[28] Given the history of adoption of first generation GM soybeans in South America, it is probable that some farmers will obtain second generation seed and plant in 2009, even if their governments have not formally approved the traits for planting in 2009

[29] Assuming that EU approval for importation and use of the relevant second generation GM HT soybean traits had not been granted

If found by an exporter of soy oil or lecithin manufacturer in Brazil
In this case, the oil or lecithin would not be exported to the EU (if identified prior to shipment) and channelled to markets/customers outside the EU where there is either no requirement for soy oil or lecithin to be certified conventional or to markets/customers where a practical and workable threshold for the adventitious (trace) presence of GM material operates. If positive test results showing traces of a not yet EU approved GMO event were found after shipment of soy oil or crude lecithin to the EU, customers (largely EU importers) would be notified and the product recalled.

If found by an EU soybean crusher/manufacturer of soy oil or lecithin
It is possible that testing of soybean imports (eg, by official inspection authorities at port of import) or of soymeal/oil extracted in the EU might identify trace presence of a not yet EU approved GMO event. Where this occurred in respect of beans or derivatives that had been crushed in the EU, it may arise after the end product (oil, meal or even lecithin) had been delivered to customers. In this circumstance, recall action would have to be initiated and costs incurred. The 'affected' parcel of product could be significant, eg, product derived from a 40,000 tonne batch of soybeans, if the test sample was taken at the end of a batch and the time between sample testing and results was two weeks. For soy oil, this could affect about 7,200 tonnes of oil[30] or in the case of lecithin this could result in a production batch of 200 tonnes of crude lecithin being affected. In such a circumstance, the crusher/supplier of oil/lecithin would inform customers about the supply of the illegal product. The expected response would be for customers to hold the oil/lecithin supplier legally responsible for any damages incurred, the crusher/supplier of oil/lecithin would, in turn, hold its supplier of certified conventional soybeans legally responsible (or supplier of soybeans that may be GM but only of EU approved traits). The end user customers in the food manufacturing or catering sectors would then have to identify if this oil/lecithin had been incorporated in final products and supplied onto retail outlets/food service companies and end consumers. The worst case scenario would therefore be a requirement to recall cooking oils or food products that utilised a batch of illegal/not yet EU approved soy oil or lecithin that was derived from soybeans containing traces of the not yet EU approved GMO event. The nature of the actions and possible costs are discussed further below (see 'if found by an EU food manufacturer').

A more probable occurrence would, however, be that one positive test result for a not yet EU approved GMO in an import shipment of soybeans (or oil) entering the EU (by official authority controls) would trigger a wave of additional official testing of soybeans/oil (and meal[31]) entering the EU together with additional testing and checking of supplies of derivatives by crushers and manufacturers of soy derivatives. Drawing on the rice case study, it is therefore likely that additional import shipments would be found to contain traces of a not yet EU approved event.

If found by a soy oil or lecithin importer in the EU
Currently, if levels of GM material are found in soy oil or lecithin (or any imported certified conventional soy or derivatives) above the labelling threshold of 0.9%, such supplies tend to be channelled to customers/markets where there is no requirement for certified conventional products. These are essentially found in the animal feed and technical use (non food) sectors (eg, tanning/leather, paint) plus bio-diesel. However, in the event of traces of a not yet EU approved GMO being found in imported soy oil or lecithin it would no longer be possible to supply this oil or lecithin to customers in the food or feed chains. The oil or lecithin would typically be returned to import suppliers with a request for replacement with guaranteed no traces of any not yet EU approved GMO. This could be relatively straightforward for importers of lecithin, who import in 16-20 tonne tanks of product but could be more problematic for the larger, bulk importers of lecithin and for most importers of soy oil. These (bulk) importers would be faced with similar problems experienced in the rice sector since August 2006. For discussion of the possible impact if supplies of oil or lecithin with an EU unapproved event had already been supplied to customers see below 'if found by an EU manufacturer'.

[30] This could be higher if the oil was mixed with other oil processed from other batches
[31] Imported primarily for use in the feed sector

If found by an EU food manufacturer
The series of tests, screening and operation of identity preserved supply chains for the production of certified conventional soybeans and derivatives that currently operate should minimise the chances of traces of a not yet EU approved GMO event in supplies of secondary processed soy derivatives such as lecithin reaching EU food manufacturers. Nevertheless, as indicated above, a possibility remains that a positive test result for the presence of a not yet EU approved GMO being found in lecithin (or any soy derivative) supplies arriving at an EU food manufacturer could occur - more likely to have arisen via a positive test result for the presence of a not yet EU approved GMO being found in a sample of soybeans imported into the EU for crushing, after the crushing and derivative extraction phase had taken place. For food product manufacturers and food service businesses using soy oil, the risks of finding or being informed by suppliers that raw materials supplied contain traces of a not yet EU approved GMO event are much higher.

