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Exploring the Global Food Supply Chain

Markets, Companies, Systems

May 2010

Exploring the Global Food Supply Chain
Markets,Companies, Systems
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Acronyms

DUS	Distinct, uniform and stable (plant variety)
EDVs	Essentially derived varieties
EU	European Union
GDP	Gross domestic product
GE	Genetically engineered
GM	Genetically modified
IP	Intellectual property
IPRs	Intellectual property rights
LDC	Least developed country
TRIPS	Trade Related Aspects of Intellectual Property Rights
UPOV	International Union for the Protection of New Varieties of Plants
WTO	World Trade Organisation

Table of Contents

Introduction

The aim of this document is to supplement "Seeds of Hunger: Intellectual Property Rights on Seeds and the Human Rights Response", published by 3D → Trade – Human Rights – Equitable Economy in May 2009, with facts and figures on the global seed and food markets. "Seeds of Hunger" highlighted two major trends in the worldwide food supply chain. First, intellectual property rights (IPRs) on seeds – the basic unit of agricultural production and the basis of life itself – are expanding. Second, market concentration all along the food supply chain is rising. In light of such trends, this report examines all parts of the supply chain, from its beginnings, the seed sector, to the last step, food retailing, and highlights possible implications.

The document contains five sections: an introduction, a chapter on the seed industry and one on the food industry, conclusions and an appendix. The two industry analyses are divided into two segments, each first depicting the global features of the industry; then exposing a cross-section of national realities through selected case studies. These are India, South Africa, Brazil, the United States of America, the European Union, Tanzania and Cambodia. Clearly, these countries and regions embody completely different realities. However, the goal is not to compare them with each other, but to assess whether territories endowed with different geographical, economic, social and cultural features experience the mentioned trends in a similar way. Although a regional organisation, the European Union (EU) is also included because of its common policy related to the seed market and because its size matches that of countries like India, the USA and Brazil better than any single European country.

Both industry sections look at the size of the relevant market, in absolute and relative terms, and at its structure to try to gauge market concentration. Depending on available data, the main actors – both domestic and international – are then identified. Also looked at are the domestic legislations in place to protect plant varieties in the countries examined, considering that, as elaborated in "Seeds of Hunger", the augmented use of commercial seeds goes hand in hand with, and is in part caused by, intellectual property (IP) systems that increasingly advantage seed corporations.[1] Appendix I explains and presents a detailed list of the main legal instruments used by countries to protect IP in the field of agriculture. Appendix II lists all data sources for the charts in the document.

[1] To a large extent, this has been facilitated by the 1991 Act of the International Union for the Protection of New Varieties of Plants (UPOV) and by the 1994 WTO Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). Both contributed to the raise of IP protection standards in agriculture for their members.

Part One - The Seed Market

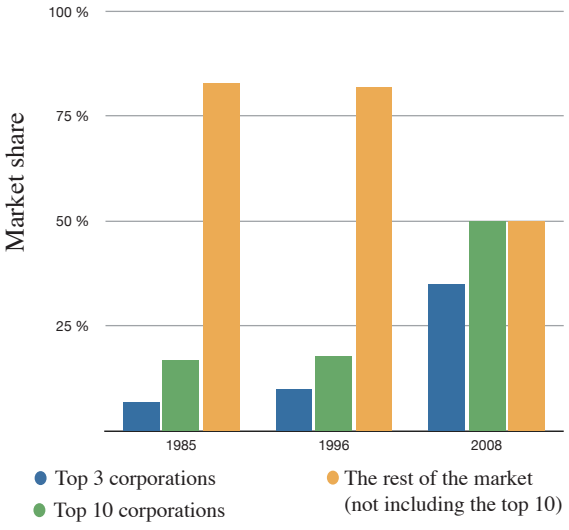
Global Perspective

It is often assumed that the global seed market includes only commercial transactions. In fact, the seed market can be divided in a commercial and a non-commercial sector. The first refers to the part of the market that is affected by monetary transactions. It includes proprietary and non-proprietary seeds. The proprietary market concerns seeds produced by private companies subject to IP legislation, while the non-proprietary market is made up of seeds commercialised through public programmes. The non-commercial seed market coincides with 'saved' seeds, i.e. harvested seeds shared among and re-sown by farmers.

According to Context Network, a market analysis firm, the commercial proprietary market accounted for 67 percent of the total world seed market, the commercial non-proprietary segment equalled 11 percent and the non-commercial one represented 22 percent in 2006.[1] However, large regional disparities lurk behind these figures. In India, for instance, saved seeds represent 70 percent of the total national market, while in the United States, already in the 1960s, the rate of saved seeds in the corn segment was less than 5 percent.[2]

Chart 1

Evolution of market concentration in the global seed industry 1985-2008



As shown in Chart 1, market concentration in the seed industry has skyrocketed since 1996, when a series of big mergers started affecting the whole agro-industry. In 1998, ten corporations dominated the market. In 2000, they had shrunk to seven and in 2001 to six.[3] Monsanto, DuPont and Syngenta took the lead of the process in the commercial seed sector.

US-based Monsanto in particular pursued an acquisition and investment strategy that enabled it to become the global leader in seeds. In 1996, Monsanto was not even in the top 10 ranking, while today, it owns a 17 percent share of the global commercial market. The corporation began its expansion in North America. When it bought Asgrow and DeKalb Genetics during 1997-1998, Monsanto obtained 14 percent of the corn and 19 percent of the soybean domestic market. Through acquiring Holdens Foundation Seeds, it strengthened its market power over the commercialization of germ plasm.[4] Next, it expanded abroad by purchasing Cargill's international seed business.[5] In 2004, Monsanto launched a new round of acquisitions. The most important were the canola seed operations of Advanta in 2004, Seminis Inc. in 2005, worth $1.4 billion[6] and Delta Pine and Land in 2006, worth $1.5 billion.[7]

Swiss-based Syngenta threw itself in the scramble for acquisitions as well, but at a slower pace than Monsanto. In 2004, the company bought a 90 percent stake in Advanta's North American corn and soybean businesses, as well as in the Golden Harvest Group of Companies, increasing its US corn

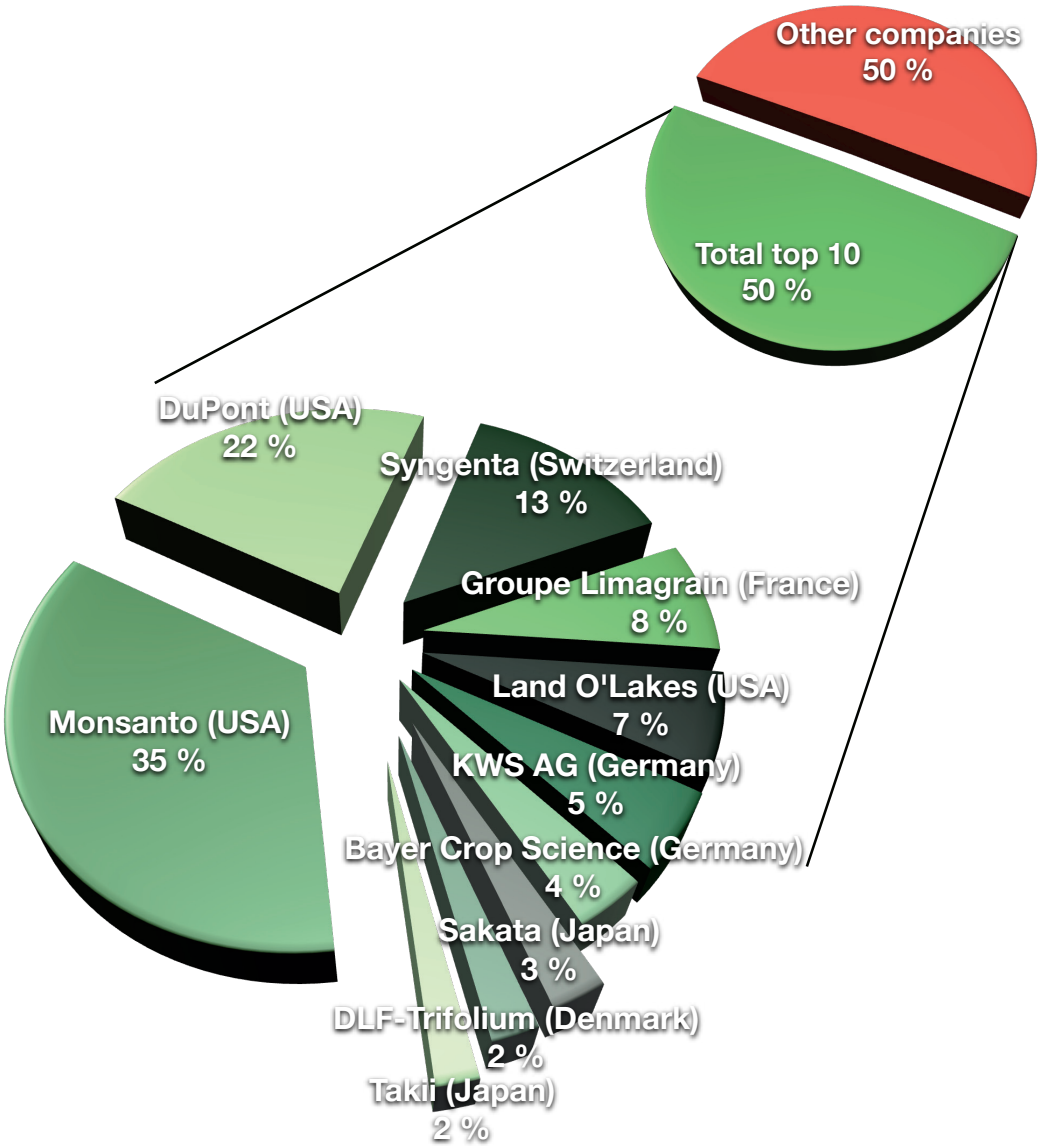
and soybean market share to 15 percent and 13 percent respectively.

