



Primary Food Processing

Cornerstone of plant-based food production and the bio-economy in Europe

Katja Logatcheva and Michiel van Galen

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This report describes the supply chains and special characteristics of plant-based primary food processors; producers of (wheat) flour, starches, vegetable oils and fats, sugar, and cocoa. The production value, direct employment in the industry, and indirect employment in farming were calculated. The significance of the plant-based primary food processing industry in terms of production value and share in the total food processing industry in the EU was estimated, and threats and opportunities were identified on the basis of desk research and interviews with PFP member organisations and companies.

Dit rapport beschrijft de ketens en de speciale karakteristieken van primaire verwerkers van plantaardige agrarische grondstoffen; producenten van (tarwe)meel, zetmeel, plantaardige oliën en vetten, plantaardige eiwitten, suiker en cacao. De omzet, directe werkgelegenheid in de industrie en indirecte werkgelegenheid in de landbouw zijn berekend. Ook is het belang van de primaire verwerkers van plantaardige agrarische grondstoffen in termen van productiewaarde en als percentage van de omzet van de totale voedselverwerkende industrie in de EU ingeschat. Op basis van deskstudie en interviews met vertegenwoordigers van bij PFP aangesloten brancheorganisaties en bedrijven zijn kansen en bedreigingen voor de sectoren in kaart gebracht.

Key words: primary food processing, sugar, cocoa, grains, flour, oilseeds, starch, vegetable oils and fats

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Cover photo: Primary Food Processors (PFP)

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Summary

S.1 Key findings

EU plant-based primary food processing, defined for the purpose of this study as those industries associated in PFP (Primary Food Processors, the association for the plant-based European primary food processing industry), produced €66bn of output in 2013. Primary food processors process large amounts of agricultural inputs into standardised ingredients for food, feed, fuel and a range of other bio-based products. In total, primary food processing accounts for about 8% of the production value of the food processing industry (Figure S.1 below). Despite the economic recession in Europe, the primary food processing industry has seen an increase in production value. **See > Chapter 4**

Plant-based primary food processing, as defined in this study, includes the manufacturing of vegetable oils, vegetable proteins, grain mill products, starches, sugar, and cocoa. About 4,000 companies are involved in industrial primary processing of agricultural commodities such as oilseeds, cereals, starch potatoes, sugar beet, and cocoa beans. Most of these are active in the processing of (wheat) flour. The number of companies has been decreasing as competition leads to consolidation to benefit from scale efficiencies. In the sugar industry, a major reform of the Common Agricultural Policy in 2006 has significantly reduced the number of companies in the past decade. **See > Paragraph 2.1**

EU primary food processors employ over 120,000 people directly. The employment of almost a million in EU agriculture can be indirectly linked to the presence of the primary food processing industry in the EU. On top of that, there is indirect employment in agriculture outside the EU and in other supplying industries and trade. **See > Chapter 3**

The unique position of the primary food processing industry puts it at the centre of a number of major developments that will shape the future of not only the industry itself, but also the future of agriculture and the European bio-economy as whole. As a key link in the supply chain, the primary food industry collects and processes inputs from a huge amount of farmers as efficiently as possible. The industry takes a major role in securing food availability and safety, as well as rural development and farm incomes. Furthermore, it is a key driving force behind the development of new bio-based industries, increasing sustainability of the European economy as a whole. **See > Paragraph 6.1**

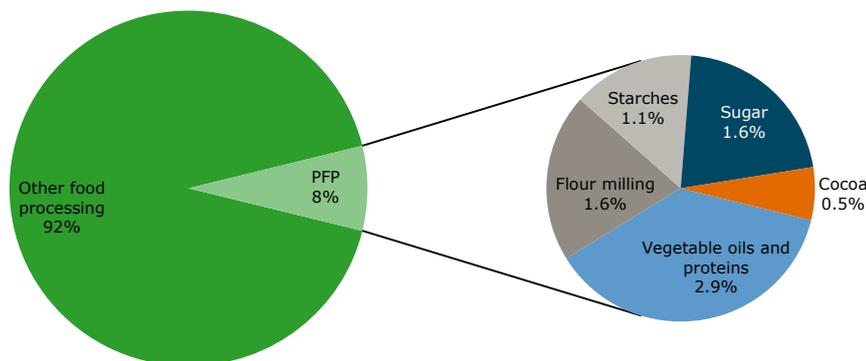


Figure S.1 Division of production value of food manufacturing and primary food processing, in 2013, in %

Source: Eurostat PRODCOM and Eurostat SBS

S.2 Complementary results

Plant-based primary food processors traditionally produce a limited number of basic food ingredients. However, the primary food processing industry in general, and processors of starches, vegetable oils & vegetable proteins, and cocoa in particular, have increased the number of product varieties and markets greatly, making these industries into real innovators and R&D performers. **See > Chapter 5**

Primary food processors have a higher investment rate than the food industry as a whole and total manufacturing. Some of the larger companies in primary food processing belong to the EU's top R&D performers. Patents are widely used to protect innovations. **See > Chapter 5**

Opportunities exist in a number of areas, the key ones being: **See > Paragraph 6.2**

1. Further development of new markets, especially those in the bio-economy. Primary food processors already have a major role in the innovation processes that take place in light a shift towards a bio-based economy.
2. World population growth and economic development will hugely increase demand for food, feed and fuel. Catering to this demand is a huge challenge and opportunity for the primary food processing industry.
3. Access to raw material inputs and access to end markets is a key competitive advantage. In light of increasing world demand, these assets should be further secured and improved through enhancing productivity at farm level with a focus on reducing environmental footprint. Increasing agricultural yields in Europe, securing supply from overseas and investments in efficient transport, storage and processing facilities is an opportunity to secure the future competitive position of the industry.

A number of threats were identified. Primary food processors face increasing global competition, partly caused by an un-level playing field as a result of (past and proposed future) trade liberalisation (subsidised competition) and EU food policy issues. Price volatility and climate change increase risks and uncertainty. Fragmentation of product flows and consequent loss of efficiency caused by increased pressure to introduce certifiable schemes are also seen as a threat by the industry. **See > Paragraph 6.3**

S.3 Method

This study was commissioned by Primary Food Processors (PFP) in Brussels and answers three main research questions: 1) What is the contribution of the primary food processing industries to the whole of the food and drink industry, and to the whole of the European economy, 2) What specific role do the primary food processing industries play in the food value chain, and 3) What factors will impact the future of the primary food processing industry in the EU?

The study is based on qualitative and quantitative analysis. The data in the report are based on industry reports, public databases (such as Eurostat) and a number of interviews with representatives of PFP member associations and companies. These interviews were used to validate the data presented in the report and collect additional (qualitative) information. Given the availability of data and the limited time available for data collection and analysis - apart from figures on the numbers of companies, employment and production values - Eurostat Structural Business Statistics which are compiled at a somewhat higher level of aggregation are used. These data include some secondary processing and smaller non-industrial companies in specific industry codes, which are strictly speaking not part of PFP. More specific disaggregated data from PRODCOM about the production value of manufactured products was used to calculate the production value of the industry. The indirect labour effects were calculated using Eurostat statistics on labour force and land use, and FAOSTAT statistics on yields. **See > Paragraph 1.2**

Samenvatting

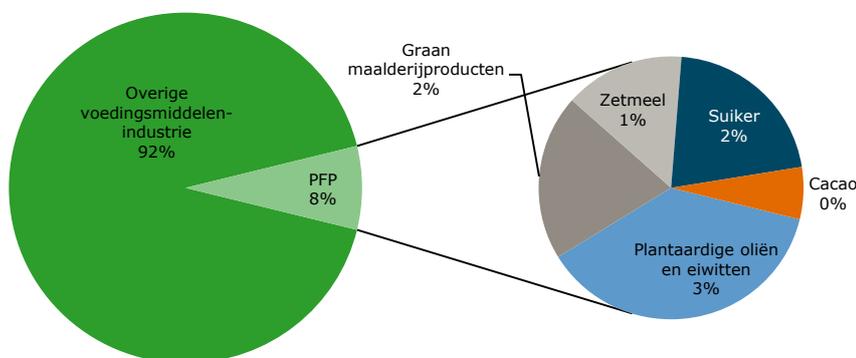
S.1 Belangrijkste uitkomsten

Primaire verwerkers van plantaardige grondstoffen, gedefinieerd als de branches die in PFP ('Primary Food Processors', associatie van de Europese primaire verwerkers van plantaardige agrarische grondstoffen) zijn georganiseerd, in de EU hadden een gezamenlijke productiewaarde van €66 miljard in 2013. Primaire verwerkers verwerken grote hoeveelheden grondstoffen en maken daarvan gestandaardiseerde ingrediënten voor toepassingen in voedingsmiddelen, diervoeders, biobrandstoffen en andere biobased producten. Primaire verwerkers van plantaardige agrarische grondstoffen zijn goed voor 8% van de productiewaarde van EU voedingsmiddelenindustrie (figuur S.1). Ondanks de recessie van de voorbije jaren is de productiewaarde van de primaire verwerkers gestegen, op suiker na. **Zie > Hoofdstuk 4**

Primaire verwerking van plantaardige agrarische grondstoffen (zoals gedefinieerd in dit rapport) betreft de productie van plantaardige oliën en vetten, plantaardige eiwitten, (graan) maalderijproducten, zetmeel, suiker en cacao. In de EU zijn ongeveer 4.000 bedrijven actief in de (industriële) primaire verwerking van plantaardige agrarische grondstoffen; het grootste deel graanmaalderijen. Het aantal bedrijven is de afgelopen jaren gedaald. Consolidatie vindt plaats door concurrentie en benutting van schaalvoordelen. In de suikerindustrie heeft een grote daling van het aantal bedrijven en verwerkingslocaties plaatsgevonden als gevolg van de hervorming van de Gemeenschappelijke Marktordening voor suiker in 2006. **Zie > Paragraaf 2.1**

Er werken meer dan 120.000 mensen in de primaire verwerking. Werkgelegenheid voor bijna een miljoen mensen in de primaire landbouw in de EU kan worden gerelateerd aan de aanwezigheid van de primaire verwerkingsindustrie. Daarnaast is er een indirecte werkgelegenheid voor boeren buiten de EU en andere toeleveranciers en handelaren binnen en buiten de EU. **Zie > Hoofdstuk 3**

Primaire verwerkers hebben te maken met een aantal belangrijke ontwikkelingen die niet alleen bepalend zijn voor de toekomst van de industrie, maar de toekomst van de Europese landbouw en de biobased economy. Als belangrijke schakel in de keten verzamelt en bewerkt de primaire industrie zo efficiënt mogelijk grondstoffen. Zij heeft een sleutelrol in het bewaken van voedselzekerheid en voedselveiligheid in de EU en draagt bij aan de instandhouding en ontwikkeling van het platteland en de inkomens van boeren. De industrie is een drijvende kracht achter de biobased economy, waarmee de duurzaamheid van de gehele Europese economie wordt versterkt. **Zie > Paragraaf 6.1**



Figuur S.1 Verdeling van de productiewaarde van de voedingsmiddelenindustrie en de primaire verwerking van agrarische grondstoffen (PFP), in 2013, in %
Source: Eurostat PRODCOM and Eurostat SBS.