Notification (from a supplier of oil or lecithin) that a batch of oil or lecithin supplied had been derived from a load of soybeans containing traces of a not yet EU approved GMO event would result in the following action being undertaken:

- Identification of whether the ‘illegal’ batch of oil or lecithin is in any stocks of oil or lecithin awaiting use/incorporation into products such as margarine, salad dressings, mayonnaise, margarine, shortenings, chocolate, biscuits and other foods, in any products currently in the process of manufacture, in stocks of finished products or in products already supplied to customers in the food retail and food service sectors;

- Isolate and remove all relevant soy oil or lecithin stocks and finished products derived from the ‘illegal’ oil or lecithin and arrange for destruction of the products;

- Notify customers in the retail and food service sectors that products supplied were manufactured from soy oil or lecithin derived from soybeans containing traces of a not yet EU approved GMO event, and that these products should be recalled and returned to the (food manufacturing) supplier;

- Inform the supplier that it (the supplier) will be legally held responsible for any actions and costs incurred in dealing with the recall. Assurances would also be sought from soy oil and lecithin suppliers that future supplies would be guaranteed to not have come from soybeans that contained traces of any not yet EU approved event or seek alternative supplies from other sources that can provide this certification guarantee.

As in the rice case study presented in section 2, the extent to which actions would need to be taken and the associated time, costs and impact will vary according to a number of factors:

- *Product withdrawal*. The volumes of products withdrawn from the market (and associated time and costs involved) would vary according to the volumes of ‘affected’ product already manufactured and supplied to customers. In the case of lecithin, batches of refined lecithin supplied to food manufacturers are typically supplied in one tonne containers or possibly 200 kg drums. Given average incorporation rates of refined lecithin in products such as chocolate, biscuits and confectionery are 0.5% (in the range of 0.2% to 1%), the volumes of end product affected (per single positive test for an EU unapproved GMO) could be in the range of 40 to 200 tonnes (the smaller the incorporation rate, the greater the possible affected volume of end product, eg, if the incorporation rate was 0.25%, the affected end product volume would be 80 to 400 tonnes of end product)[32]. In the case of soy oil, where incorporation levels are similarly low, affected end product volumes are likely to be similar (because batches supplied are likely to be in similar volume containers).

[32]The worst case scenario would be if a 40,000 tonne shipment of soybeans was affected - this equates to 200 tonnes of lecithin which could be in up to 40,000 tonnes of end product

Where incorporation rates are higher, the volumes of product affected could (paradoxically) potentially be greater because the volumes/batches supplied tend to be significant[33]. Clearly the direct costs associated with product withdrawal/recall will vary according to the volumes involved together with costs of collection, transport, warehousing/storage, handling and destruction;

- *Replacement of supplies*. In the short term of one-two months, the scope for continuing to produce food products will depend on how quickly suppliers can re-supply products like soy oil or refined lecithin with the necessary guarantees that it is free from the presence of not yet EU approved GMO events. In the case of a derivative like soy lecithin, as there is a low initial probability of import supplies being found to contain or be derived from (import) sources that do contain traces of not yet EU approved GMO events, it is probable that supplies (mainly from importers of lecithin rather than from EU crushers of soybeans) are unlikely to be significantly disrupted. The scope for obtaining future supplies certified as not having been derived from soybeans with trace levels of not yet EU approved GMO events from EU crushers may be more problematic (see above), necessitating some switching of supplies away from this source to importers of crude lecithin. In the case of soy oil, there are likely to be significant problems with getting the necessary guarantees from EU crushers of imported soybeans simply because of the difficulties in ensuring zero presence of a not yet EU approved trait in bulk import shipments of soybeans for crushing. As in the case of both rice and what may happen regarding the supplies of lecithin from EU crushed soybeans, the short term response will likely be a switch to importing more soy oil. Alternatively, for some users, a switch to using rapeseed oil may be possible (depending on its impact on product functionality);

- *Possible differentiated impact at member state level*. The experiences of the LL601 rice case show how the responses of different member state authorities may impact on the actions and costs involved. If a member state authority requires testing of supplies through the food chain and permits sale of finished products for which no positive test results arise, the impact will be much less than requiring immediate withdrawal of all possible products that may have been derived from soybean raw materials containing trace levels of not yet EU approved GMO events and/or the temporary closure of food processing facilities (as for example occurred in respect of rice milling for a period in some countries, eg, France);