DuPont, also headquartered in the USA, struck an important deal at the end of the 1990s, by acquiring the then leader of the seed market Pioneer Hi-Bred International for $7.7 billion.[8] Thereafter, the corporation resorted to a different strategy, made up of agreements with independent companies aimed at sharing germ plasm and involving co-branding and distribution under non-Pioneer brands.[9]

As a consequence, the seed market has become much less competitive, with the top ten seed corporations owning 50 percent of the commercial seed world market. Broken down, this figure reveals that concentration is even higher at the top of the ranking. The top three companies together own 35 percent of the market and the top 5 account for 42 percent. In 1996, the aggregate market share of the ten biggest companies equalled 18 percent, while the relative figure for the biggest three and five corporations were 10 percent and 13 percent, respectively. This means that concentration within the

Chart 2

Top 10 corporations' market share of the global seed market



seed market has increased nearly threefold, if we consider the top ten corporations, and slightly more if we take into account the top three and top five ones.

Market concentration in the pesticide sector dwarfs that of the seed industry. As shown in Charts 3 and 4, the biggest ten corporations together control 82 percent of the pesticides world business. This situation is not new, since it can be traced back at least to the mid-1990s. Furthermore, four out of the ten biggest companies in the pesticide sector are also among the top ten leaders of the seed market. This translates into commercial strategies that give buyers little choice but to buy the products from the same suppliers. The best example is provided once again by Monsanto. The company engineers seeds that are tolerant only to its own herbicides. Hence, the company manages to bridge its pesticides ("crop protection") and seed businesses, increasing customers' dependence on its products.

Chart 4

Top 10 corporations' market share of the global pesticides market

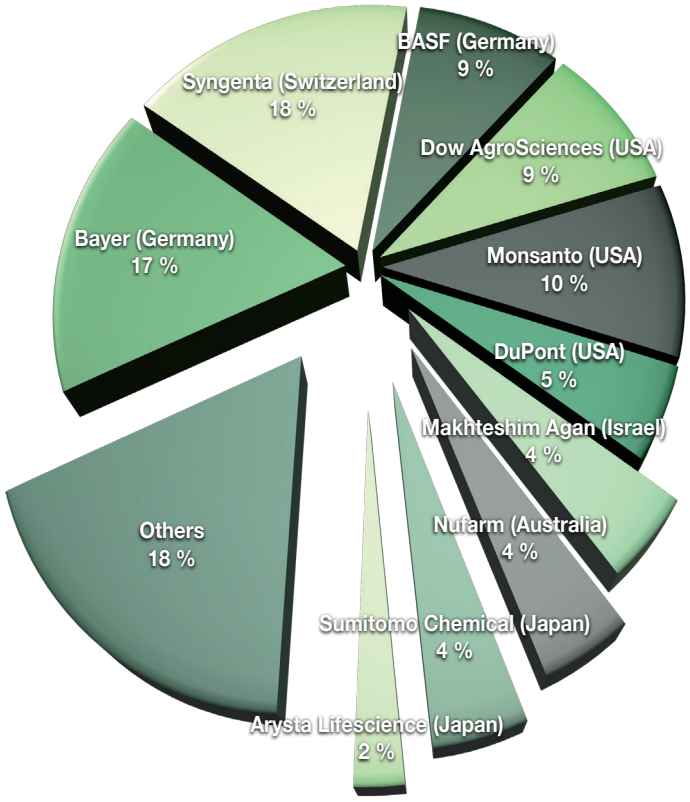
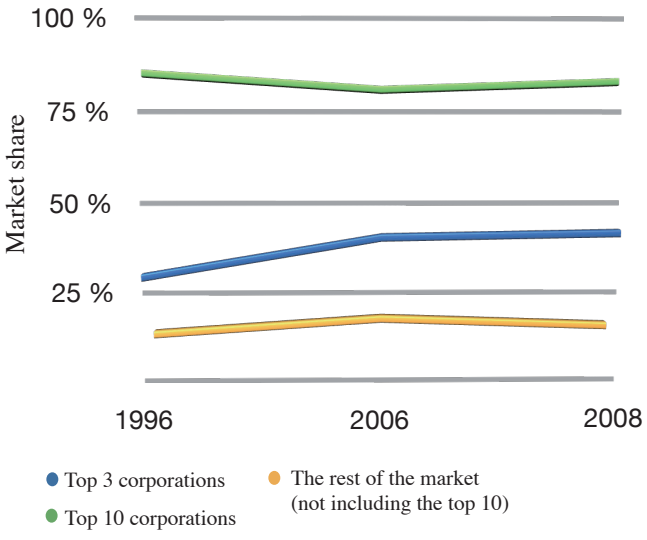


Chart 3

Evolution of market concentration in the global pesticides industry 1996-2008



Endnotes

[1] *Sizing Up the Seed Market*, Seedworld, http://www.seedquest.com/hosting/seedworld/archive/consolidation.htm (accessed on 9 April 2010)
[2] HOWARD PHILIP H., "Visualizing Concentration in the Global Seed Industry 1996-2008", in *Sustainability*, Vol.1, Issue 4, December 2009, p. 1269
[3] Originally they were BASF, American Cyanamid, Zeneca, Novartis, Rhone Poulenc, AgrEvo, DuPont, Monsanto, Dow AgroSciences and Bayer. Then, AgrEvo and Rhone Poulenc merged into Aventis (1999) and BASF purchased American Cyanamid. Finally, in 2000 Zeneca and Novartis gave birth to Syngenta, by merging their agrochemical business (UNCTAD, *Tracking the Trend towards Market Concentration: The Case of the Agricultural Input Industry*, 20 April 2006, p. 4)
[4] Germ plasm is the part of a germ cell that contains hereditary material (chromosomes and genes).
[5] HAYENGA L. MARVIN, "Structural Change in the Biotech Seed and Chemical Industrial Complex", *AgBioForum* – Vol. 1, n. 2, 1998, p. 3
[6] UNCTAD, *op. cit.*, pp. 9-10
[7] HOWARD PHILIP P., *op. cit.*, p. 1276. Because of the acquisition of Delta Pine Land, Monsanto was forced to divest its cotton brand Stoneville, which was then purchased by Bayer Cropscience.
[8] UNCTAD, *op. cit.*, pp. 9-10
[9] HOWARD PHILIP P., *op. cit.,* p. 1276

Country and Regional Focus

This section looks at the seed markets in India, South Africa, Brazil, the United States, the European Union, Tanzania and Cambodia. For each case, an attempt is made to measure market concentration and to provide information about the legal framework pertaining to the protection of plant varieties.

India

The Indian seed market is the sixth largest in the world, with an estimated value of $1.1 billion, accounting for 3.7 percent of the global seed market. India's consumption of commercial seed has skyrocketed in the last two years, running at a 12 percent rate.[1] Multinational corporations are not yet very active. 70 percent of the Indian seed market is made up of saved seeds, 26 percent is distributed through public seed companies and only 4 percent is sold by private companies. Nevertheless, Monsanto and Syngenta are actively engaged in the hybrid seed market through their local branches in India. Compared to the global market, the market in hybrid seeds is growing twice as much in India.[2] The relevance of the Indian seed market is easily grasped when considering that about one sixth of the world population lives in this country and that irrigated land and farmland areas are respectively the largest and second largest in the world.[3]

Legally, India distinguishes itself from other countries presented as it has not joined the International Union for the Protection of New Varieties of Plants (UPOV). In 1966, the Indian government passed a law on seeds that introduced the category of 'notified seeds', namely seeds that have to conform to a certain minimum standard. With the introduction of this law, selling of varieties without prior testing of their quality was forbidden, but the act said nothing about non-notified varieties. Therefore, it did not affect the overwhelmingly traditional exchange of seeds.[4] In 1988, a new policy on seeds development opened up the market to private companies. Imports of vegetable seeds became legal, and companies that struck collaboration deals with foreign corporations were allowed to import crop seeds for two years.