S.2 Aanvullende resultaten

Primaire verwerkers van plantaardige agrarische grondstoffen produceerden van oudsher een beperkt aantal basisingrediënten voor voedingsmiddelen. De afgelopen jaren is echter de aandacht van de primaire verwerkers in het algemeen, en van de verwerkers van zetmeel, suikers, plantaardige oliën & eiwitten, en cacao, in het bijzonder, steeds meer gericht op product innovatie, waarmee deze industrieën steeds R&D intensiever zijn geworden. **Zie > Hoofdstuk 5**

Primaire verwerkers hebben een hogere investeringsquote dan de voedingsmiddelenindustrie en de maakindustrie als geheel. Enkele van de grotere bedrijven in de primaire verwerking behoren tot de EU-top in termen van R&D. Patenten worden veelvuldig gebruikt. **Zie > Hoofdstuk 5**

Kansen zijn er op een aantal terreinen. De belangrijkste zijn: **Zie > Paragraaf 6.2**

1. verdere ontwikkeling van nieuwe markten, in het bijzonder in de biobased economy. Primaire verwerkers hebben al een grote rol in de innovatieprocessen die plaatsvinden in de biobased economy.
2. wereldwijde bevolkingsgroei en economische ontwikkeling zal de vraag naar voedsel, diervoeder en brandstoffen aanzienlijk doen stijgen. Om aan deze vraag tegemoet te komen is een grote uitdaging en een grote kans voor de primaire verwerkers van (plantaardige) agrarische grondstoffen.
3. toegang tot grondstoffen en toegang tot eindmarkten is een belangrijke bron van concurrentiekracht. In het licht van de toenemende vraag naar grondstoffen en eindproducten is het van groot belang dat deze concurrentievoordelen worden beschermd en uitgebouwd. Het verbeteren van gewasopbrengsten in Europa en tegelijkertijd reduceren van de milieubelasting, veiligstellen van aanbod van buiten de EU en investeringen in efficiënte transport, opslag en verwerkingscapaciteit zijn een kans om de toekomstige concurrentiekracht van de primaire verwerkers in de EU te waarborgen.

Er zijn ook bedreigingen. De concurrentiekracht van primaire verwerkers staat onder druk door toenemende internationale concurrentie, gedeeltelijk als gevolg van handelsverdragen die kunnen leiden tot oneerlijke concurrentie (gesubsidieerde concurrentie), en kosten als gevolg van Voedselbeleid van de EU. Prijs volatiliteit en klimaatverandering verhogen risico's en onzekerheid. Fragmentatie van de productstromen en daarmee gepaard gaande efficiëntie verlies, als gevolg van toegenomen druk van afnemers om verschillende duurzaamheids certificeringen in te voeren wordt door de industrie ook als een bedreiging ervaren. **Zie > Paragraaf 6.3**

S.3 Methode

Deze studie is uitgevoerd in opdracht van 'Primary Food Processors' (PFP) in Brussel en geeft antwoord op een drie hoofdvragen: 1) Wat is de bijdrage van de primaire verwerkers aan de levensmiddelenindustrie en aan de Europese economie als geheel, 2) welke specifieke rol spelen de primaire verwerkers in de voedingsmiddelen keten, 3) welke factoren bepalen de toekomst van de primaire verwerkingsindustrie in de EU?

De studie is uitgevoerd op basis van kwalitatieve en kwantitatieve analyse. De data komen uit (sector)rapporten, publieke databanken (zoals Eurostat) en een aantal interviews met vertegenwoordigers van PFP en de aangesloten organisaties en bedrijven. Deze interviews zijn gebruikt om de data te valideren en additionele kwalitatieve informatie te verzamelen. Vanwege beperkingen aan de beschikbare data en tijd die voor dit onderzoek beschikbaar was, is – behalve voor gegevens over het aantal bedrijven, werkgelegenheid en productiewaarde – gebruik gemaakt van Eurostat data op een iets hoger geaggregeerd niveau waarin ook een deel secundaire verwerking en kleinere bedrijven zijn meegenomen die strikt genomen niet tot PFP behoren. Voor de berekening van de productiewaarde zijn gedesaggregeerde gegevens van Eurostat PRODCOM gebruikt. De indirecte werkgelegenheid in de landbouw zijn berekend op basis van Eurostat 'Labour force' en 'Land use' statistieken en FAOSTAT-data over gewasopbrengsten. **Zie > Paragraaf 1.2**

1 Introduction

1.1 Research questions

Primary food processing has not always been given the specific attention of policy makers that it may deserve given its key role in the food supply chain. For plant-based primary food processors it is important to showcase the industry's vital importance in the European food supply chain, its importance for the creation and preservation of jobs in Europe, and its specific needs to strengthen the industry's competitiveness. In this context it is vital to show the contribution of primary food processing to the economic wealth of the food and drink industry as a whole and our economies in general, as well as its contribution to job growth and improvements in sustainable food production.

Primary food processing is an economic activity within the food supply chain, which focuses on first-stage processing of agricultural raw materials. Plant-based primary food processors (associated in PFP, the association for the European primary food processing industry) take in plant-based agricultural raw materials and convert them into ingredients of consistent and defined quality for use by consumers, secondary food manufacturers, compound feed manufacturers and industrial users. First-stage processing generally involves transformation of or extraction of different components from the raw material – preventing in certain cases its deterioration – for use as ingredients for food, feed or bio-based products. During secondary processing, the outputs of the primary food processing industry are further processed into a wide range of processed foods and other products. In this study, we focus on those primary processing industries that are part of PFP, which are primary processors dealing with vegetable raw materials as opposed to dairy or meat processors.

The study is focused on three research questions: 1) What is the contribution of the primary food processing industries to the whole of the food and drink industry, and to the whole of the European economy, 2) What specific role do the primary food processing industries play in the food value chain, and 3) What factors will impact the future of the primary food processing industry in the EU?

1.2 Data and method

The study involves both qualitative and quantitative analysis of six individual value chains of PFP: a) vegetable oils, b) vegetable proteins, c) grain mill products, d) starches, e) sugar, and f) cocoa. The basic processing of these products is the primary scope of activity of the members of PFP. The data in the report is based on industry reports, public databases (such as Eurostat and FAOSTAT) and a number of interviews with representatives of PFP member associations and companies. These interviews were used to validate the data presented in the report and collect qualitative information about, for example, opportunities and threats to the industry. Secondary data needed for the quantitative analysis are collected from public statistical data sources and PFP member associations and companies.

Given the availability of data and the limited time available for data collection and analysis, we used the following general categories from the NACE classification for data from Eurostat Structural Business Statistics and more specific disaggregated data from PRODCOM about the production value of manufactured products. The indirect labour effects were calculated on the basis of the amount of raw material intake from the EU and EU productivity and employment figures. The basis for these data is Eurostat statistics on labour input (Labour force: number of persons and farm work (AWU) by type of farming (2-digit) and economic size of farm (SO in euros) [ef_olfftecs]), land use (Land use: number of farms and areas of different crops by type of farming (2-digit) [ef_oluft]) and yields (FAOSTAT). We supplemented these sources with data from PFP members and data obtained from a short desk study.

Table 1.1*Data included in the study*

Eurostat Structural Business Statistics (NACE Rev. 2)	Eurostat PRODCOM	PFM industry data
C1041 Manufacture of oils and fats	PRODCOM: 1041.21, .22, .24- .30, .41, .51-.59, .71	FEDIOL, EUVEPRO
C1061 Manufacture of grain mill products	PRODCOM: 1061.	European Flour Millers
C1062 Manufacture of starches and starch products	PRODCOM: 1062.	Starch Europe
C1081 Manufacture of sugar	PRODCOM: 1081.11, .12, .13, .14, .20	CEFS
C1082 Manufacture of cocoa, chocolate and sugar confectionery	PRODCOM: 1082.11, .12, .13, .14	ECA Grinding statistics.





2 Short overview of plant-based primary food processing supply chains

Primary food processing is an economic activity within food supply chains, which focuses on first-stage processing of agricultural raw materials. First stage processing is transformation of or extraction of different components from the raw material for use as food or feed or ingredients for further processing; during secondary processing, the products of primary food processing are further processed into a wide range of processed foods. This chapter describes the supply chains associated with primary food processing. We start with an overview of the number of firms in each of the primary food processing value chains. After that, each individual value chain is briefly described.

2.1 Primary food processing: number of firms

According to industry reports, European primary food processing – defined as those industries that are part of the PFP association, excluding e.g. dairy and meat processing – is comprised of about 4,000 companies (source: PFP member associations). About 95% of the companies represented by PFP are active in wheat flour milling (see Table 2.1). The companies associated in PFP represent by far the largest part of turnover in their respective industry branches. However, there is in addition an unknown number of mostly small companies that are in some way involved in primary food processing activities, such as small-scale artisan millers and bakeries and chocolate makers. Eurostat reports larger numbers of companies in each industry, as their figures include those small-scale companies that are – strictly speaking – not industrial primary processors. Because the necessary level of detail (disaggregation of industrial activities beyond NACE R2) to separate primary and secondary food processing in Eurostat is not available, only PFP industry figures about the number of companies are presented below in Table 2.1.