- *Legal costs and claims*. Legal cases could arise issues such as breach of contract/non supply, cost of testing and disposal or return, legal costs of preparing case against suppliers and contractual 'fines' for having to withdraw/recall products or failure to subsequently supply products in accordance with contracts. There might also be legal claims from consumers who had eaten products containing 'illegal ingredients'. The level and cost of these issues will also vary according to the number of customers involved and the volumes of product affected;

- *Adverse impact on brands and product/company image*. Food company (and retailer own label) brands of processed foods, confectionery, biscuits and chocolate will potentially be damaged, as general reputations/goodwill may be negatively impacted. This may result in short term losses of sales and profits. There may also be costs associated with having to cancel promotional and marketing activities (eg, having to pay for advertising space reserved but not used, preparation of marketing material no longer used). Assessing the impact of this category of possible impact/cost is difficult because any assessment requires making assumptions about levels of sales that might otherwise have occurred;

- *Staff time*. Dealing with the issues of checking, testing, contacting customers and suppliers, recalls, etc will inevitably require considerable input of staff time (including senior management) that would otherwise have been utilised on business activities that aim to develop sales, profits and development of business;

[33] If volumes/batches of oil supplied were the same as for derivatives like lecithin, clearly the end product volumes would be lower because of the higher incorporation rates

- *Loss of sales and profits*. Disruption to both the supply of soy oil or lecithin raw materials and sale of products containing soy oil or lecithin, as well as the additional costs referred to above could be significant (and will vary by company);

- *Financial charges*. Where companies incur loss of sales, profits and additional costs associated with dealing with LLP of not yet EU approved GMO events this may necessitate requesting additional borrowing facilities from banks. These may be granted on less favourable terms (eg, higher interest rates) than existing borrowing. Also if compensation claims are made against insurance policies the subsequent premiums for renewal may be higher than if no claims had been made (ie, loss of a no claims bonus);

Table 14 provide summaries of likely costs associated with a single incidence of a not yet EU approved GMO being found in a batch of lecithin supplied that might be incurred by food manufacturers and the supply chain in terms of lost sales, lost profits and product destruction costs. Clearly the costs are directly linked to the volumes of end product affected/batch size of lecithin supplied. Thus, for a small food manufacturer affected by produce derived by one small container of illegal lecithin, the costs in terms of immediate lost sales, profits and destruction costs are between €66,000 and €118,000. When the volumes affected increase up to 200 tonnes of lecithin (the volume derived from a typical 40,000 tonne shipment of soybean) the costs are a thousand times higher at €66 million to €118 million.

Table 14: Loss of sales, gross margin & destruction costs arising from a single incident of not yet EU approved GMO LLP in lecithin supplies

	200 kg drum of lecithin	1 tonne container lecithin	200 tonnes of lecithin (40,000 tonne load of beans)
Volume of end product affected (tonnes)	40	200	40,000
Cost of raw materials in end product (€/tonne)	1,000-2,000	1,000-2,000	1,000-2,000
Sales value (ex-factory) of affected product ('000 euros)	52-104	260-520	52,000-104,000
Gross margin ('000 euros)	12-24	60-120	12,000-24,000
Raw material value lost ('000 euros)	40-80	200-400	40,000-80,000
Destruction costs ('000 euros)	14	70	14,000

Notes: 1. Assumed incorporation rate of lecithin 0.5%, 2. Cost of raw material based on a range of bakery, chocolate & confectionery products, 3. Assumed to be 30% to cover overheads and profit, Destruction cost estimated at 350 euros/tonne

These costs are, nevertheless, are only part of the total costs likely to be incurred by the food industry dealing with an incident of finding a not yet EU approved GMO in the supply chain. Thus, Table 15 provides an estimate of other costs of dealing with an isolated incidence of LLP for a not yet EU approved GMO event in supplies of soybeans from which lecithin was extracted and used. This adds between €0.32 million and €0.76 million per food manufacturer affected.