To comply with the Agreement on Trade Related Aspects of Intellectual Property (TRIPS) of the World Trade Organisation (WTO), India devised a *sui generis* system in 2001 by adopting the Plant Variety Protection and Farmers' Rights Act. Despite pressure from the seed industry, the bill defends farmers' rights by allowing them "...to save, use, sow, re-sow, exchange, share or sell his farm produce including seed of a variety protected...".[5] Moreover, it provides that breeders who want to build upon farmers' varieties to obtain an "essentially derived variety" need farmers' permission. Once the authorisation received, a share of the profits yielded by the new variety must be paid to a national gene fund.[6]

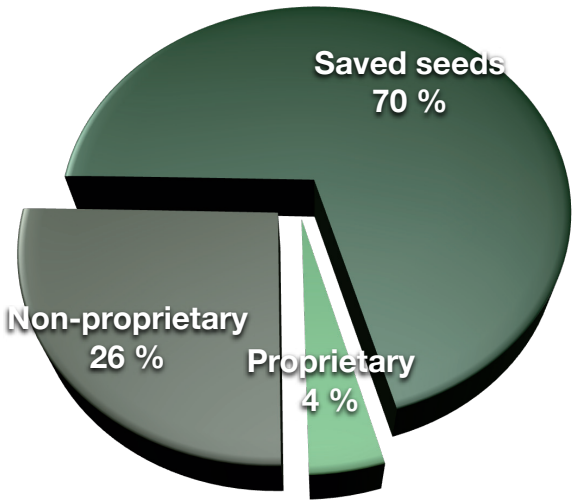
In 2002, India allowed Monsanto to commercialize Bt Cotton in the country.[7] Two years later, the Indian parliament approved a new law on seeds. However, the bill was considered too biased in favour of breeders and its entry into force was put on hold pending a report by the Parliamentary Standing Committee on Agriculture. An amended bill proposed in 2008 has yet to be approved. Therefore, the 1966 Seed Law and the 2001 Plant Variety Protection and Farmers' Rights Act currently regulate the market.

South Africa

The South African seed market is the largest on the African continent, with an estimated value of $300 million.[8] Unfortunately, not

Chart 6

Share of the proprietary, non prorietary and non-commercial segments in the Indian seed market



much data is available about the share of the national market held by private and public companies. The case is presented, nevertheless, because the South African market of genetically modified (GM) seeds is one of the most developed in the world. Suffice it to say that, today, South Africa is the 20th biggest commercial seed market in the world, but it ranks 8th as far as GM seeds are concerned.

In other African countries, farmer-saved seeds represent about 90 percent of the total seed market. In South Africa, a large commercial agricultural sector exists in parallel with widespread subsistence farming by mostly poor smallholders. Commercial agriculture occupies about 80 percent of the agricultural land, while small farmers, which make up about one third of the country's population, till the remainder[9] and chiefly use harvested seeds. In the agro-industrial sector, commercial seeds are predominant.

South Africa has been one of the first countries in the continent to devise a policy on plant variety protection. This can be traced back to 1976, when the Plant Breeders' Rights Act was approved, making provisions for the protection of plant varieties. It was coupled with the Plant Improvement Act, which regulated the distribution and sale of plants and propagating material. In 1978, the country joined UPOV.[10] Farmers' rights are partly addressed in Article 23 of the Plant Breeders' Rights Act, which provides that farmers can re-sow protected seeds insofar as these have been produced on their own land.[11]

This provision notwithstanding, South Africa has "…actively opposed the system of community and farmers' rights embodied in the African Model Law…" and has "…instead sought to develop more traditional systems of intellectual property rights intended to promote the adoption of agricultural biotechnology…".[12] In 1997, the Act on Genetically Modified Organisms paved the way for the introduction of genetically modified (GM) varieties in the maize, cotton and soybean sectors. More recently, the government stated why South Africa must go for GM production: "…South Africa does not have ideal conditions for crop production […] Genetic modification provides a way of meeting the growing demand for food without placing even greater pressure on scarce resources…".[13] Multinationals are therefore actively engaged in the country. Around two thirds of the commercial market is controlled by the ten biggest companies, four of which are among the top ten international brands (Monsanto, Sakata, Syngenta and DuPont).

While still being a small market when compared to Brazil, Argentina and the USA, the share of GM crops in the total production of maize, cotton and soybean are respectively 62 percent, 96 percent and 88 percent.[14] Moreover, market concentration in these specific crop sectors is higher than in the seed market as a whole. Monsanto and Pannar, a local seed company, almost monopolise the wheat and maize seed production, while Monsanto is the only producer of cottonseeds.[15] Not surprisingly, many observers think that multinationals are determined to use South Africa as a launching pad for GM crops in the rest of Africa.

Brazil

The Brazilian seed market accounts for 7.6 percent of the world market, with an estimated value of $1.9 billion, in 2007, the fourth largest market in the world.[16] Like South Africa, Brazil has undergone a series of legal changes throughout the 1990s that have boosted seed market concentration as well as penetration by multinational companies. Brazil is a signatory of the 1978 UPOV Convention and plant variety protection is mainstreamed in the domestic legislation by Law n. 9456 of 1997, which recognizes the granting of plant variety protection certificates. The holder of this certificate enjoys protection of the "…reproducing and vegetative propagating material of the whole plant..."[17] for a period of 15 years.

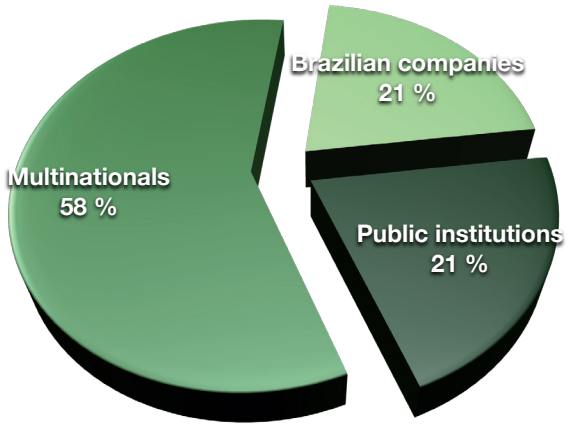
However, breeders' rights are not considered infringed when "…a small rural producer multiplies seed for donation or exchange in dealings exclusively with other small rural producers, under programs of financing or support for small rural producers conducted by public bodies or non-governmental agencies, authorized by the Government…".[18] The law provides compulsory licenses as well. In 2005, the Government passed a law on biosafety, which allows cultivation of GM crops, provided that the demand for research and commercial distribution of the specific crop be approved by the National Technical Committee. The law has been criticized for bestowing the Committee with too much power. Also, many considered the Committee's composition as being blatantly favouring the biotechnology industry.[19]

Aside from the legal framework, concentration has also been spurred by foreign corporations acquiring Brazilian firms. Data is only available regarding the production of corn and soybean seeds, which nevertheless represents 75 percent of the Brazilian seed market. As shown in chart 7, about 58 percent of the corn segment is controlled by multinationals, 21 percent by Brazilian companies and the remainder by public research institutions. Monsanto alone accounts for 20 percent of the corn seed production.

In the soybean segment, multinationals own 28 percent of the market, while public research institutions make up 49 percent.[20] According to a survey conducted by a Brazilian media company, in 2009, the amount of land cultivated with GM seeds became larger than land sown with conventional crops. Transgenic seeds are used in 67.4 percent of the soybean area and 39.5 percent of the corn area (only one year after they had been introduced in the corn industry). In Rio Grande do Sul, the share of transgenic soybean on the total soybean area is as high as 95 percent.[21] Finally, as far as the non-commercial slice of the market is concerned, the average use of farmer-saved corn and soybean seeds equals 16 percent and 45 percent, respectively.[22]

Chart 7

Ownership of the commercial corn seed market in Brazil



The United States of America

With an estimated value of $8.5 billion, the US seed market is the largest in the world (the EU one is bigger but it includes 27 countries).[23] At the same time, it boasts one of the highest rates of adoption of GM crops and of market concentration. GM seeds were easily accepted soon after they were introduced in 1996. According to the

US National Agricultural Statistics Service (NASS), nowadays, 85 percent of the domestic corn acreage, 88 percent of the soybean and 86 percent of the cotton ones are genetically engineered (GE) crops.[24]

The concentration trend, for its part, is embodied in the global seed market leader, Monsanto, which dominates the US market. Either through the brands it owns or through seed traits[25] licensing agreements, Monsanto controls 60 percent of the corn seed, 62 percent of the soybean and about 40 percent of the vegetable seed markets. With regard to genetically engineered seeds, concentration figures are even higher. Monsanto's traits make up 80 percent of the US corn acreage, 91 percent of the soybean and 95 percent of the cotton one, while 95 percent of sugar beets planted in the United States possess the Monsanto's Roundup Ready trait.