Table 2.1

Number of primary food processing companies by industry activity and estimated market coverage in the EU, in 2015

	Number of companies	Market coverage (PFP members in total EU market)
Manufacture of vegetable oils and vegetable proteins	35	~85%
Manufacture of wheat flour mill products	3800	~90%
Manufacture of starches and starch products	24, a)	~95%
Manufacture of sugar	61	~100%
Cocoa grinding and/or expelling	20, b)	~100%
Primary food processing total	~ 4,000	

a) with 78 plants; b) of which 9 grinders/traders.

Source: CEFS, ECA, European Flour Millers, EUVEPRO, FEDIOL, PFP, Starch Europe. Calculation: LEI Wageningen UR.

The number of companies in the primary food processing industry is declining. Consolidation is driven by economies of scale as well as regulatory reforms. In the years up to and following the 2006 CMO reform in the sugar sector, the number of sugar beet processing factories in the EU decreased dramatically. Between 2002 and 2013/2014 the number of sugar and refinery companies decreased from 76 to 61 according to CEFS statistics, while the number of factories decreased even more from 213 to 109.



2.2 Vegetable oils and vegetable proteins

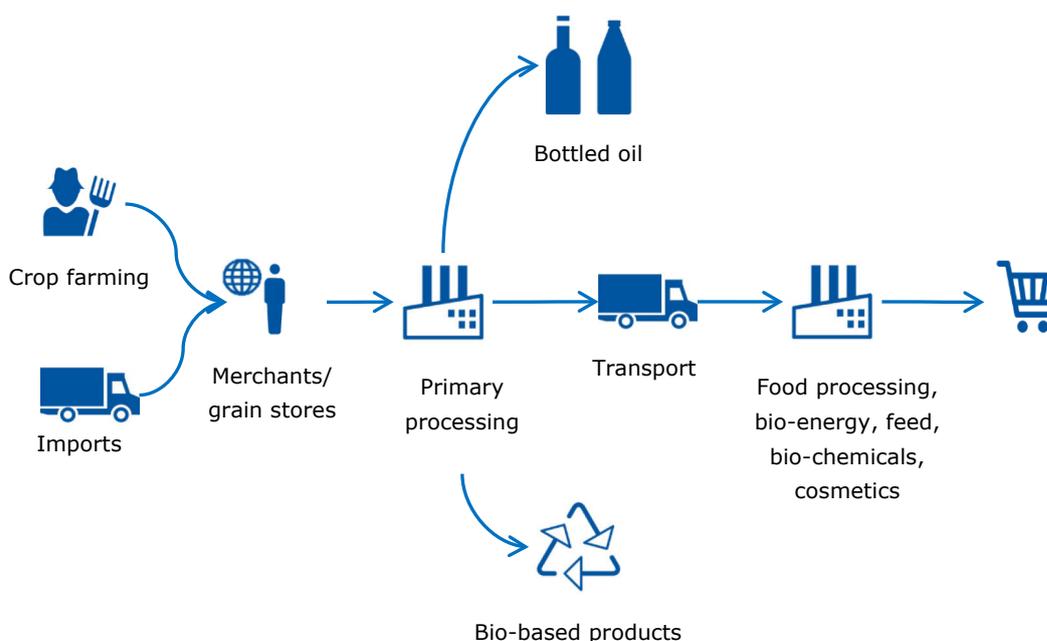


Figure 2.1 Stylised vegetable oils supply chain and the role of primary food processing

2.2.1 Production of vegetable oils and protein meals

The main actors in the EU vegetable oils and vegetable proteins supply chain are crop farmers, traders of oilseeds, processors of oilseeds and of crude vegetable oils into refined oils and protein meals, secondary processors, like food, feed, biodiesel and chemical industries, and distributors to the end users. The end users are other industries (e.g. producers of biodiesel, oleo-chemical, cosmetics, compound feed industry), animal farms (feed material) and consumer households (edible oils or food containing vegetable oil). Also transportation and storage and (international) trading play an important role in the supply chain in delivering the products from one stage in the chain to another. Some companies are active on more than one stage of the supply chain. The level of integration of the supply chain differs per product and per market. For example, some oilseed processing companies are also active in storage and trade (transport and sales) of products across the chain, some may be involved in downstream processing of vegetable oils (bottling, margarine production, or biodiesel) and some also in the production of compound feed.

Most raw material supply is purchased from EU and international (consolidated) traders, and from first collectors (cooperatives); rather little (volume-wise) directly from farmers. Roughly two thirds of oilseeds for further processing are EU sourced. In 2012, the EU farmers provided 27,714 thousand tonnes of oilseeds to the primary food processing industry. Another 15,320 thousand tonnes of oilseeds were imported from outside the EU (Fediol¹), most of which were soybeans from Brazil and the USA. Rapeseeds, soybeans and sunflower seeds are the most important processed oilseed varieties (see Table 2.2).

1 Croatia not included.



Table 2.2*Oilseeds crushing in Europe, in 1,000 tonnes, in 2002 and 2012*

	2002	2012
Rapeseed	12,206	22,492
Soybean	17,335	12,558
Sunflower seed	5,913	6,479
Linseed	599	583
Maize germ	330	462
Cotton seed	713	252
Other oilseeds	125	208
Total oilseeds crushing	37,221	43,034

Source: Fediol.

The primary food processors crush oilseeds (pressing and extraction) to produce vegetable oils, protein meals and other co-products like hulls and lecithin. They refine crude vegetable oils that are EU produced and imported tropical oils. Eighty-five per cent of the crushing and refining activity in the EU is operated by about 35 companies in 17 EU member states (Fediol). The EU vegetable oil and vegetable protein industry processed about 45m tonnes in 2013 (Eurostat). About 15m tonnes of vegetable oils were produced and delivered to further processing (Fediol). Vegetable oils are used in food (54%), biodiesel (33%), chemicals/cosmetics/paintings (5%), feed (4%) and direct energy (4%) (Fediol). The industry fully refines 7.2m tonnes of crude oils resulting from EU crushing activity and 4.7m tonnes of imported crude vegetable oils, mostly tropical oils, like palm oil or coconut oil. Over 85% of this refined vegetable oil is delivered to downstream industries for further processing; only a small share is sold in bottles to the consumer. Refining leads to a standardised product fit for use as edible oil with characteristics that consumers desire such as flavour and odour, clear appearance, light colour, stability to oxidation and suitability for frying. In addition, 6.5m tonnes of mostly EU grown vegetable oils are semi-refined for use in biodiesel plants.

About 28.5m tonnes of protein meals were delivered to further processing (Fediol). Rapeseed and sunflower seed, once crushed, produce 40% vegetable oil and 60% protein meal, while soybeans deliver 80% meals, which is protein-rich and primarily used for animal feed. Companies (whether they buy oil, meal or other co-products) range from very large to very small, producing large or small (co-)product flows. Some farmers get meal supplies directly from primary food processing firms.

2.2.2 Production of vegetable protein for human consumption

The main sources of vegetable proteins on world markets today are soy beans (56% share) and vital wheat gluten (43% share). There are other food crops that contain high levels of good quality protein (such as peas and beans), but production levels of these proteins remains low at present (1% share for pea protein, and about 1% for all other vegetable sources).

The supply chain for plant proteins starts with breeders who provide arable farmers with grain cultivars adapted to the local climatic conditions. For protein crops in the EU a breeding gap is indicated because the market is small and limited commercial breeding activity takes place. Arable farmers sell their products either to the processing industry (oilseed crops) or to the compounding industry, directly or via intermediates (feed grains, pulses).

The EU depends on imported high-protein plant products. The main reason for this is that protein crops in the EU are not competitive with the crops currently being produced. The low competitiveness of EU vegetable protein products is caused at least in part by the relatively few investments made in the past decades in developing these protein crops relative to that of wheat or maize (Schreuder and De Visser, 2014).

A small but growing amount of vegetable proteins are used for vegetarian products, dairy alternatives, high protein/nutritional foods, infant food and other food ingredients that enhance e.g. nutritional characteristics and texture. 'It is estimated that more than 1.1m tonnes of vegetable proteins are consumed in Europe each year (Frost & Sullivan)', and that the global market for vegetable proteins in 2012 was growing rapidly at a rate of about 5% per annum.



2.3 Wheat flour

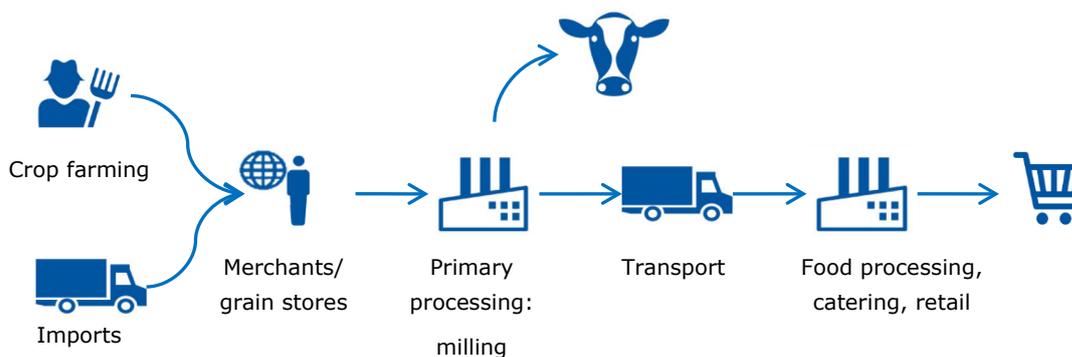


Figure 2.3 Stylised wheat flour supply chain and primary food processing

The EU wheat flour supply chain consists of the next main segments: primary production (wheat farmers), primary food processing (wheat milling), secondary processing (food industry), wheat collection, (international) trading, storage and transportation and sale to the consumers. Some companies are active on more than one stage of the supply chain. The level of integration of the supply chain differs per product and per market.

The EU plays an important role in world wheat production: 143m tonnes in 2013 (FAOSTAT). There are over 170 thousand farms with soft wheat and over 61 thousand commercial farms with durum wheat in the EU (source: FADN). The EU is a net exporter of wheat (Eurostat reports 30m tonnes export and 5m tonnes import in 2014). A part of the wheat goes to feed and non-food industrial consumption (bio-ethanol). Another part goes to food processing for human purposes.