Table 15: Other costs arising from an isolated incident of LLP not yet approved GMO soybean in lecithin supplies

Category of cost	Value (Euros: '000s)	Comments
Testing/re-testing	5-15 per company	Based on initiation of complete re-testing along an identity preserved supply chain for one 10-20,000 tonne 'base' soybean load
Legal cost	20-100 per company	For dealing with customer legal cases bought against companies and issuing claims against suppliers – based experience in the rice sector
Adverse impact on brands/company reputation	Very difficult to estimate – depends on many factors and assumptions on loss of sales	Withdrawal of advertising and promotional activities, loss of placement/listing fees paid for produce not subsequently supplied, payment of withdrawal/penalties, loss of market share (lost in short term and not subsequently regained)
Financial charges	200-400 per company	Payment of higher interest rates on borrowing, higher insurance renewal premiums – based on experience in the rice sector
Staff time	100-250 per company	
Total	**325-765**	

Drawing on the experience from the rice sector it is evident that more than one company would be affected. There are many food manufacturing businesses in the EU that use lecithin as a raw material (both large and small) and therefore a significant number could be affected by a single incident. For example, if 50 small lecithin users were affected (one 200 kg drum of lecithin 'affected' each, or 10 tonnes of lecithin in total) then the total cost of dealing with an isolated incident would be between €19.5 million and €44 million. If, however, the products that had used the lecithin derived from a full shipment of crushed soybeans had to be withdrawn from the market, the costs would be (again assuming the 200 tonnes of lecithin from one shipment was spread across 50 food companies[34]) would be between €82 million and €156 million.

In the case of soy oil use in the food chain, the impacts and costs of dealing with an isolated incident would be similar. The main difference to the lecithin example above would be the range and number of food companies affected would probably be wider, especially as important volumes of soy oil are utilised in the food service sector across the EU.

3.6.3 Knock-on effects: post isolated incident of LLP of a not yet EU approved GMO

After an incident of trace levels of a not yet EU approved soybean GMO event being found in the EU soy oil and lecithin supply chains, there are knock on effects that would affect the food sector. This sub-section briefly examines these possibilities.

a) Systematic testing of supplies

As in the rice example, it can be expected that the advent of one positive test for the presence of a not yet EU approved GMO in supplies of (probably) soybeans entering the EU for crushing would trigger systematic testing of all shipments of soybeans, oil and meal entering the EU by national authorities from that date. Risk management systems in the food industry would probably also be reviewed by many companies operating in the soybean/derivative supply chain and additional testing introduced.

[34] Clearly larger food company users of lecithin

The key point to note from this (again drawing on the experience in the rice sector) is that additional positive test results for the presence of a not yet EU approved trait would most likely arise for some shipments of soybeans (and/or key derivatives like oil and meal), especially as several boat loads of 40,000-50,000 tonnes of soybeans are typically entering EU ports for crushing per month. This means that the cost estimates presented in section 3.6.2 could be replicated per incident and, should (as occurred in the rice sector) this occur, it is not unreasonable to foresee these costs increasing four/fivefold (ie, the costs are incurred by a wider range of soy oil and lecithin users in the food chain), potentially pushing the total costs up to between €328 million and €780 million.

b) Disruption to supplies of soy oil and lecithin

In order to minimise disruption to supplies of soy derivative raw materials used in the food industry, suppliers of soy oil and lecithin (post first incidence of a not yet EU approved GMO being found in the supply chain) would ask suppliers to guarantee that future supplies will be 100% free from presence of not yet EU approved GMOs.

In the lecithin supply chain, where the chance of finding presence of a not yet EU approved GMO is lowest (relative to soy oil or soybeans), this may initially be possible (because the current supply chain is dominated by the use of identity preserved systems in which screening and testing of material is carried out several times at various points in the supply chain and should, therefore minimise the chances of illegal material going undetected by the time crude lecithin is manufactured). The most vulnerable part of the supply chain initially is probably where soy lecithin is extracted from soybeans imported into the EU for crushing, especially when the soybean supplies originate in the US (which will be the first soybean growing country to commercially plant second generation GM HT soybeans). Where parts of the EU food industry currently source lecithin from this origin of supply it would initially be more difficult for EU-based crushers to provide guarantees concerning the zero presence of a not yet EU approved GM HT soy trait in raw materials that have been used to extract lecithin than would probably be the case for importers of crude lecithin sourced from certified conventional soybeans crushed in Brazil. Therefore this will probably lead to some switching of sourcing by some soy-lecithin using food companies in the EU away from EU crushers to importers of crude lecithin (using certified conventional supplies from Brazil, or other origins such as India or China[35]). By 2010 (possibly as early as 2009) this option in respect of Brazil may also become problematic, leaving a search for supplies from countries such as India and China. Whilst there is a lack of data on the share of the certified conventional soy lecithin used by the EU food industry that derives from imported lecithin compared to lecithin derived from certified conventional soybeans crushed in the EU, if the share of the total EU lecithin market accounted for by EU produced lecithin is used ((15%-20%), then the maximum annual volume initially affected is 6,750 to 11,000 tonnes of crude lecithin. Given global production and capacity levels it is likely that this volume of additional imported supplies could be forthcoming from origins such as Brazil, India and China in the next year or two. From 2009/2010, however, the potential volumes affected could be larger and extend to all EU current supplies of lecithin, if incidents in the presence of not yet EU approved GMOs in soybeans from which lecithin is manufactured arise in Brazil. The prospect of disruption to supplies of lecithin therefore exists mostly from 2009/10.