It is then no surprise that such a concentration has made prices soar. In 2009, hybrid corn and soybean seeds were, on average, 30 percent and 25 percent more expensive than they were in 2008. Members of the US seed industry reacted to this price hike and called for an antitrust inquiry into the concentration of the seed market, criticizing the anti-competitive practices of the biggest companies.[26]

Although they signed the 1991 UPOV Act, the United States still grants patents for asexually reproduced plants. In principle, the law fairly balances breeders' and farmers' rights. On the one hand, the 1970 Plant Variety Protection Act endows plant breeders with exclusive marketing rights for 18 years.[27] On the other hand, farmers are allowed to re-sow their own seeds and even to sell them, provided that the sale is "...a bona fide sale for other than reproductive purposes...".[28] Yet, Monsanto has sought, and often obtained, legal prosecution of those US farmers who plant saved seeds of Monsanto's protected varieties.

Chart 8

Monsanto's share of the US commercial soybean seed market

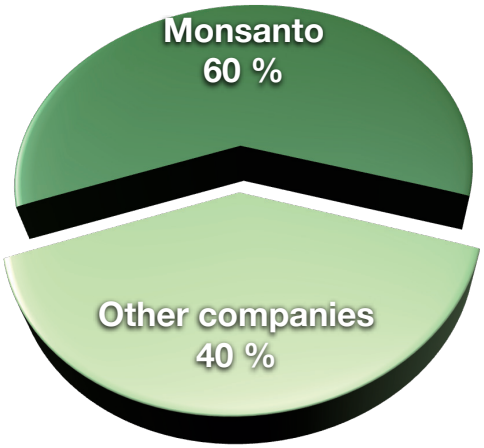
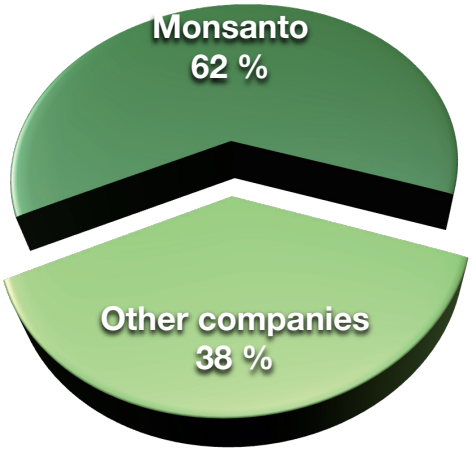


Chart 9

Monsanto's share of the US commercial corn seed market

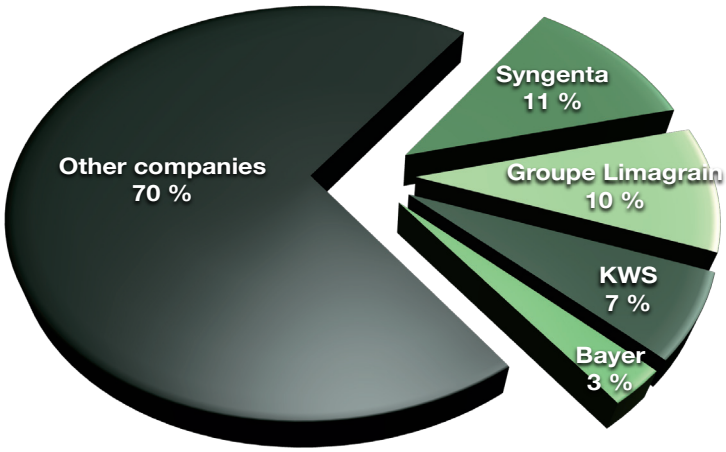


The European Union

The European seed market is valued at $9.5 billion and it is the second biggest regional market, on a par with North America. The EU is also the first global seed exporter with an estimated export value of $3.9 billion, equal to 60 percent of the global export value.[29] Although they have roughly the same size, the European market differs from the American one. On the one hand, market concentration is lower in Europe. No specific data is available on the EU market, but it is possible to estimate concentration by using European sales figures of the four biggest

Chart 10

Top 4 corporations' share of the European commercial seed market



European companies (Syngenta, Groupe Limagrain, KWS and Bayer CropScience). The four firms' share of the $9.5 billion European seed market is approximately 30 percent.[30] This seems to confirm the claim that the European seed industry, mostly made up of small and medium enterprises[31], is less concentrated than the American and the global markets.[32] On the other hand, European governments and citizens are wary of letting GM crops cross their borders. Only one GM crop is allowed for cultivation in the European Union (note that member countries can chose to ban it, as France did in 2008). This is GM maize resistant to insects (Bt. maize). Nevertheless, its rate of adoption has been lower than two percent so far.[33]

Saving seeds still seems to be a widespread practice in some European countries. In France, for instance, it is believed that 50 percent of self-pollinating crops[34] are raised by means of farm-saved seeds, while they account for 90 percent of all major crops in Poland.[35] Curiously, this happens despite legislation that forbids exchange and sale of saved seeds and that defends the intellectual property rights of seed corporations.[36] Plant variety protection within the European Union has been introduced by Regulation 2100/94 of 27 July 1994, aligning with the 1991 UPOV Convention, in which the EU takes part as a regional organization. Breeders can obtain 25 year-long rights applicable in the entire Union by filing a single application to the Community Plant Variety Office, a simplified procedure that has contributed to the harmonisation of plant variety protection laws among EU member states. Under the regulation, farmers are allowed to re-sow their own harvested seed without infringing any breeders' right, but they have to pay a royalty, not higher than 50 percent of the normal price of the seed. Small farmers do not have to pay.[37]

Tanzania

In Tanzania, agriculture is dominated by smallholders and traditional farming, and 80 percent of Tanzanians work in agriculture.[38] As shown in Chart 11, 90 percent of seeds are produced by farmers. Recently, the government has called for a sector reform with the aim of increasing the share of improved seed used by farmers to raise food production by ten percent per year and halve the poverty rate by 2015.[39] The government had already reformed the seed sector in the 1990s, opening up the industry to private production. Recently, the reform has been

Chart 11

Share of farmer saved seeds in Tanzania's seed industry

continued by means of the 2002 Protection of New Plant Varieties (Plant Breeders' Rights) Act and the 2003 Seed Act. The Plant Breeders' Rights Act introduced a *sui generis* system, which resembles the 1978 version of UPOV. It bestows upon breeders' of a new variety exclusive rights for 20 years "… to sell, reproduce and multiply propagating material of the variety, or to stock the variety for any of these purposes…", while assuring that the "…Act shall not affect the fulfilment of the Government's obligations pertaining to the protection of farmers' rights to equitably share and access to traditional cultivars and germ plasm…".[40] However, the rights of farmers are not further specified in the Act. The Seed Act established the Tanzanian Seed Certification Institute, tasking it with enforcing the legislation on seeds.[41]

Thus, improved seeds are slowly spreading in the commercial seed market and the government is also pushing to introduce GM crops. The former public company TANSEED International, the most important actor in the domestic industry, has recently introduced new maize varieties that have improved dramatically the productivity of 50 demonstration plots.[42] Monsanto and DuPont are present in the market along with TANSEED, but they do not control a substantial share of the industry.

Cambodia

Cambodia mostly relies on traditional agriculture to eke out a living. In 2005, about 70 percent of the population tilled the fields and agriculture accounted for about 30 percent of GDP.[43]

Rice, which is grown on 90% of the cultivable area, was the main target of a series of state programmes, funded by international and non-governmental organisations (NGOs), aiming at improving productivity and expanding the cultivated area. Thus, in 1995, the country achieved food self-sufficiency and then turned into a net exporter of rice. The government also introduced improved seeds, fertilizers and pesticides, thus bringing the productivity per hectare from 1.3 tons in the early 1990s to 2.1 tons in 2006.

Rice seeds are developed and distributed by semi-private institutions like AQIP Seed Company (a joint venture owned by the government and private sector members), the Cambodian Agricultural Research and Development Institute (CARDI) and the Rice

As shown in Chart 12, the Thai Charoen Pokphand Group owns 75 percent of Cambodia's corn seed market. The widespread use of hybrid seeds in this segment, with a rate of adoption of 90%-95%, is surprising. The change occurred around 2003 and it is purported to have been brought about by a mysterious disease, called yellowing disease. Hybrids imported from abroad, in fact, were the only seeds resistant to this new disease. Some sources point out that the yellowing disease started soon after foreign hybrids were introduced in the country. According to them, this is more than a simple coincidence.