The wheat milling industry buys wheat from agricultural cooperatives, traders, other processors and directly from farmers. There are differences between European countries in the degree of consolidation of production capacity and national market coverage. In the Northern parts of the EU (UK, Benelux, Germany, Scandinavia, Baltics) concentrated large mills dominate. In southern EU countries the market is less consolidated with smaller mills. On the whole, the European milling industry continues to become more consolidated, both in the North and in the South.

Sometimes, there is a (partial) vertical integration with grain collecting cooperatives in key European producing countries like France. Wheat flour producers often combine production with wheat flour bulk trading activities.

The EU milling industry delivers 35m tonnes of wheat flour each year; with Germany (18%), the UK (14%) and France (13%) as biggest producing countries (Unigrains estimates). Only 2 to 3% of EU wheat flour is exported.

The primary use of wheat flour is bread production at the secondary food processing level. This makes bread the flagship end product within the wheat flour supply chain. An estimated 69% of total wheat flour is destined for bread production; 52% of wheat flour is sold to industrial bakeries, bakery wholesales and other food processing firms with bakery activities (Unigrains estimates). Other wheat flour goes to other food processing, for example as an ingredient for composite food products. Often, this involves bulk sales.

The sales market of wheat flour consists predominantly of large-scale industrial buyers in Northern Europe. In Southern Europe, there is still a plurality of artisan bakeries and food producers, however there is a trend towards consolidation and industrialisation as well.



2.4 Starch

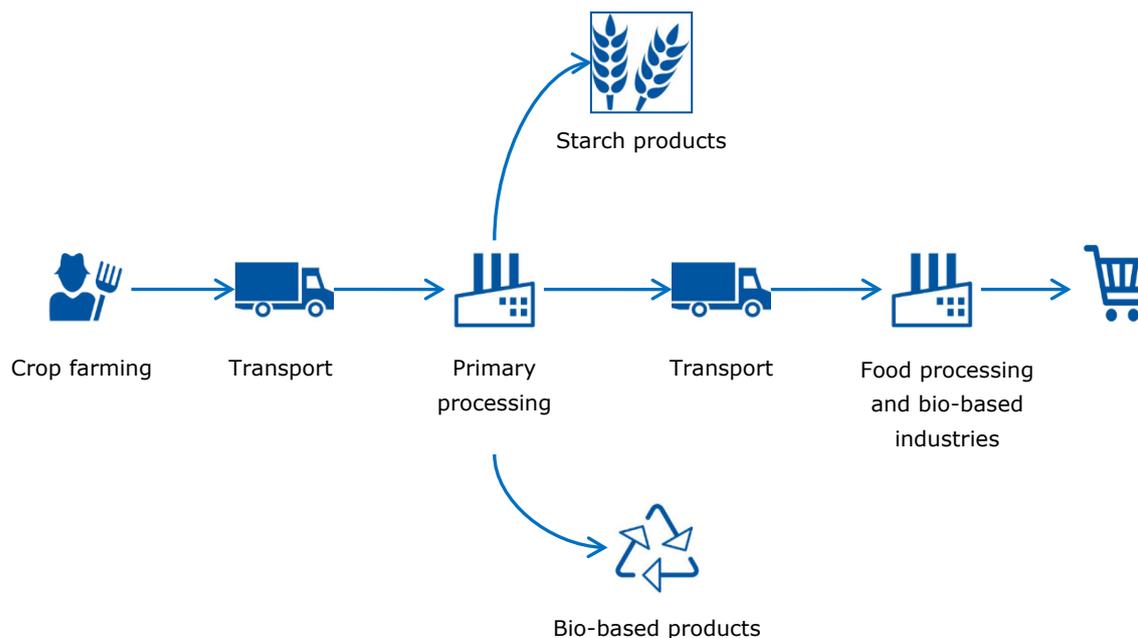


Figure 2.4 Stylised starch supply chain and primary food processing

The main actors in the EU starch supply chain are arable farms (potato, wheat and maize), primary and secondary processors and distribution to end users. Also collection, transportation and trading play an important role in the starch supply chain.

In 2013, a total of 22m tonnes of crops were processed into starch products: 7.8m tonnes of maize, 7.9m tonnes of wheat and 6.3m tonnes of starch potatoes (source: Starch Europe). These are crops with a high starch content that are primarily used for starch making in Europe. EU starch producers also extract starch from peas, barley and rice but the scale is limited. Over 95% of the agricultural raw materials processed by the EU starch industry are grown in the EU.

The EU is the world's third biggest starch producer, behind the US and China. It is the biggest producer of potato starch and wheat starch in the world (sources: Starch Europe, Agrosynergy).

Primary food processors extract and process starches from crops to produce a very large range of starch products. These include native starches, modified starches, maltodextrins, polyols, glucose syrups, dextrose, glucose fructose syrups and various other starch sweeteners. Starch extraction from agricultural raw materials also produces (high-value) co-products, such as wheat gluten. The production of glucose fructose syrup (with a fructose content of more than 10%) is restricted by the EU sugar quota regime to 720 thousand tonnes, though this restriction will end in 2017.

About 24 enterprises cover most of the EU starch market producing from 78 starch plants in 20 Member States. Potato starch processing is concentrated on a national level. Cereal starch production is dominated by multinational companies, some with starch production plants outside the EU, though there also exist a number of smaller national cereal starch companies.

In the EU, 10m tonnes of starch products were produced in 2013, together with 5m tonnes of starch co-products. Starch is mainly used for supplying domestic markets. Approximately 5% of production volume is destined for export outside the EU. Sixty-one per cent of starch products supply is destined for the food and drink industry, 29% for corrugating and paper and 10% for the chemical, pharmaceutical, feed and other non-food sectors. Starch co-products are sold mainly to the animal feed industry, but also to the food industry (source: Starch Europe).



2.5 Sugar

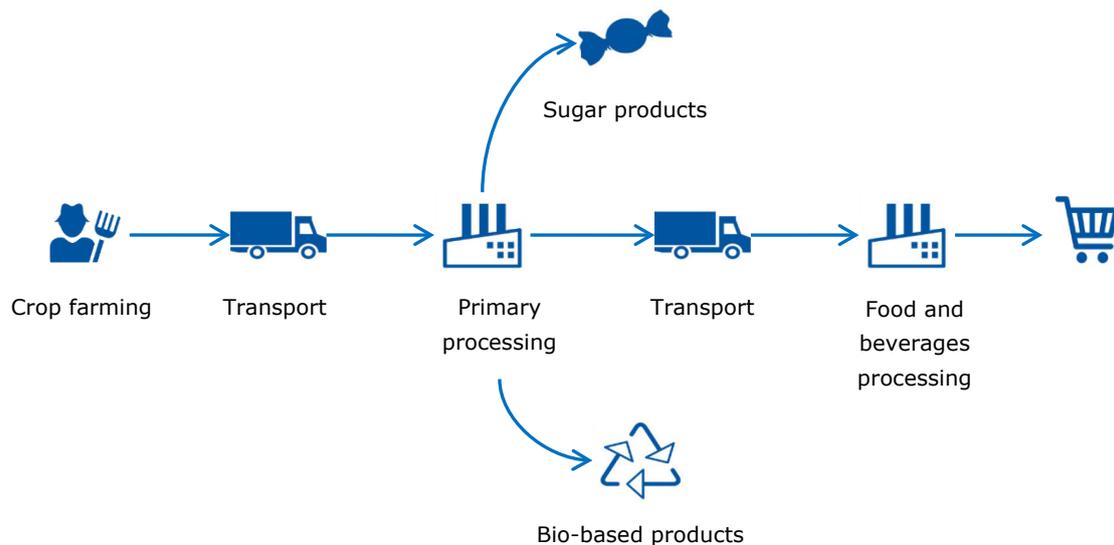


Figure 2.5 Stylised (beet) sugar supply chain and primary food processing

The main actors in the EU sugar supply chain are: seed breeders, operators active in the agricultural supply trade, sugar beet growers (including farm cooperatives), primary food processors (sugar manufacturers), secondary processors and distributors to end users. In addition, collection, transportation and trading also play an important role in the sugar supply chain.

Sugar is extracted from the sugar beet, which in 2014 was grown in 19 EU Member States on a total harvested area of 1.5m hectares (source: CEFS). EU sugar beet is purchased by 61 sugar companies located in beet growing regions. In addition to EU-produced beet sugar, cane sugar is imported into the EU as both raw and refined sugar.

The EU sugar sector has undergone two substantial reforms in recent years, in 2006 and 2013. These have resulted in major changes in the industry, for example:

- A 30% reduction in quota sugar production;
- The progressive abolition or suspension of support measures;
- The dismantling of the quota system, minimum beet price and the majority of internal regulation by 2017;
- A reduction in EU sugar prices by over 40%;
- The introduction of unrestricted and preferential import arrangements, especially with the so-called least developed countries (LDCs) and developing countries in Africa, the Caribbean and the Pacific (ACP), from 2009.

As a result of these reforms, by 2017 the EU will have one of the most deregulated and market orientated sugar industries in the world.

Total EU production of beet sugar for all purposes is typically between 15 and 19m tonnes per year. Under the new preferential import arrangements imports have considerably increased in recent years and now average about 3.5m tonnes per year. Roughly 82% of supplies are sold for human food consumption in the EU, with 11% transformed into renewable energy and industrial products and 7% exported to third countries.

Sugar is manufactured into a wide range of food products most of which are marketed throughout the EU. The majority of output is sold to secondary food processing customers as an ingredient in food and beverages. The retail trade, including supermarkets, is also a significant customer base.



The European sugar industry also contributes to development and production of non-food bio-based products like bio-plastics and bio-ethanol from sugar beet. The EU produced about 6.6bn litres of bio-ethanol in 2014, of which some 18% was from sugar (1.2bn litres), which represents about 8% of sugar supply (in white sugar equivalent) (ePure 2015).