In the case of soy oil, disruption to supplies is, however, more likely to occur as early as the autumn of 2008 because:

- The majority of supplies used in the EU food sector (including food service sector) derive from EU crushed soybeans, of which the US is an important supplier. EU crushers may be able to initially switch to crushing more soybeans from South America (subject to availability – primary availability being post harvest which is six months after harvest in the Northern hemisphere) but this option may begin to prove problematic from 2009/10 (2010 harvest in South America) once farmers in these countries begin to access second generation GM HT soybean traits[36].

[35] Where GM HT soybeans are not currently commercially planted

[36] Global trade in soybeans from countries where farmers probably won't begin to access second generation GM HT traits by 2010 (ie, it is assumed that those in the US, Argentina, Brazil, Uruguay, Paraguay, Paraguay and South Africa will begin to access) accounted for only 1.6% of global trade in soybeans in 2006/07 (1.1 million tonnes). This compares with EU imports of 14.84 million tonnes in 2006/07

Also, the global nature of trade in grains and oilseeds means that vessels shipping soybeans from South America to the EU in 2008/09 may have previously been used to ship US origin soybeans to export markets and may, therefore, retain trace levels (eg, in dust) of not yet EU approved GMO soy traits when used to transport soybeans from South America to the EU;

- The volumes affected are significantly larger than for lecithin. The EU food industry uses annually about 1.1 million tonnes of soy oil. As in the lecithin example, the EU market could turn increasingly to imports of soy oil. Initially this may be possible, although in the context of world production/trade of soy oil, EU food sector use is equal to about 10% of global trade in soy oil. Any significant move by the EU into the global soy oil market would therefore cause significant disruption to this market and could result in price rises for soy oil on world markets (see below). Alternatively, the EU food sector might turn to using additional volumes of certified conventional rapeseed oil or other conventional oils. Any significant move into other oils would also cause disruption to these markets and could lead to price increases (see c) and e) below).

c) Impact on prices of soy oil, lecithin and other oils

An increase in the short term demand for imported soy lecithin as indicated in b) above (ie, assuming that lecithin production from EU crushed soybeans might initially stop due to the difficulties in guaranteeing freedom from not yet EU approved GMO events) is equal to between 3% and 5% of global production levels and would, therefore, probably lead to an increase in the price of certified conventional lecithin. Whilst it is not possible to predict how the price might change in this hypothetical scenario, a short term price increase of 25%-35% is possible in a distinct and limited market of this nature, resulting in the price of certified conventional crude lecithin increasing to about 1,375-1,620 euros/tonne (compared to 1,100-1,200 euros/tonne at present). On a volume of 6,750-11,000 tonnes of crude lecithin, the additional cost is therefore between 1.85 million euros and 4.62 million euros[37]. If this higher price level continued for a number of months, this would affect all users of lecithin when re-stocking. The additional cost for a year's usage of certified conventional soy lecithin (on 45,000-55,000 tonnes) at this level of price increase is between 12.4 and 23.1 million euros.

It is reasonable to assume that the world price of soy oil might rise if the EU food sector had to look increasingly to world markets for alternative supplies. If it was initially assumed that only the oil derived from US origin soybeans crushed in the EU had to be replaced by imports this would equate to about 0.64 million tonnes (based on 2006/07 import volumes), or about 6% of global soy oil trade of oil. Based on 2007/08 estimates of lower US origin imports, the impact would, however, be less. Nevertheless, in a fairly price sensitive market like soy oil (as applies to all oils), this could lead to short term rises in the world price of soy oil. In the longer term, as the risk increases of LLP of not yet EU approved GM soybean traits being found in supplies from South America entering the EU for crushing increases (2009/2010), the volumes of soy oil affected would rise. Replacing the full 1.1 million tonnes of soy oil currently used annually by the EU food sector is equal to 10% of global trade in soy oil and would cause important disruption to this market. It is clearly difficult to estimate what might happen to the price of soy oil in this scenario, especially given its high degree of substitutability for, and competition with, other oils. For illustrative purposes, a 10% increase in price would add +€82/tonne to the price of soy oil (+€86/tonne for certified non GM/conventional), resulting in an increase in food sector raw material costs of 91 million[38]. If the price of soy oil rose by 30%, the increase in raw material costs would be +€275 million.