Source: PURTILL CORINNE, ROEUN VANN, "Seeds of Discontent", The Cambodia Daily, November 2004

Research Institute. Most farmers then harvest and re-sow the seeds they have received in the following seasons.[44] However, it is estimated that AQIP is able to supply only ten percent of the estimated domestic demand for improved seeds.[45]

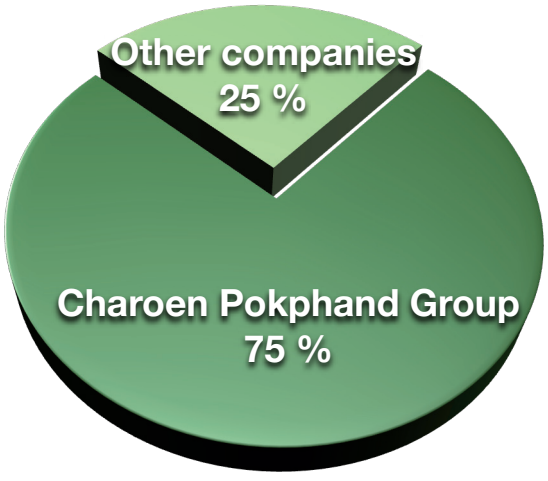
As of 2003, there were no private seed and fertilizer corporations operating in the country.[46] More recently, foreign companies have made inroads into the Cambodian market. This is the case with Kasekor Khmer Rongroeung Co Ltd, a joint venture between the Singapore-based Sunland Agritech and Malaynesia Resources. In 2008, the company distributed seeds and fertilizers to Cambodian farmers and started operating a 2 hectares test plot, which it plans to expand to 200 hectares.[47]

Migration to hybrids has already occurred in the corn sector, where the Thai company Charoen Pokphand Group successfully sold hybrids to Cambodian farmers (see box).

Today, hybrids represent about 90-95 percent of the national corn production and the market share of the Group is between 70 and 80 percent[48], while the remainder is shared by public programmes and multinationals like DuPont.[49] Cambodia is currently drafting a law on seed and breeders' rights, which has been reviewed by UPOV for conformity with the 1991 Convention.[50]

Chart 12

Structure of the commercial corn seed market in Cambodia



Endnotes

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The data about the area cultivated with GM soybean and that about the use of farmer-saved seeds seem inconsistent with each other. How can 67% of the soybean area be sown with GM seed, usually protected by IPRs, if 45% of the soybean seeds are saved by farmers? The answer seems to lie in the fact that this seed is smuggled from neighbouring Argentina, where GM soybean was introduced earlier. According to some authors, this smuggling activity has caused the removal of the ban on GM soybean by the Brazilian government in 2003. They believe that some seed corporations pushed smuggling of GM soybean seeds from Argentina to Brazil to build up later a case for infringment of their intellectual property rights, thus urging the government to recognise the reality on the ground and allow the cultivation of GM soybean.
[23] INTERNATIONAL SEED FEDERATION, *Estimated Value of the Domestic Market in Selected Countries*, June 2008, http://www.worldseed.org (accessed on 9 April 2010)
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[30] This figure is probably an overestimate since the data we used for Syngenta concerns Europe, Africa and the Middle East. Figures have been drawn from statistics provided by corporations in their annual reports. See Appendix I.
[31] EUROPEAN SEED ASSOCIATION, *op. cit.*
[32] As presented at the beginning of the report, the top four global corporations own 39% of the global seed market and Monsanto alone enjoys an impressive dominance on the US market.
[33] The total acreage sown with GM maize is 107,717 hectares, while the EU total agricultural area is equal to 180 million hectares. Spain is the only country that makes extensive use of Bt. maize, with a rate of adoption of about 13%. Data drawn from: GMO COMPASS, *GM Maize: 108,000 Hectares Under Cultivation*, http://www.gmo-compass.org/eng/agri_biotechnology/gmo_planting/392.gm_maize_cultivation_europe_2008.html (accessed on 9 April 2010)
[34] Self-pollinating crops are those which do not need an external pollinator but can reproduce by themselves, since they are endowed with both stigma and stamen. Few plants are actually self-pollinating, like peanuts. Soybean is partially self-pollinating.
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Part Two - The Food Market

Global Perspective

This section provides an overview of the food industry, one step up the food supply chain. Broadly speaking, the industry can be divided into the processing sector, i.e. manufacturing and packaging of food, and the retail sector, i.e. distribution and selling. As Chart 13 shows, the food processing industry is less concentrated than the seed and the pesticides sectors. The share of the top ten global corporations in the global market is 28 percent and the top five companies account for 18 percent. Therefore, we cannot talk about an oligopoly in the global food processing market.[1] Moreover, as illustrated in Chart 14, concentration has not substantially increased over the last eight years. However, this is not the case with food retail. Here, the top 15 global supermarket companies represent more than 30 percent of global sales.[2] As stated by the UN Special Rapporteur on the

Chart 13

Top 10 corporations' share of the global food processing market

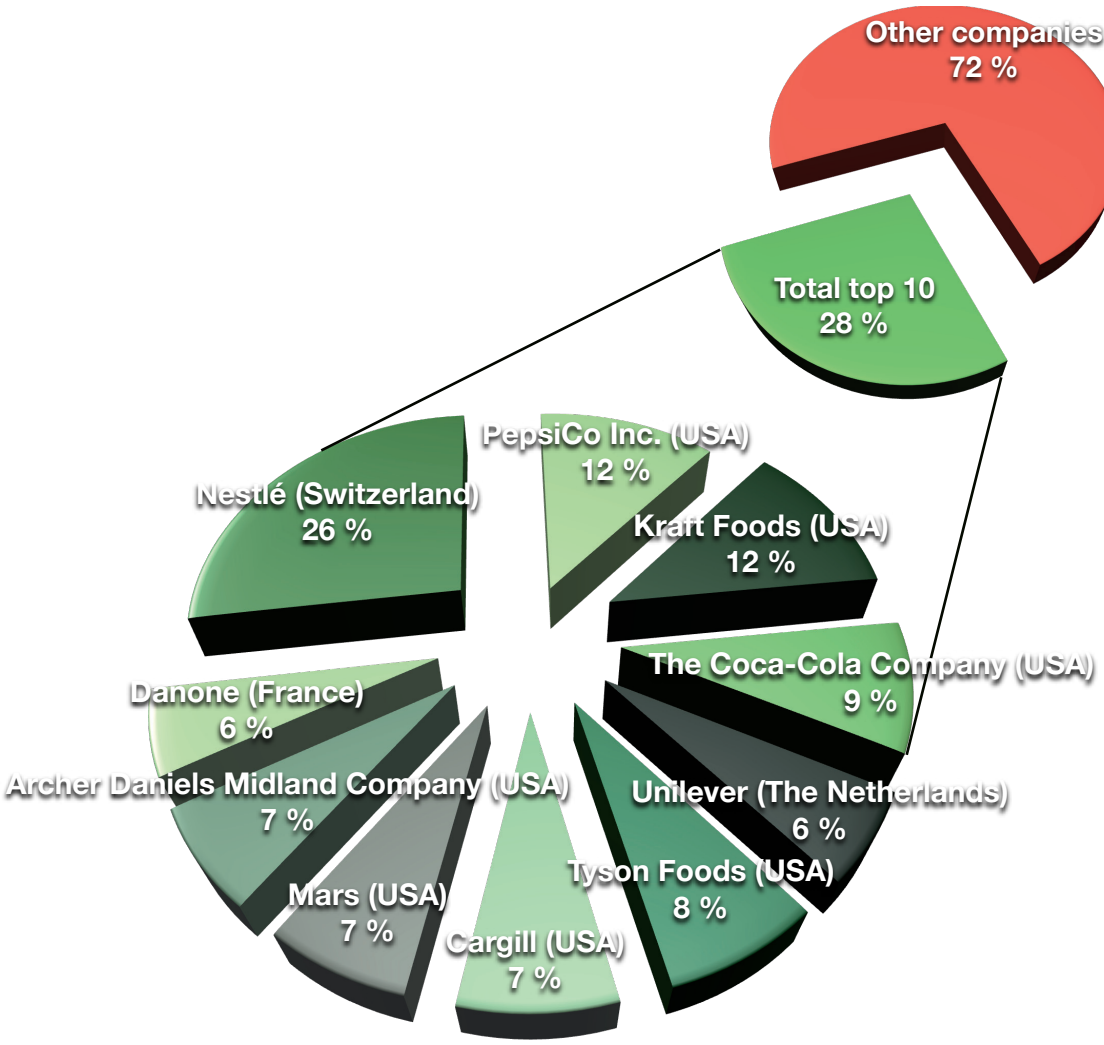
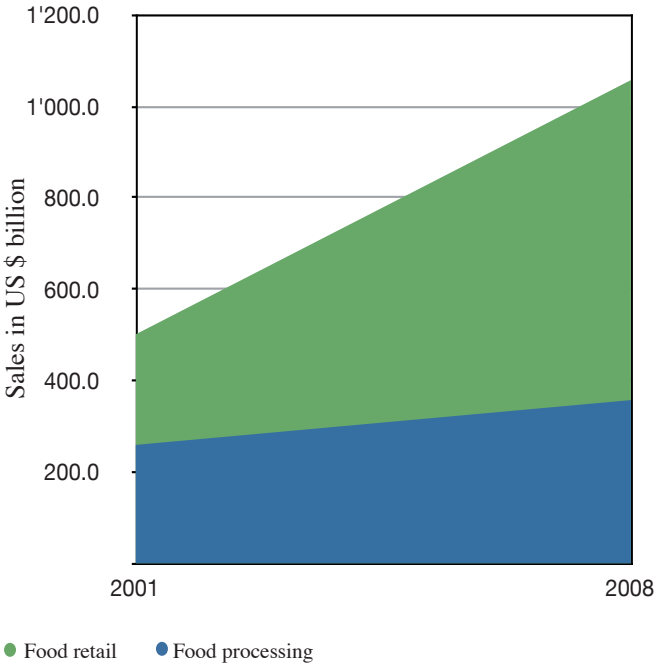