2.6 Cocoa²

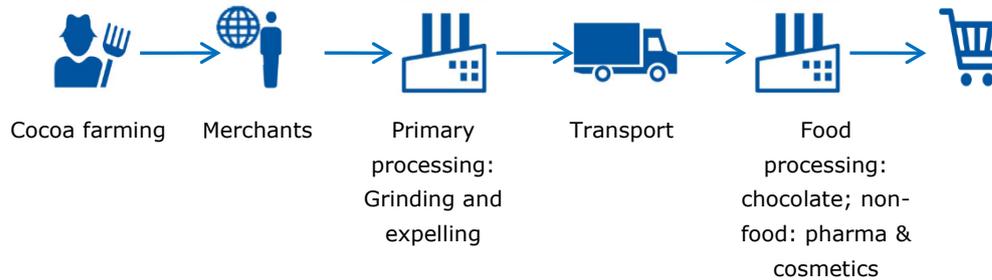


Figure 2.6 Stylised cocoa supply chain and primary food processing

Cocoa beans are exclusively harvested in third countries. For the 2013/2014 season, the total world production reached just over 4.3m tonnes (source: ICCO, 2015). The primary growing regions are Africa (ca. 75%), Latin America (about 15%) and Asia (about 10%). The largest producing country by volume is Côte d'Ivoire, which produces 40% of global supply, followed by Ghana (20%), and Indonesia (under 10%).

The largest importing regions are Europe and Northern America, where a majority of cocoa beans are processed (grinding and further manufacture). While grinding in producing countries has increased over the years, Europe remains the largest single grinding region, with close to 35% of global grind volumes.

Cocoa farmers are essentially smallholders. Trading intermediaries of different sizes are involved in supplying cocoa grinders. The market for cocoa grinding is highly concentrated at the European as well as global levels. Some companies combine grinding with production of industrial chocolate. In Europe, ADM³, Barry Callebaut and Cargill are the biggest players, grinding cocoa into liquor, butter and powder. Barry Callebaut is the biggest producer of industrial chocolate in the EEA.⁴

Grinders process de-shelled cocoa beans (nibs) into intermediate products: cocoa liquor (or mass), which is then further processed into cocoa powder and cocoa butter. These semi-finished products are used by manufacturers of chocolate and confectionary products, as well as for other food and cosmetics applications. End users include some large global companies as well as a host of SMEs.

About two thirds of all cocoa is used to produce chocolate and chocolate products (in the chocolate and confectionery industries). Six major chocolate manufacturers dominate the world chocolate market: Mondelez International (Kraft foods before 2012), Nestlé, Mars, Hershey's, Ferrero and Lindt Sprüngli, which all have facilities in the EU. One third of all cocoa is used for producing products other than chocolate and confectionery products (such as biscuits, dairy, ice cream, bakery, aromas), and also cosmetics (1% of the overall cocoa production) as well as limited applications in other industries.

² This chapter is for most parts based on chapter 2.3 in Logatcheva (2014). Some additions and/or alterations to the original text have been made to highlight the position of the European primary food processing industry. Also some data has been updated to later periods.

³ 2015 will see the finalisation of the acquisition of ADM's cocoa business by Olam.

⁴ European Economic Area, i.e. EU and EFTA excluding Switzerland.

World cocoa consumption grows on average by about 3% per annum. The EU remains the biggest consuming region (about 50% of world consumption) (ICCO, 2012), but demand for cocoa-based products is steadily growing in emerging countries.

3 More than one million jobs

3.1 Direct labour

Between 2008 and 2012 overall employment in manufacturing in the EU declined slightly from 33m to 30m. Food manufacturing was fairly constant in terms of employment, and actually managed to keep employment stable around 4.1m (source: Eurostat). Direct employment in primary food processing is estimated at more than 120,000 in 2015 (see Table 3.1; source: industry data). Employment in primary food processing-related industries has been slightly decreasing except for oils and fats. In vegetable oils and proteins manufacturing there has been no reduction in employment, due to crushing capacity increases between 2006 and 2009 (Fediol). The most notable decrease in employment was in the sugar industry. Between 2008 and 2012 employment decreased by about 20%, after reforms of the sugar sector. Food processing in general and primary food processing in particular have been quite resilient during the economic crisis compared to many other manufacturing industries in terms of employment.

Table 3.1

Number of persons employed in primary food processing industry, in the EU, in 2015 a)

	Number of persons employed (1,000)
Manufacture of vegetable oils and vegetable proteins	20 (~85% market share)
Manufacture of wheat flour mill products	45 (~90% market share)
Manufacture of starches and starch products	16 (~95% market share)
Manufacture of sugar ^{b)}	31 (~100% market share)
Cocoa grinding and/or expelling	n.a.
Primary food processing total	>120

n.a.: not available; a) Industry data reports, 2015; b) Eurostat sugar processing definition used (CEFS covers mainly sugar beet processing). The employment data does not differ significantly between Eurostat and CEFS.

Sources: CEFS, ECA, European Flour Millers, Eurostat, EUVEPRO, FEDIOL, PFP, Starch Europe. Calculations LEI Wageningen UR.

3.2 Indirect labour at farm level

The individual sector figures will always seem modest in comparison to those for manufactured food and feed. However primary food processors play a significant role in the European food processing industry and the European food chain as a whole. As mentioned before, being a major buyer for a number of crops, there is a strong chain interdependence between the European agricultural sector and primary food processors. More than 200m tonnes of agricultural inputs are purchased from EU farmers, in addition to significant volumes that are imported from third countries (see Table 3.2).

Table 3.2

EU farm level input, by industry activity, in 2014

Industry activity	Type of EU farms input	Weight in tonnes
Manufacture of oils and fats	Oilseeds for crushing	27,714,000
Manufacture of wheat flour mill products	Soft wheat and rye	45,000,000
Manufacture of starches and starch products	Starch potatoes	6,670,000
	Wheat	8,280,000
	Maize	8,050,000
Manufacture of sugar	Sugar beet	105,000,000
Cocoa grinding and/or expelling	no input at EU farm level	
Total input		200,714,000

Source: CEFS, ECA, European Flour Millers, EUVEPRO, FEDIOL, PFP, Starch Europe.

More than 120,000 people are directly employed in the EU primary food processing industry. In addition, the industry's position in the supply chain indirectly affects employment upstream in the supply chain. The calculated indirect employment at the European farm level is almost one million jobs (412,000 full-time jobs).⁵ Note that the number of farmers affected may be even larger because arable farms are generally not specialising in just one crop. These numbers do not include employment effects for other agricultural suppliers of inputs, such as fertilisers, seeds, and transport services, nor the indirect impact on the non-EU farm level. In addition to EU-sourced inputs, primary processors purchased about 17m tonnes of non-EU agricultural raw materials in 2014. The role of primary food processing in providing employment in the EU is therefore much higher than is shown in Table 3.3 due to significant impacts on indirect employment upstream in the supply chain.

Table 3.3

Estimated indirect labour at EU farm level, by industry activity, in total persons employed and in annual work units (AWU)

Industry activity	Persons employed at EU farm level ^{a)}	Annual work units (AWU) at EU farm level ^{b)}
Manufacture of oils and fats	369,681	161,062
Manufacture of wheat flour mill products	356,627	142,672
Manufacture of starches and starch products	159,221	59,409
Manufacture of sugar	105,326	49,249
Cocoa grinding and/or expelling	no input at EU farm level	no input at EU farm level
Total estimated indirect labour	990,855	412,392

n.a.= not applicable, i.e. no EU farm level sourcing

a) AWU corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis (see:

[http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Annual_work_unit_\(AWU\)](http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Annual_work_unit_(AWU))). The estimation is based on the Eurostat data on total EU-28 family labour and regular labour force in AWU per hectare and related average EU-28 crop yields. Base year 2013.

b) Estimation based on the Eurostat data on total EU-28 family labour and regular labour force in Persons Employed per hectare and related average EU-28 crop yields. Base year 2013.

Source: CEFS, ECA, European Flour Millers, Eurostat, EUVEPRO, FAOSTAT, FEDIOL, PFP, Starch Europe. Calculations LEI Wageningen UR.

⁵ The indirect labour effects were calculated on the basis of the amount of raw material intake from the EU and average EU productivity and employment figures for e.g. cereals and oil seeds production. The basis for this data is Eurostat statistics on labour input (Labour force: number of persons and farm work (AWU) by type of farming (2-digit) and economic size of farm (SO in euros) [ef_olfftecs]), land use (Land use: number of farms and areas of different crops by type of farming (2-digit) [ef_oluft]) and yields (FAOSTAT).

4 Production value increased despite economic crisis

The total production value of primary food processing in the EU is estimated at €66bn in 2013. Primary food processing has a total share of 8% in the production value of the food manufacturing industry in the EU-28. Vegetable oils and proteins makes up the largest share of primary food processing in terms of production value, with 37% of the total production value of primary food processing. Vegetables oils and proteins is followed by sugar and flour milling with 21% and 20% respectively. The production value of especially sugar, vegetable oils and proteins, and (wheat) flour milling has fluctuated significantly in recent years. Sugar prices spiked in 2006 and between 2010 and 2012, but have since decreased. Wheat prices, vegetables oil prices and vegetable protein prices are fluctuating just as much, with price fluctuations exceeding 300% for e.g. soybean meal in the 2005-2014 period. The cocoa industry has experienced significant swings on both cocoa beans and cocoa semi-finished products prices. Starch prices have been somewhat less volatile, resulting in more stable production values.

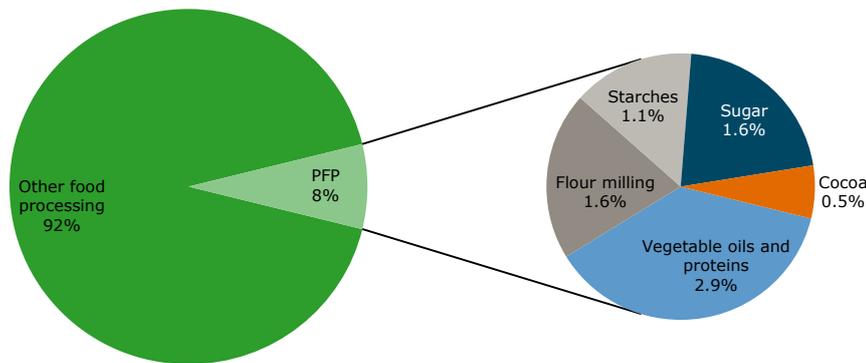


Figure 4.1 Division of production value of food manufacturing and primary food processing, in 2013, in %

Source: Eurostat PRODCOM and Eurostat SBS.