Similarly, if some (or all) of the EU food industry's soy oil use was replaced by additional use of alternative oils, this would likely impact negatively on the price of these oils relative to soy oil prices. For example, the average premium of EU conventional rapeseed oil over certified conventional soy oil for the period 2005/06 to 2007/08[39]was €106/tonne and the average premium over the same period relative to uncertified soy oil was €154/tonne.

[37] If this higher price were to remain in the global market for several months without falling back to pre- incident prices, this would also affect the cost of replenishing stock of lecithin for all EU food manufacturers using soy lecithin

[38] Calculated on the basis of 0.3 million tonnes of certified conventional soy oil and 0.8 million tonnes of other soy oil being replaced

[39] First five months of 2007/08

If all of the 1.1 million tonnes of EU food sector soy oil was replaced by rapeseed oil, this would add €155 million to EU food industry raw material costs[40]. This illustrative cost estimate is, however, probably conservative given the likely upward pressure on rapeseed oil prices that would arise if the EU food sector sought to replace significant volumes of soy oil with rapeseed oil.

d) Impact on consumers

At the consumer price level, the initial impact of finding a not yet EU approved GMO in supplies of soy oil and lecithin used in many food products is likely to be limited. At the product level, the increases in price referred to c) above would have only a minor effect on the total cost of raw materials used in most foodstuffs that use soy oil or lecithin. For example, for a product like a biscuit, the additional cost of changing supplies of lecithin and soy oil (or alternative) would add no more than 1% to raw material costs. In the short term this level of increase in raw material costs is unlikely to be passed on down the supply chain in the form of higher prices to consumers but absorbed by the supply chain. For a product with a relatively high incorporation rate of soy oil, however this level of raw material price increase is more significant. For example some of the lower quality spreads and margarines sold could have incorporation levels for soy oil of between 25% and 60%. An increase in the cost of this raw material (eg, 10%-20%) would add between 2.5% and 12% to total raw material costs. Where total raw material cost increases are significant, this is unlikely to be absorbed by the product manufacturer and either passed on to customers in the form of higher prices or alternative raw materials sought (see e) below).

At the product availability/choice level, it is possible that in the immediate aftermath of a product withdrawal, some consumers might find a short term unavailability of a specific product (as occurred in the rice example). In the longer term, however, availability and choice of products is likely to be a more serious issue with possible significant impact, once all of the mainstream global supplying countries of soybeans begin to adopt the second generation of GM HT soybeans and the EU food sector has to seek alternative raw materials (see e) below). This could begin to impact from 2010.

e) Possible search for and use of alternatives

One avenue open to a food sector faced with increased incidence of not yet EU approved GMOs being found in supplies of soy oil and lecithin (apart from looking for alternative supplies of soy oil and lecithin, as discussed above) is to switch ingredient use away from soy in favour of other oils.

There is limited scope for substituting away from lecithin to alternative (synthetic) emulsifiers. The main alternative that may be explored is a switch away from soy-based lecithin to an alternative (natural) lecithin that derives from oilseeds for which no GM traits are currently utilised (or expected in the next few years); the main one of which is sunflower lecithin. Currently, sunflower lecithin is used by some food manufacturers in the EU, although volumes used are small by comparison with soy lecithin. The more limited use of sunflower lecithin largely reflects a combination of reasons including lower levels of production capacity/supply, less functionality relative to soy lecithin for some products (eg, sunflower lecithin performs poorly compared to soy lecithin in terms of anti spattering in margarines) and a higher price than soy lecithin. For example, sunflower lecithin currently trades at prices of about €1,800-2,000/tonne, which is +63% to +67% relative to certified conventional soy lecithin. Clearly as a short term alternative to replacing any shortfall in certified conventional soy lecithin from EU crushed soybeans, a switching to sunflower lecithin may be a route taken by some operators in the food sector (dependant on availability and functionality) but the cost would probably be higher than seeking alternative supplies of certified conventional soy lecithin. In the longer term (2010), the likely difficulties that may well occur in obtaining supplies of certified conventional soy lecithin that can be guaranteed to have not been derived from soybeans containing even trace levels of not yet EU approved GMOs, may result in this alternative being further pursued. However, the current global production capacity of sunflower lecithin is inadequate to meet any significant increase in demand that might arise from the EU food sector and would require additional investment in processing facilities by sunflower crushers. It is possible that additional production capacity might become available if sunflower crushers perceive this increase in demand to be consistent and long term. However, functionality issues suggest that this alternative is not realistic for all food sector users.