Chart 14

Sales evolution in food retail and food processing 2001/2008



the right to food, Oliver De Schutter, "... global retailers and fast food chains are expanding...."[3], This is evidenced by data showing that the top 10 retail corporations have more than doubled their share of the global food retail market since 2001. While the food retail sector has followed the concentration path that other industries have been treading for the last twenty years, the food processing sector seems not to have undergone the same trend. From the companies' perspective, the reason for this lies in the fact that the processing industry is not as close to customers as food retailers are and, thereby, is adjusting more slowly to their tastes. Such adjustment is also more expensive, since customers in different countries have different tastes, hampering the centralisation of production sought by corporations in order to realize economies of scale.[4] For the same reason, market concentration, which is not yet of concern globally, can be higher for specific product lines or in national markets.[5] Note that the skyrocketing increase in market concentration in the food retail sector can have negative consequences on the supply chain. This is clearly the case with Wal-Mart, the global leader in food retail. The rapid growth of the company not only threatens market competition in general, but it also tends to reduce wages and working standards in the food industry as a whole. With over $400 billion in sales, the company is able to impose its own prices on suppliers, squeezing out revenues from smaller companies along the supply chain.[6] As De Schutter noted "...Due to deeply unequal bargaining positions of food producers and consumers on the one hand, and buyers and retailers on the other hand, the latter can continue to pay relatively low prices for crops even when the prices increase on regional or international markets, and they can continue charge high prices to consumers even though prices fall on these markets...".[7] This may reduce wages and worsen working conditions of agricultural workers as well as make commodities' prices soar, eventually jeopardizing the right to food. States should then protect agricultural workers through a sound labour legislation and strengthen farmers' bargaining power by promoting alternative trading and distribution channels.[8]

Endnotes

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[3] DE SCHUTTER OLIVER, *Agribusiness and the Right to Food, Report of the Special Rapporteur on the Right to Food*, UN document A/HRC/13/33, 22 December 2009, para. 6. We stress the importance of this report, which also contains recommendations to government and agribusiness.
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Country and Regional Focus

India

The Indian food market is estimated at $91.7 billion, with the processing segment accounting for $29.4 billion. Although it is the fifth largest industry in the country, it is still in inception. Processed food makes up only 2 percent of total agriculture and food produce in the country. The government has put food processing and retail high on its agenda and is both easing legislation and increasing investments in the sector.[1]

Considering the immense potential for growth, multinationals have already entered the market. Unilever, Nestlé, Pepsi and Cadbury are presently the most important actors.

Today, small retailers account for 97 percent of sales. With twelve million shops, India has the largest density of groceries in the world. Big corporations plan to bring their 3 percent share to 15-20 percent within a few years. Investments are planned not only by foreign corporations, but also by domestic firms like Reliance, Tata and Birlas.[2]

Chart 15

Structure of the Indian retail market

South Africa

Chart 16

Top 4 corporations' share of supermarket retailing in South Africa

Retail through supermarkets in South Africa accounts for about 55% of the total food retail and it is dominated by the above companies.

The South African food market is almost equally divided into an informal food retailing sector and a retail system based on the supermarket format. The latter accounts for about 55 percent of the total food market. It is dominated by a small group of domestic and international firms.[3] Pick'n Pay, Shoprite, SPAR and Woolworths together own 88.5 percent of all supermarkets (with 33 percent, 30 percent, 13.5 percent and 12 percent, respectively). These figures indicate that consolidation and concentration are ongoing in the South African retail system, where supermarket chains are crowding out fresh produce markets.[4]

Trans-nationalisation is also on its way in the food processing sector. Unilever, Nestlé, Procter & Gamble, the Bidvest Group, Foodcorp and Pioneer Foods make up most of South African food processing sales along

with domestic firms like Tiger Brands, National Brands, Tongaat-Hulett Group and Illovo Sugar.[5] Market concentration is thus also high in the food processing segment, although it varies widely from one produce line to the other. On average, the market share of the top four companies is about 57 percent. This concentration co-exists with numerous small and medium sized enterprises that supply the informal retail system.[6]

Brazil

Unfortunately, little data about the Brazilian food market is available in literature (therefore, this section is less detailed than the previous ones).

In 2001, Brazilian food consumption accounted for 19 percent of the global market, with an aggregated value of $19 billion. Informal enterprises made up 79 percent of food retail, while foreign firms dominated the rest, owning 90 percent of all supermarkets. Carrefour was the then market leader.[7]

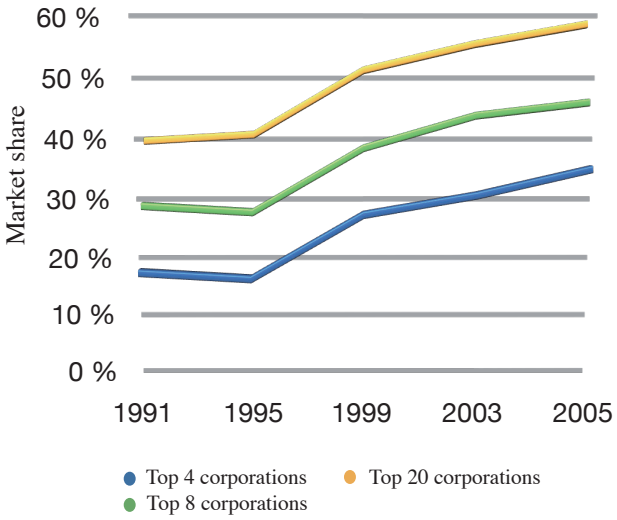
Today, the picture is different. Formal retail constitutes 46 percent of the total retail market and hypermarkets have a share of 53 percent.[8] Carrefour remains the food retail leader, followed by the Brazilian firm Pão de Açúcar and American Wal-Mart. All in all, the top five supermarket chains make up roughly 40 percent of total sales.[9]

The United States of America

The American food market has been estimated at about $1.5 trillion, with food retail accounting for most of it. A handful of companies are leading the food processing sector, which has undergone a process of consolidation and concentration mostly through mergers. As a consequence, processing plants have become fewer and bigger. Concentration has particularly increased in the diary and meat subsectors. In the former, in 2004, fewer than half of the plants produced twice as much milk as in 1994. In the latter, the four largest hog slaughter firms owned 64 percent of the market.[10] Nevertheless, the US food processing industry as a whole remains quite competitive and profit margins are low.[11]