Despite the economic crisis, the primary food processing industry has seen an increase in production value. The production value of all branches of the primary food processing industry increased except sugar, which underwent a structural sector reform with a 30% reduction in quota sugar production and a 60% drop in the number of factories between 2000 and 2008.

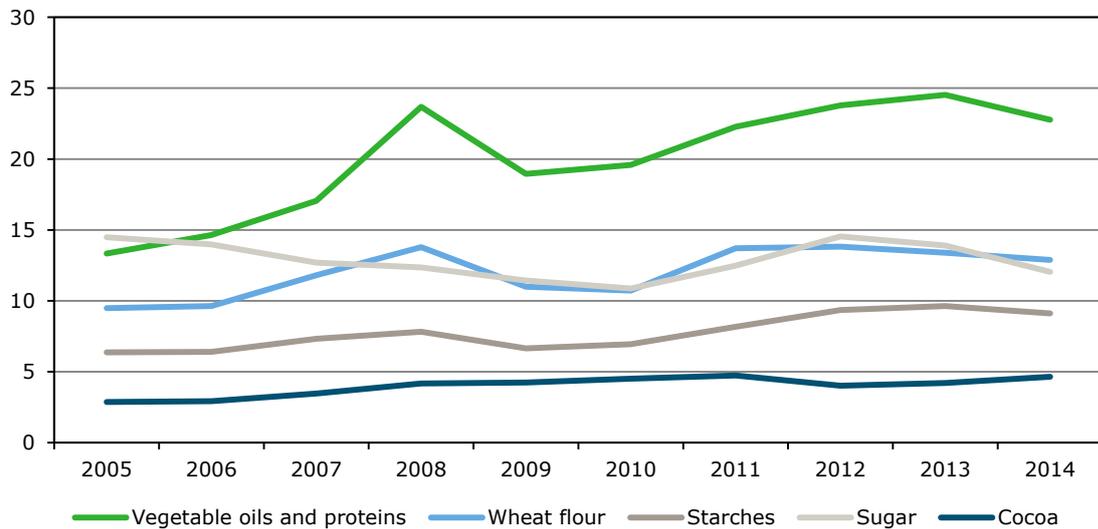


Figure 4.2 Production value of primary food processing, 2005-2014, in bn euro
Source: Eurostat

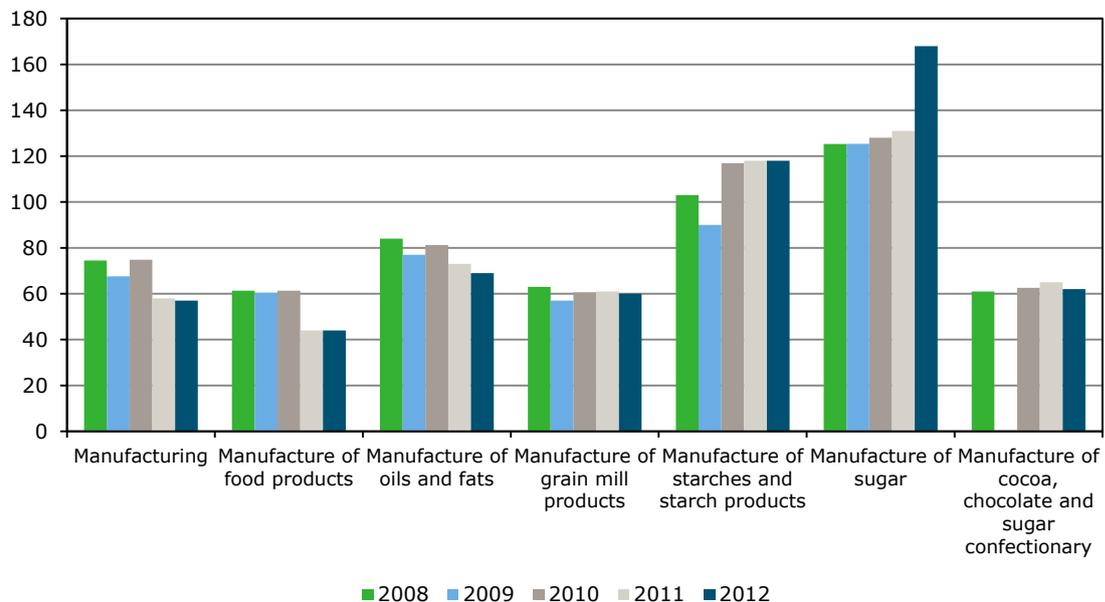


Figure 4.3 Gross value added per employee, 2008-2012, in 1,000 euro
Source: Eurostat

Gross value added per employee is relatively high in most primary food processing industries. Compared to the food industry as a whole, especially starch and sugar manufacturing have a high labour productivity ratio. This shows that these industries depend on high volumes and large scale processing to be efficient. Value added per employee in the production of oils and fats (including animal fats) has decreased, mainly due to price developments.

5 Investing in efficiency, sustainability and the biobased economy

Plant-based primary food processors invest a relatively high share of value added in tangible assets, most notably machines and equipment, and buildings, when compared to other manufacturing sectors and the food industry as a whole. In Figure 5.1 average investment rates (gross investment / value added at factor costs) are presented for the period 2008-2013. Manufacturers of oils and fats (data including animal fats) and producers of starches and starch products had the highest investment rates in 2012-2013. More than 25% of value added was reinvested in the industry assets. In 2008/2009 investments rates in oils and fats and in grain mill products were exceptionally high. The peaks are largely attributable to individual investments in particular countries. Large investments in grain milling took place in 2008 in, for example, Italy and Romania.

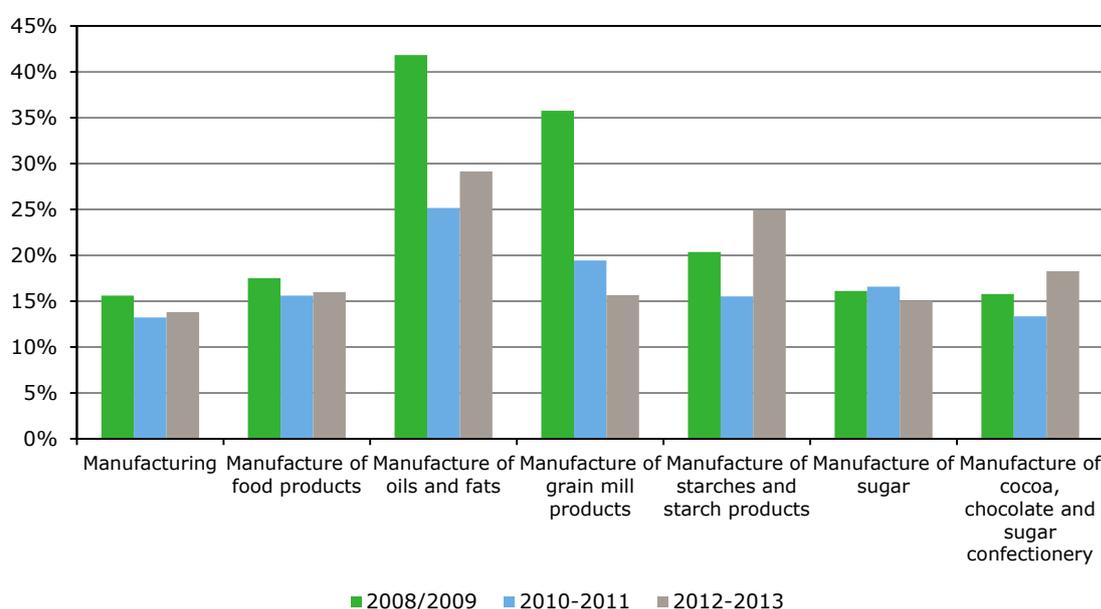
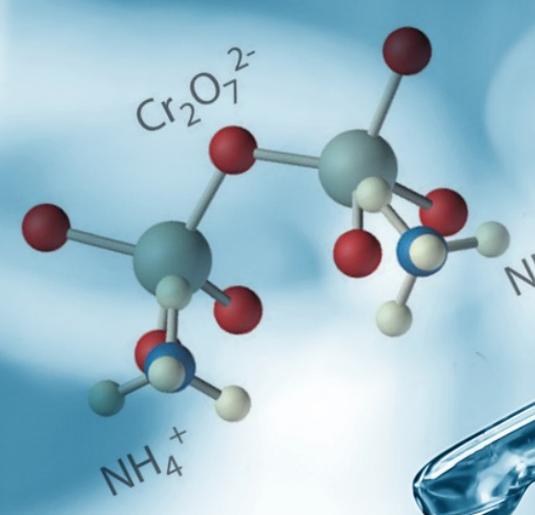
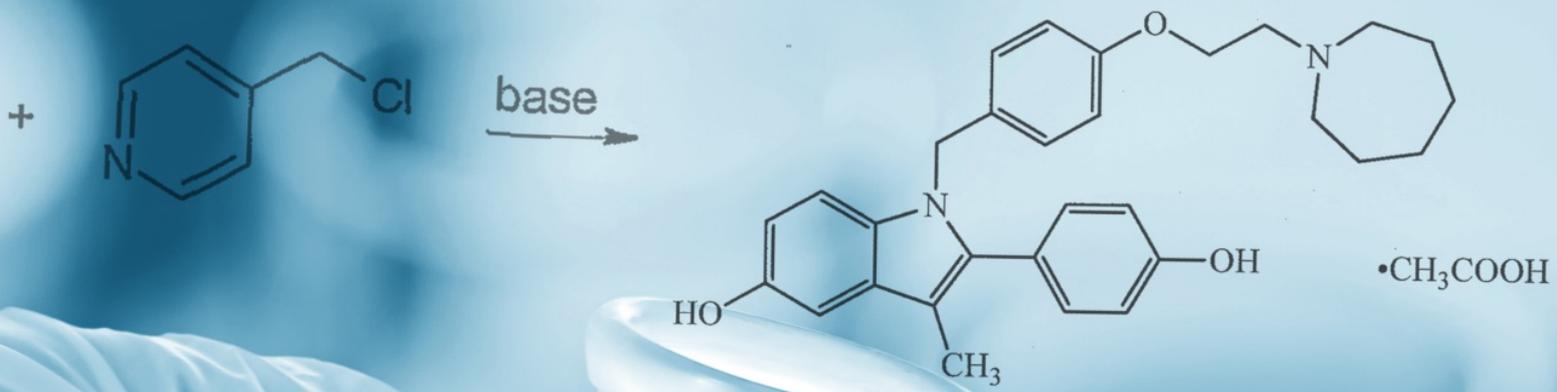


Figure 5.1 Investment rate (gross investments/value added at factor costs), 2008-2013, in %
Source: Eurostat

In plant-based primary food processing advances in technology have fostered economies of scale and a reduction in production costs per unit of output. Capacity developments vary between industry branches. Flour milling had, at least in some EU regions, to deal with capacity surpluses, which led to a reduction of the number of production facilities. The sugar industry underwent production facility rationalisation due to the EU sugar reform in 2006. The EU cocoa industry experiences 2.1% grindings growth on annual basis.