[40] Calculated on the basis of 0.3 million tonnes of certified conventional soy oil and 0.8 million tonnes of other soy oil being replaced

In relation to soy oil, there is a relatively high degree of substitutability between oils used in the food industry. For some products, where soy oil is specifically used for functionality reasons, a switch is more difficult than in the case of use which is primarily driven by price reasons (as is the case in the majority of uses, notably cooking oils and lower value spreads). Therefore there could be a significant shift away from use of soy oil by the EU food sector and into alternative oils like rapeseed oil. The extent to which changes may occur will depend on availability and price.

As the volumes affected in relation to soy oil are much larger than soy lecithin, it is likely that the impact of the EU food (and feed) sector(s) looking to replace important volumes of soy oil with alternatives (which is possible from 2009/2010), will result in price rises for competing oils. On the basis that the EU food sector uses 1.1 million tonnes of soy oil per year and significant disruption to these supplies may occur by 2009/2010, this is equal to between 26% of global sunflower oil trade, 54% of global rapeseed oil trade and 4% of global palm oil trade. It is therefore reasonable to assume that there would be upward pressure on prices in (traditionally price sensitive) world markets for these oils (see c) above, especially relating to rapeseed oil.

f) Other soy derivative using sectors in the food industry

The analysis presented in the sub-sections above relate to two soy derivatives only. The implications of finding LLP of not yet EU approved GMOs in the soybean and derivative supply chain do, however, go much wider than this. There are numerous soy derivatives used in the EU food sector, each of which would be faced with the same problems, issues, actions and costs outlined above. Consequently, the cost estimates represented (€82 million to €156 million) for dealing with a single incidence of not yet EU approved GMO LLP in the soy lecithin and soy oil supply chains are likely to be replicated across a number of soy derivative using sub sectors. Taking a conservative perspective and looking only at the broad categories of soy and soy derivative used in the food sector (whole beans, refined soy oil, the category of whole soy derivatives such as tofu, soy milk and miso etc, full fat soy flour, soy lecithin, and edible soy protein concentrates/isolates), this suggests that the cost of dealing with a <u>single incidence</u> of not yet EU approved GMO LLP in soybean supplies across all soy using parts of the EU food sector could be between €492 million and €936 million.

3.7 Conclusions from the soy derivative case study

The main conclusions that can be drawn from the soybean derivative case study are:

- The operation of a zero tolerance threshold for the presence of GMO traits not yet EU approved, coupled with the asynchronous nature of the EU's GMO approval process is likely to cause significant disruption to the EU soybean and derivative processing and user sectors (notably the EU food industry). First incidence of disruption can reasonably be expected in late 2008 and can then be expected to get progressively worse during 2009, potentially causing significant problems by 2010;

- The most vulnerable part of the supply chain is likely to be (initially) the EU soybean crushing sector, which currently uses a significant volume of US origin soybeans for crushing. Drawing on the experiences of the rice sector and with supplies of maize derivatives (notably maize gluten) from the US in 2007/08, that could not be guaranteed to be 100% free of the presence of GMO traits not yet EU approved, it is probable that similar difficulties will arise for the EU soybean crushing sector;

- Initially (2008/09) EU crushers may look to switch sources of supply (of soybeans) away from the US to other origins (notably in South America) but once soybean farmers in these countries begin to access second generation GM HT traits, this alternative will potentially be as problematic as using US origin soybeans (likely to begin in 2009/10 and increasing into 2010/11). Also, the global nature of trade in grains and oilseeds means that vessels shipping soybeans from South America to the EU in 2008/09 may have previously been used to ship US origin soybeans to export markets and may therefore retain trace levels (eg, in dust) of not yet EU approved GMO soy traits when used to transport soybeans from South America to the EU;

- Faced with difficulties in guaranteeing that supplies are 100% free from the presence of GMOs not yet approved in the EU, this may result in short/medium term inactivity in the crushing sector as crushers see little option but to shut down processing facilities. This will have a negative impact on income and employment generation in the sector;