Chart 17

Evolution of market concentration in the US food retail industry 1991-2005



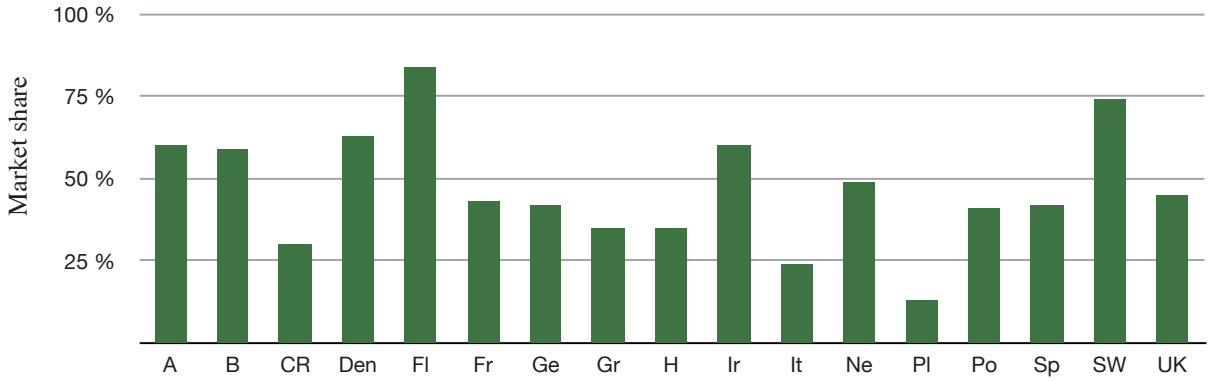
As far as food retail is concerned, two major trends can be highlighted. On the one hand, non-traditional retailers have spread, chiefly embodied by supercenters like Wal-Mart (a combination of supermarkets and store areas for general merchandise), increasing their market share from 13.4 percent in 1988 to 32.6 percent in 2006.[12] On the other hand, market concentration has increased. As shown in Chart 17, the market share of the top twenty food retail companies was equal to 62 percent in 2005, while just a decade earlier it was less than 40 percent. Likewise, the market share of the top four corporations was well above 30 percent, having increased about ten percent over ten years.[13] Foreign companies improved their penetration as well, increasing their market share from 6.8 percent in 1988 to 17.7 percent in 2006.[14]

The European Union

The food market is the second largest manufacturing sector of the European Union. Estimated at $1.3 billion, it represents

Chart 18

Top 4 corporations' share of the domestic food retail market in some European countries



13.5 percent of the total revenue of the manufacturing industry. At the same time, the EU is the first food and drink exporter in the world, accounting for a 20 percent share of the total export value. Nevertheless, this leadership has been eroded by five percent over the last ten years.[15]

The European food processing sector is highly fragmented. While there are some multinational companies able to compete worldwide, 99 percent are small and medium enterprises.[16] This situation is curious, because the fragmentation in food processing goes hand in hand with a high concentration in food retail. For instance, in 2004, non-specialised retailers with more than 250 employees accounted for just 0.2 percent of European enterprises, but they realised 71.2 percent of revenues.[17] As a consequence, the market share of the top three food retailers was, on average, 40 percent, reaching more than 75 percent in Nordic countries.[18] Moreover, while the ten biggest retailers experienced a 59 percent growth of their sales over five years, the food processing companies lost about 12 percent of their sales over the same period.[19]

Tanzania

In Tanzania, the food processing industry is almost inexistent, as illustrated by the large share – estimated at between 40 and 80 percent – of agricultural produce that perishes before reaching consumers.[20] For instance, 99 percent of farm animals are held by small owners who use them mainly for milk production. Likewise, in the dairy sector, processing is chiefly carried out by small producers who sell their products in rural or urban fresh markets. Cooperatives are important, thanks also to Tanzania Diaries Limited, a parastatal company that has become the major domestic buyer of farmers' milk.[21]

Food retail is dominated by mini-markets, small groceries and fresh markets, although the number of supermarkets is on the raise. While in 2002, there were only four supermarkets in the entire country[22], whose population is about 40 million, in 2006, they numbered 48, accounting for 21 percent of the vegetable and 7 percent of the fruit supply.[23] The sector is dominated by the South African firm Shoprite, along with the local Imalaseko and Shopper's Plaza. To cope with supply shortages of local products, Shoprite is partly importing produce from South Africa.[24]

Cambodia

Likewise, corporate structures have not penetrated the Cambodian food sector yet. In rural areas, households produce about 30 percent of their own consumption and purchase the remainder from the market.

Poor roads hamper access of the rural population, which accounts for about 80 percent of the total, to the wider domestic market.[25] Processing is affected by the lack of infrastructure as well. Rice mills work at about 60 percent of their capacity because they do not have enough working capital. Moreover, only four of them meet quality and quantity requirements for export. As a result, a major part of Cambodia's paddy is milled in neighbouring countries and then re-imported.[26]

Large-scale domestic producers operate in the fish sauce, soy sauce and noodle markets, where "President Foods Cambodia" owns a 40-45 percent share. Wheat flour is mostly imported.[27]

Supermarkets and shopping malls are concentrated in Phnom Phen and a couple of other urban centres like Siem Reap and Preah Sihanouk, where about 20 percent of the population lives. This portion of the market is currently dominated by domestic retailers like Lucky Supermarket.[28]

Endnotes

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[28] See LODISH EMILY, "Fast Food Giants Still Holding Off on Cambodia", *The Cambodia Daily*, July 4, 2007, http://www.camnet.com.kh/cambodia.daily/selected_features/cd-Jul-4-2007.htm (accessed on 9 April 2010) and ROSSITER JAMES, "Shopping Mall Developer Moves into Cambodia", *Times Online*, June 12, 2007, http://business.timesonline.co.uk/tol/business/industry_sectors/construction_and_property/article1923089.ece (accessed on 9 April 2010)

Conclusion

As evidenced in the previous pages, market concentration is increasing in both the seed and the food industry, although some exceptions can be found at the country level. However, the extent and the pace of the process differ. While the global seed and pesticides markets are becoming more and more oligopolistic, meaning that an increasingly smaller group of firms controls the market, the trend is less pronounced in the food sector. A market is generally considered competitive as long as the top four firms together account for not more than 40 percent of industry sales.[1] With this lens, the global seed market still appears competitive, since the top four corporations together "only" hold 39 percent of the total. What is striking, however, is that, in 1996, their aggregated market share was just 12 percent, marking a raise of more than 300 percent since then. Not surprisingly, among the case studies, India, Tanzania and Cambodia stand out as countries in which farm-saved seeds make up the majority of seeds used. In all the other cases examined, commercial seeds hold the lion's share and, on average, market concentration follows global trends. The global food market is less concentrated since the top ten food processors and retailers own about 30 percent of the world market. Nevertheless, it is noteworthy that concentration in the food retail industry has more than doubled since 2001. India, Tanzania and Cambodia stand out once again. India, in fact, boasts the highest density of small groceries in the world, with small retailers accounting for 97 percent of domestic sales. In Tanzania and Cambodia, food processing and marketing activities are limited. In Brazil and South Africa, the top four retailers account for an estimated 20 percent and 50 percent, respectively, of the domestic food retail market, while in the USA and the EU, they realize about 40 percent of domestic sales. In India, Tanzania and Cambodia, concentration in food retailing is not yet an issue. In Brazil, the sector shows a lower concentration than the global average, while in the EU, the USA and South Africa, concentration is well above that average. Although the sample of cases under analysis is small, it seems to indicate that market concentration in the food supply chain is expanding across the world. Out of seven case studies, four are – at least partially – affected by the two trends described. India, Tanzania and Cambodia still rely mostly on traditional farming, but, as described above, governments in these countries are introducing new legislation and technologies aimed at reinforcing IP systems and modern farming techniques. Even though no single corporation is – as of yet – directly operating in both industries, rising market concentration might have negative consequences on small producers. On the one hand, the more widespread use of commercial, proprietary seeds and crop protection products may make small producers highly dependent on big corporations to supply inputs. On the other hand, the growing market power and limited number of food retailers threatens the capacity of small producers to ask for sustainable prices. Therefore, in a scenario where market concentration soars in both the seed and the food sectors, small producers might find themselves squeezed between high prices on the supply side and low prices on the demand side, due to reduced competition in both.

[1] HOWARD PHILIP H., *op. cit.*, p. 1270.

Appendix I
How Different Countries Protect Their Plant Varieties

As pointed out in "Seeds of Hunger", the international intellectual property rights regime is strongly influencing national agricultural systems. While IPRs can potentially contribute to development, the more recent international legal instruments aiming at harmonising and reinforcing IP protection do not always match developing countries' needs for flexibilities.

The two main international legal instruments are:

- the International Convention for the Protection of New Varieties of Plants signed in 1961, with its three acts (1961, 1978 and 1991)
- the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) signed in 1994 (annex to the Marrakesh Agreement, which established the World Trade Organisation).

The 1961 Convention established the International Union for the Protection of New Varieties of Plants (UPOV), an intergovernmental organisation based in Geneva, Switzerland. It has been revised in 1972, 1978 and 1991. Each UPOV act provides a slightly different way of plant variety protection. Countries that have joined the organisation before 1991 are bound by the older acts, while newcomers must sign the Act of 1991, which entails tighter IP protection.

The TRIPS Agreement requires that all WTO members have a system of new plant varieties protection, either through patents or through *a sui generis* system. WTO members are not required to join UPOV, considered to be the most widespread *sui generis* system. However, pressure on developing countries to join is strong, for instance in bilateral free trade negotiations.