In total, the relevant industries of primary food processing (including some secondary processing) account for about 17% of total gross investments in the European food industry (average of 2009 and 2012, Eurostat). Manufacture of cocoa, chocolate and sugar confectionery (no separate data for primary processing of cocoa are available) take up the largest share, followed by oils and fats (including animals fats) and grain mill products (see Figure 5.2).



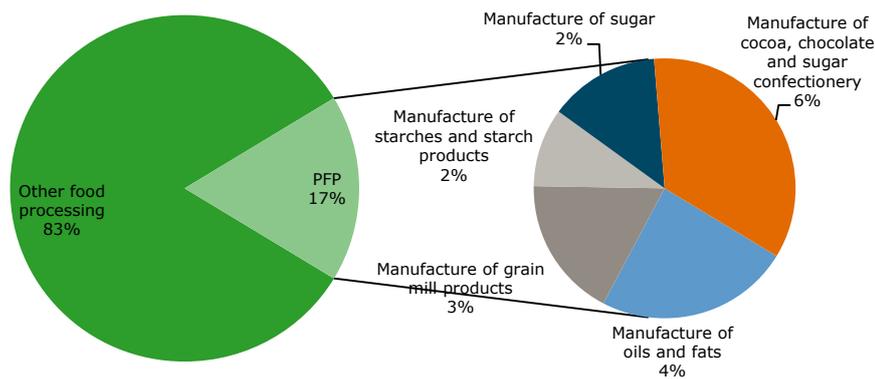


Figure 5.2 Gross investment in fixed tangible assets, average of 2009 and 2012, in %
 Source: Eurostat

Industry branches that produce a relatively large number of diverse products from the basic input, such as starch products for bio-based applications, invest more in research and development of new products. Primary food processors invest in production process improvements related to efficiency, safety and sustainability, e.g. insulation (for salmonella prevention) in oils and proteins manufacturing, compliance with food and feed safety regulations, water treatment, emissions reduction, and energy efficiency.

At least a quarter of the companies with more than €100m turnover that are active in one of the industrial classifications of the primary food processing industry (NACE R2 1041, 1061, 1062, 1081, 1082, including some secondary processing) hold patents (source: Bureau van Dijk ORBIS database). Many of these patents (both national, European as well as worldwide patents) include methods for the production, extraction, refining or otherwise treatment of primary food ingredients. Although patents and R&D spending is concentrated in the larger companies, like in almost any industry, the number of companies that hold patents is larger than in many other branches of the food industry. Some of the top-performing companies in terms of R&D and patents are Roquette Frères, Tate & Lyle, Südzucker, and Cosun. All of these companies belong to the top-1000 R&D-companies in Europe. The top-5 companies are estimated to spend a combined €150m to €200m on R&D annually. In recent years, much of the industry's R&D has been targeted towards bio-chemicals, bio-refinery and other bio-based processes. Starches, sugars and oils have a huge potential to contribute to a bio-based economy.



6 A key industry in the supply chain: opportunities and threats

6.1 Distinctive features of the industry

Plant-based primary food processing involves processing of several types of raw agricultural inputs using different techniques and for different end markets. At the same time, it is subject to a number of similar characteristics which set these industries apart from the rest of the food processing industry.

1. Products of plant-based primary food processing are mostly used as ingredients. About 85% of industry output is destined for food. The products of primary food processors can be found in a vast range of food products, making them an essential part of most food supply chains. The rest of PFP products consist of packaged consumer goods, feed and bio-based products, such as paper, cosmetics, oleo-chemicals, energy, and many more.
2. Plant-based primary food processing largely depends on high volume processing using basic processing techniques such as milling, grinding and pressing. Although not all plants are of the same large scale, benefitting from scale effects in processing is a common feature of all primary processing industries. These large scale processing facilities have been at the core of primary food processing for a long time, but new markets are developing in bio-based products and e.g. meat-substitutes, which are encouraging primary food processors to explore new production processes and product innovation. Innovative research and development and new processing facilities are reshaping parts of the primary food processing industry.
3. More than 200m tonnes of raw materials are sourced from within the EU, which means there is a high degree of chain interdependence between European primary food processors and European farms (with some exception for non-domestically available products like cocoa, tropical oils and to some extent soya). These interdependencies are sometimes institutionalised in vertical supply chain integrations. Large cooperative primary processors exist e.g. in sugar and starch.
4. Advances in technology are fostering economies of scale and, as a result, creating opportunities for reduction of production costs per unit across the primary food processing industries. Typically operating at relatively low profit margins, most primary food processors (with some notable exceptions in flour milling and starch potatoes) rely on relatively large volumes to make a profit.
5. The primary food processing gross margin as a share of a consumer product price is relatively small compared to other segments of food supply chains (see for example Baltussen *et al.*, 2014).⁶ That means that value added per unit of consumer product is relatively low. However, players in some branches are increasingly investing in the development of relatively high-value products.
6. Primary food processors produce and trade large volumes of mainly standardised products. Most of these products are handled through continuous processing of raw materials. Batch processing is exceptional, and applies for products with relatively limited storability, or high-value niche products (such as speciality cocoa products).
7. Plant-based primary food processors are active on commodity markets for large volumes of mostly non-standardised raw material input. Most agricultural commodity markets are characterised by a high degree of price volatility. Agricultural supply varies from period to period because of natural factors such as weather conditions and diseases and, at least in some cases, political developments in supplying regions. At agricultural farms, there is lagged supply response to price changes due to the length of the production cycle (seasonality). At the same time, demand elasticities are relatively small with respect to price, i.e. primary food processors' demand is generally little responsive to changes in raw material input prices (FAO *et al.*, 2011).⁷ Due to this

⁶ See <https://www.acm.nl/nl/publicaties/publicatie/13680/Prijsvorming-van-voedsel/>

⁷ <http://www.oecd.org/tad/agricultural-trade/48152638.pdf>

price volatility primary food processors rely on commodity risk management (forward contracts, futures, OTCs), and profits depend heavily on price developments.

8. Primary food processors have to show the ability to respond to customer demand with regard to food safety and quality criteria and standards. EU consumer demand for food pulls supply from the food supply chain, including primary food processors. Since food safety and food security is high on the EU agenda, it is of utmost importance to the downstream supply chain that the primary food processors' supply is secure and of high quality. Primary food processors can consequently be seen as safeguards of food safety at the base of the food supply chain.
9. Primary food processors face a high variety of suppliers, from smallholders to large trading companies. The proximity to suppliers varies as well. Raw materials are purchased regionally (e.g. sugar beet, starch potatoes, wheat), Europe-wide (e.g. wheat), or are imported from outside the EU (e.g. cocoa, wheat, soybeans, tropical vegetable oils). Having relatively large scale processing units also means that supplies from many small scale farmers are transported and collected, before being mixed to produce standardised output in an economically efficient way. This greatly lowers transaction costs in the supply chain. When sourced (directly) from small volume suppliers (e.g. smallholders in the case of cocoa) there is increased attention for food processors' social responsibility issues. There is variety on the demand side as well: primary food processors provide both small and large volumes to large secondary food processing companies, small food companies and (specialist) wholesalers.

6.2 Opportunities

New markets

- Bio-based economy demand. Demand for bio-based applications of agricultural raw materials will increase demand for wheat, maize, starch, oilseeds, sugar and a number of related products. The primary food processing industry is increasing its research and development effort in bio-chemicals, bio-materials, bio-refinery and bio-energy products.
- Upcoming world markets in Asia and Africa, and growing income levels are leading to increased demand for high quality European products. By 2050 the world's population is expected to have reached about 9bn, and the demand for food to have increased by between 70% and 100% (FAO *et al.*, 2011). These world demographic developments are expected to pull demand from EU primary food processors as well.
- Product innovation and differentiation will make it possible to spread risks between low and high margin business models. Primary processors could put more focus on new innovative food products that follow industrial and consumer trends and non-food bio-based applications.

Exploiting the industries' competitive edge

- The proximity to European downstream industry makes it possible to respond well to specific customer demand. Physical proximity to large industrial and consumer EU markets provides primary processors with an advantage in distribution possibilities.
- Closeness to major trade hubs in the EU and access to well-developed European distribution networks provide a competitive advantage compared to existing competitors and new EU market entrants from e.g. North- and South America. Some EU primary food processors have a competitive advantage in Europe due to the availability of raw agricultural inputs like starch potatoes. Other industries, like cocoa, benefit from excellent production and logistics.

Sustainability

- There are opportunities in process innovation to improve the environmental performance of processing units (energy efficiency, water recycling, emissions reductions), which can both lower costs and increase sustainability. This will add to the industries' position as sustainable supplier to the European market. Further increasing the industry's environmental performance can provide a competitive edge over competition from abroad.

Supply chain opportunities

- In some primary food processing sectors, such as wheat flour, there is on-going consolidation. Further increases in the scale of production facilitates cost-efficiency gains.

-
- Backward and forward supply chain integration or cooperation will increase transparency (on stocks and costs), reduce uncertainty and limit the associated risks.

6.3 Threats

Plant-based primary processors are major players on the EU's and the world's agricultural markets, and have a stake in global agricultural raw material security. The position of primary food processors is threatened by a number of developments, which are summarised in brief below.