- All users of soy derivatives in the food (and feed) sector(s) will be faced with increased risk of incidence of LLP of GMOs not yet EU approved being found in supplies of soy-based raw materials. Initially, users of first derivative products like soy oil (especially if derived from EU crushed beans imported from the US) probably have the highest risk, with the levels of risk being less for users of secondary processed derivatives like soy lecithin, especially where the bulk of supplies currently come from certified conventional soybeans supplied through an identity preserved supply chain;

- The increased risks result in legal uncertainty for businesses (eg, possibilities of legal actions being bought, fines imposed, etc). This has a negative impact on business confidence, re-enforcing the negative economic impacts;

- Whilst the cost of dealing with a single incident of not yet EU approved GMO LLP will vary by sector and company, the cost in one sub-sector of the food chain (eg, lecithin users) is likely to be between €82 million and €156 million. Given there are many uses of soybeans and derivatives, these costs can reasonably be expected to replicated across several user sectors, pushing the cost up to between €492 million and €936 million;

- Drawing on the experience of the rice sector, a first identified positive test for not yet EU approved GMO LLP in supplies of soybeans entering the EU will likely trigger systematic testing of all import shipments and additional positive tests can be expected. This suggests a wider range of businesses will be affected than in the case of a single incident, resulting in additional costs. The total cost of dealing with several incidents of not yet EU approved GMO LLP could therefore rise to between €1 billion and €2.8 billion[41];

- Following an incident of not yet EU approved GMO LLP being found in supplies of raw materials, it is likely that some food sector businesses will look (initially) increasingly to replace soy derivatives derived from EU crushed soybeans (that could be from the US) with additional imports of the derivatives (as in the case of lecithin). This will probably result in upward pressure on the prices of these products adding further to the costs incurred by the EU food sector;

- In the long term, the combination of costs incurred by the food sector (which adversely affects profitability) and probable increased import dependence will have a negative impact on future income and employment generation in the sector. As in the rice sector, those at greatest risk will be small and medium sized businesses that make up the majority of the EU food sector;

[41] Based on two to three 40,000 tonne shipments being affected from which derivatives were supplied and used by all of the six soy using sub-sectors in the food industry

- At the consumer level, the initial impact of finding LLP of a not yet EU approved GMO in supplies of soy derivatives used in many food products is likely to be limited. At the product availability/choice level, it is possible that in the immediate aftermath of a product withdrawal, some consumers might find a short term (limited) unavailability of a specific product (as occurred in the rice example). The low incorporation rates of soy derivatives in many food products means that even if the cost of finding replacement supplies is higher, such additional costs are likely to be absorbed by the supply chain rather than passed on to the end consumer. Where soy derivative ingredient incorporation is higher (eg, cooking oils, some yellow fat spreads), it may result in these being passed onto consumers in the form of higher prices;

- In the longer term, availability and choice of products for consumers could become more problematic once all of the mainstream global supplying countries of soybeans begin to adopt the second generation of GM HT soybeans and the EU food sector has to seek alternative raw materials. This could affect consumers from 2010;

- One avenue open to a food sector faced with increased incidence of LLP of not yet EU approved GMOs being found in supplies of soy derivatives is to consider switching ingredient use away from soy in favour of other oils and derivatives. This policy was initiated by some businesses in the late 1990s when GM avoidance policies were first adopted and therefore may be extended in the face of new problems associated with LLP of not yet EU approved GMOs. The scope for switching will depend upon the functionality of the alternative and its impact on attributes such as taste, texture, appearance and shelf life, price and availability. Where soy derivatives are mostly utilised for price reasons, substitution will be relatively easier than where the soy derivative has a product-specific functionality role. Thus it is likely to be relatively more straightforward to replace soy oil with alternatives than soy lecithin;

- The impact of the EU food (and feed) sector(s) looking to replace important volumes of derivatives like soy oil with alternatives (which is possible from 2009/2010), is likely to result in price rises for competing oils. The main source of alternative oil that might first be looked at to take up any significant demand from the EU is probably rapeseed oil. At recent price premia of rapeseed oil relative to both certified conventional soy oil and uncertified soy oil, replacement of 1.1 million tonnes of soy oil would add €155 million to the raw material costs of the EU food sector. A major move into rapeseed oil and away from soy oil by the EU food sector would, however, create upward pressure on the world and EU price of rapeseed oil. Thus, realistically the price premia of rapeseed oil relative to certified conventional soy oil would probably widen, adding further to raw material costs of the EU food industry (ie, making the €155 million costs referred to above look conservative);

- Third country suppliers of agricultural raw materials to the EU may become unwilling to supply products because of increased risks of cargo refusal or legal disputes.

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