Market developments

- Increased competition. European primary food processors are increasingly facing global competition. Competitors from outside the EU with lower production costs due to lower labour and/or energy costs, are increasingly getting access to EU and global markets. There are world players with access to cheaper raw material inputs due to availability of genetically modified crops (e.g. USA) or cheaper labour and energy that already have a competitive advantage on the world markets. Especially worrying is increased competition from outside the EU if that competition is based on distorting supports and an un-level playing field.

Price risk and its management

- Price volatility. Production volatility in important supplying regions is increasingly causing price volatility, which can be problematic. In the recent past there were long periods of price volatility.⁸ In the case of a tight supply-demand balance even more volatility is expected.
- Risk management regulation. The tools for mitigating commodity price fluctuation are becoming critical. The Markets in Financial Instruments Directive 2 (MiFID 2) could represent a serious challenge in Europe if this involves higher costs for participants, tighter margins and reduced flexibility, when hedging (KPMG, 2012).⁹

Production

- The CAP has secured constant and regular production and supplies for primary industries. The last round of reforms have led to a steady reduction of market regulation, with as a consequence increased price risk and uncertainty for both primary food processors and farmers.
- Availability of supply. According to FAO *et al.* (2011), growing population and income in emerging and developing countries will add significantly to the demand for food in the near and long-term future.¹⁰ If the rate of growth of agricultural production does not keep pace with demand, upward pressure on prices will result. For sectors for which raw material accessibility is an issue, e.g. wheat, vegetable oils and proteins, and cacao, political instability in sourcing regions such as Ukraine (wheat, sunflower seed oil) or West Africa (cocoa) can present a challenge.
- Climate change. Longer periods of drought and heavy rainfall are expected in large parts of the world. Agricultural crops are naturally susceptible to weather conditions. Cocoa, for example, is a difficult crop that requires a stable equatorial climate. Variations in the amount of rainfall can particularly affect cocoa yields. This is a very real problem in west-Africa, where Ghana for instance has experienced prolonged dry spells of 3-5 months (Hardman and Co, 2014).¹¹
- Availability of crop protection products: especially in the context of climate change the availability and range of allowed crop protection products is a concern. Climate change is likely to increase the presence of undesirable pests in the EU, increasing the need for plant protection products.
- Increased spread of genetically modified organisms (GMO) cultivation globally, beyond the current soybeans, corn and canola crops, increases the risks for industries importing agricultural raw material, that these supplies may not be EU compliant. In the longer run, EU primary processors

⁸ For example between 2006 and 2011 as described in FAO *et al.* (2011).

⁹ <https://www.kpmg.com/BE/en/IssuesAndInsights/ArticlesPublications/Documents/MiFID-what-is-it.pdf>

¹⁰ OECD. 1 June 2011. Price Volatility in Food and Agricultural Markets: Policy Responses. Policy Report including contributions by FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTF. Retrieved from <http://www.oecd.org/tad/agricultural-trade/48152638.pdf>

¹¹ <http://themarketmogul.com/wp-content/uploads/2015/03/Cacao-Giant-on-a-pinhead-May14-FINAL.pdf>

may find it more difficult to compete with non-EU players having access to more competitive and to nutritionally enhanced products or ingredients.

Regulatory Issues and Burden

- EU food law is very complex and prescriptive. Problems may arise due to the diverging interpretation of EU laws or to the burdensome implementation of provisions at national level. In some cases however, insufficient European harmonisation can be a source of problems, such as losses of commodities for food use.¹²
- Health and nutrition legislation. Shifts in general views and opinions about healthy food could affect demand for individual products,¹³ but these changes could also be enforced by regulation, e.g. regulations that limit the use of sugar, fat or salt in food products.
- EU regulations on the import and use of GM products are impeding the use of imported material in the European market even of products that are not GM. Only products that are not GM traceable get into the EU relatively easily. Moreover, non-GM products are not valued outside the EU as they are on the EU market. These regulations limit supplies for primary food processors.

Trade negotiations

- European plant-based primary food processing industries are at risk from further trade liberalisation that threatens to expose them to – in some cases – competition on unbalanced playing fields. Many primary food processors in third countries have larger scale and/or lower production cost, which is sometimes due to a different regulatory approach, or are heavily subsidised by their governments. These subsidies can take many forms, for example: external trade measures, fixed/supported prices, market clearing mechanisms/marketing arrangements, subsidised credit or debt renegotiations/restructuring, export taxes and export support. When primary processed products from such sources are allowed to enter the EU market, EU producers are placed at a clear disadvantage and forced to compete on a skewed playing field.
- The EU is currently negotiating with a number of countries that subsidise their primary food processing sectors, notably the US, Brazil (as part of the Mercosur negotiations), Thailand and India. Meanwhile, negotiations have already been concluded with a number of other such countries and blocs, e.g. Vietnam, Central America and Southern Africa. These agreements offer tariff-rate quotas to primary processed products in significant quantities, thereby opening up EU processors to competition that is subsidised and potentially trade distorting. There is a real threat that such trade agreements will lead to job losses in the EU.
- Existing trade agreements, notably between individual Asean countries and high-growth markets such as Japan and China at a time when the EU has not yet launched or completed trade negotiations with these countries is putting the EU industry at a disadvantage in these markets. This trend is likely to have a negative impact on EU exports but also on the competitiveness, growth and innovation of the EU industry.

Supply chain threats

- Mounting pressure by downstream business players and regulators on driving sustainability in the supply chain through certifiable schemes, is increasing fragmentation of flows and niche markets and can act as an impediment to efficient mainstream commodity supply.
- Chain integration and lack of transparency in supply chains. Primary food processing industries – with the exception of cocoa, tropical oils and soya – rely to a large extent on European farmers for their supply. Non transparency (information deficiency about crop supply, demand, stocks and export availability), has effects on supply chain efficiency, with higher costs, and availability and accessibility issues as a result. For this reason, some primary food processing companies have invested in farms outside the European Union. However, in general, there is little backward chain integration, with some notable exceptions for sugar beet and wheat processing.

¹² See an example of variable EU Maximum Residue Levels (MRLs) for pesticide residues issue, and consequently, risk of cross-contamination and loss <http://www.fediol.be/web/pesticide%20residues/1011306087/list1187970134/f1.html>

¹³ For example, the declining EU meat consumption in the EU in the recent years is not only associated with economic crisis or policies, but also with perceptions about meat production and its consumption influence on health.

7 Conclusions

The main objective of this study is to show the contribution of the plant-based primary food processing industry, defined for the purpose of this study as those industries associated in PFP, to the whole of the food and drink industry, and to the whole of the European economy. The main conclusions are:

1. There are about 4,000 (industrial) plant-based primary food processors in the European Union, as represented by PFP. Most of these companies are active in the processing of (wheat) flour. The number of companies has been decreasing and average scale is increasing. Especially in the sugar industry, a major reform of the Common Agricultural Policy has significantly reduced the number of companies in the past decade.
2. Plant-based primary food processing has a combined production value of €66bn. Primary food processing includes the production of vegetable oils, vegetable protein, grain mill products, starches, sugar and cocoa, which account for about 8% of total food industry production value in the EU. Despite the economic recession, the production value of all branches, except sugar, has increased since 2005.
3. Direct employment in the plant-based primary food processing industry is – by its very nature as a capital intensive industry – relatively limited to about 120,000 people. However, aside from direct employment, the industry's demand for raw materials has a huge indirect effect on farm level employment. We estimate that about 990,000 farm workers (412,000 annual work units) are indirectly employed thanks to the industry's demand for agricultural inputs in the EU. In addition, a large number of farmers' jobs outside the EU are indirectly affected. As many of the raw inputs are sourced from relatively nearby the processing facilities, shifting production capacity to outside the EU would greatly affect EU farmers.
4. Plant-based primary food processors have a higher investment rate than the food industry as a whole and total manufacturing. Some of the larger companies in primary food processing belong to the EU's top-R&D performers. Patents are widely used to protect innovations.

The following conclusions can be made regarding the specific role that primary food processing industries play in the food value chain:

1. Plant-based primary food processors are an important supply chain link in many EU food and bio-based supply chains. The main actors in these supply chains are farmers within and outside the EU; collectors, buyers and traders; primary processors; secondary processors; and wholesale and retail distribution to end-users. Primary food processors play a key role in efficiently processing large amounts of raw materials from numerous suppliers into basic food, feed and bio-based ingredients. Primary processors have a central position in European food, feed, non-food industrial and energy chains. They are major players on the European and world agricultural markets, and have a stake in global agricultural raw material security.
2. The European plant-based primary food processing manufacturers use both EU and non-EU raw materials. Industry branches such as sugar, starch, wheat flour and vegetable oil producers are strongly reliant on EU domestic agricultural sourcing. Two hundred million tonnes of agricultural input is used from EU farmers. The link between primary food processing and European farming is very strong and in some cases institutionalised through cooperative ownership. This makes a competitive primary food processing industry also an important pillar for rural development and farm income in the EU.
3. Traditionally, plant-based primary food processors produce a limited number of basic food ingredients. However, processors of starches, sugars, cocoa and vegetable oils and vegetable proteins have particularly invested in product innovation and variation, making these industries into real innovators and R&D performers.

Regarding the future of the primary food processing industry, a number of important opportunities and threats were identified:

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1. Opportunities exist in a number of areas, the key ones being: 1) further development of new markets, especially those in the bio-economy. Primary food processors already have a major role in the innovation processes that take place in light of a shift towards a bio-based economy; 2) world population growth and economic development will hugely increase demand for food, feed and fuel. Catering to this demand is a huge challenge and opportunity for the primary food processing industry; 3) access to raw material inputs and access to end markets is a key competitive advantage. In light of increasing world demand, these assets should be further secured and improved through enhancing productivity at farm level with a focus on reducing its environmental footprint. Increasing agricultural yields in Europe, securing supply from overseas and investments in efficient transport, storage and processing facilities is an opportunity to secure the future competitive position of the industry.
 2. There are also a number of major threats to the industry. Primary food processors face increasing global competition, much of which on a skewed playing field, while they are also challenged by climate change and price volatility issues. Fragmentation of product flows and consequent loss of efficiency caused by increased pressure to introduce certifiable schemes are also seen as a threat by the industry.

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