Table 1
A comparison of three IPR systems for plant varieties

Criteria	UPOV 1978	UPOV 1991	Utility patents (USA)
Scope of protection	Varieties or species listed by the country	Varieties of all genera and species (within 10 years of joining)	Varieties of any sexually reproduced plants
Duration of protection	Minimum 15–20 years (depending on crop)	Minimum 20–25 years (depending on crop)	20 years (from filing date)
Disclosure	Description of variety (DUS)	Description of variety (DUS)	Enabling or best mode disclosure plus deposit of novel material
Rights	Prevent others from commercializing the propagating materials	Prevent others from commercializing the propagating materials and, under certain conditions, using harvested material	Prevent others from making, using, selling the invention or selling a component of the invention
Breeder's exemption	Use in breeding allowed	Use in breeding allowed, but shared rights for EDVs	Use in breeding not allowed
Seed saving	Allowed on own holding	Only allowed for listed crops	Not allowed
Seed exchange	Allowed if non-commercial	Not allowed	Not allowed

Source: TRIPP ROBERT, LOUWAARS NIELS, EATON DEREK, "Plant Variety Protection in Developing Countries, a Report from the Field", *Food Policy,* 32(2007), p. 358.

The difference between UPOV's plant variety protection acts and patents is not always clear. Therefore, Table 1 provides a brief comparison between them and Table 2 lists membership by country of the main international instruments of plant variety protection. The table contains six columns, listing whether a country:

1. is a WTO member, making it compulsory to implement a plant variety system (TRIPS)
2. is a UPOV member (the applicable UPOV act is specified) or has initiated the procedure for becoming a member (marked by X)
3. has enacted a non-UPOV *sui generis* system
4. has signed the Bangui Agreement
5. provides plant variety protection through patents.

Two points need further explanations. First, the Bangui Agreement established the African Intellectual Property Organisation in 1999. This is relevant to the discussion because in Annex X of the Agreement, the members committed themselves to join UPOV and the model they adopted in the meantime is shaped according to the UPOV 1991 Act. Also, while many countries have designed specific plant variety protection legislation, few among them have devised a truly non-UPOV *sui generis* system. India and Thailand are the most cited examples. Another remarkable initiative is the Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources adopted by the Organisation of African Unity. The latter is not taken into account in the table because it is not a law as such, but a model that African countries can use when designing their own laws. The main feature of *sui generis* instruments outside UPOV is that they give wider attention to farmers' rights than UPOV acts do.

Table 2

COUNTRY	WTO	UPOV	NON-UPOV	BANGUI	PATENT
Afghanistan					
Albania		91			
Algeria					
Andorra					
Angola					
Antigua&Barbuda					
Argentina		78			
Armenia		X			
Australia		91			
Austria		91			
Azerbaijan		91			
Bahamas					
Bahrain					
Bangladesh					
Barbados					
Belarus		91			
Belgium		72			
Belize					
Benin		X			
Bhutan					
Bolivia		78			
Bosnia&Herzegovina		X			
Botswana					
Brazil		78			
Brunei					
Bulgaria		91			
Burkina Faso		X			
Burundi					
Cambodia					
Cameroon		X			
Canada		78			
Cape Verde					
Central African Republic		X			
Chad		X			
Chile		78			
China		78			
Colombia		78			
Comoros					
Congo DRC					
Congo		X			
Costa Rica		91			
Côte d'Ivoire		X			
Croatia		91			
Cuba					
Cyprus					

COUNTRY	WTO	UPOV	NON-UPOV	BANGUI	PATENT
Czech Republic		91			
Denmark		91			
Djibouti					
Dominica					
Dominican Republic		91			
East Timor					
Ecuador		78			
Egypt		X			
El Salvador					
Equatorial Guinea		X			
Eritrea					
Estonia		91			
Ethiopia					
European Community		91			
Fiji					
Finland		91			
France		78			
Gabon		X			
Gambia					
Georgia		91			
Germany		91			
Ghana					
Greece					
Grenada					
Guatemala		X			
Guinea		X			
Guinea-Bissau		X			
Guyana					
Haiti					
Honduras		X			
Hungary		91			
Iceland		91			
India		X			
Indonesia					
Iran					
Iraq					
Ireland		78			
Israel		91			
Italy		78			
Jamaica					
Japan		91			
Jordan		91			
Kazakhstan		X			
Kenya		78			
Kiribati					

COUNTRY	WTO	UPOV	NON-UPOV	BANGUI	PATENT
Korea, North					
Korea, South		91			
Kuwait					
Kyrgyzstan		91			
Laos					
Latvia		91			
Lebanon					
Lesotho					
Liberia					
Libya					
Liechtenstein					
Lithuania		91			
Luxembourg					
Macedonia		X			
Madagascar					
Malawi					
Malaysia		X			
Maldives					
Mali		X			
Malta					
Marshall Islands					
Mauritania		X			
Mauritius		X			
Mexico		78			
Micronesia					
Moldova		91			
Monaco					
Mongolia					
Montenegro		X			
Morocco		91			
Mozambique					
Myanmar					
Namibia					
Nauru					
Nepal					
Netherlands		91			
New Zealand		78			
Nicaragua		78			
Niger		X			
Nigeria					
Norway		78			
Oman		91			
Pakistan					
Palau					
Panama		78			

COUNTRY	WTO	UPOV	NON-UPOV	BANGUI	PATENT
Papua New Guinea					
Paraguay		78			
Peru		X			
Philippines		X			
Poland		91			
Portugal		78			
Qatar					
Romania		91			
Russian Federation		91			
Rwanda					
Saint Kitts and Nevis					
Saint Lucia					
Saint Vincent and the Grenadines					
Samoa					
San Marino					
Sao Tome and Principe					
Saudi Arabia					
Senegal		X			
Serbia		X			
Seychelles					
Sierra Leone					
Singapore		91			
Slovakia		91			
Slovenia		91			
Solomon Islands					
Somalia					
South Africa		78			
Spain		91			
Sri Lanka					
Sudan					
Suriname					
Swaziland					
Sweden		91			
Switzerland		91			
Syrian Arab Republic					
Tanzania					
Tajikistan		X			
Thailand					
Togo		X			
Tonga					
Trinidad and Tobago		78			
Tunisia		91			
Turkey		91			
Turkmenistan					

COUNTRY	WTO	UPOV	NON-UPOV	BANGUI	PATENT
Tuvalu					
Uganda					
Ukraine		91			
United Arab Emirates					
United Kingdom		91			
United States of America		91			
Uruguay		78			
Uzbekistan		91			
Vanatu					
Venzuela		X			
Vietnam		91			
Yemen					
Zambia					
Zimbabwe		X			

Sources:

UPOV official website: www.upov.int; WIPO official website: www.wipo.int; GRAIN official website: www.grain.org; Farmers' Rights Project official website: www.farmersrights.org

Appendix II - Data Sources for Charts

Charts 1-2:

Sources for 2008 sales:

BAYER CROPSCIENCE, *Bayer CropScience accelerates expansion of biotech and seed business with investments of around EUR 3.5 billion through 2018*, News Release, 17 September 2009, http://www.bayercropscience.com/bcsweb/cropprotection.nsf/id/EN_20090917_1 DU PONT, *2008 Data Book*, http://phx.corporate-ir.net/phoenix.zhtml?c=73320&p=irol-irhome
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LAND O'LAKES INC., *Growing Together, 2008 Annual Report*, http://www.landolakesinc.com/media/2008AnnualReport/2008AnnualReportVideo/index-s.html
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MONSANTO, *Growing Together, 2009 Annual Report*, http://www.monsanto.com/investors/financial_reports/annual_report/2009/default.asp
SYNGENTA, *Key Facts*, http://www.syngenta.com/en/investor_relations/thisissyngenta_keyfacts.html

Unfortunately 2008 figures for Takii Seed Corporation and DLF-Trifolium were not available. We have therefore used the 2007 data. These have been drawn from ETC GROUP, *Who Owns Nature, Corporate Power and the Final Frontier in the Commodification of Life*, November 2008
The 1985 and 1996 market shares have been calculated out of data provided by the former Secretary of the International Seed Federation, Bernard Le Buanec in "News and Views", *Seed Info*, n. 35, July 2008, p. 9
The 2008 market share has been calculated out of the data used in the first chart. With regard to the value of the global commercial seed market, we referred to the International Seed Federation's estimates, available at www.worldseed.org

Charts 3-4:

Sources for 2008 sales:

BAYER CROPSCIENCE, *Creating Value through Innovation and Growth, Facts and Figures 2008-2009*, http://www.bayercropscience.com/bcsweb/cropprotection.nsf/id/EN_Publications?open
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BRICE ANDY, "Agrochemical Market Shows Strength in Downturn", *ICIS.com*, 9 June 2009, http://www.icis.com/Articles/2009/06/16/9223643/agchem-market-shows-strength-in-

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DOW CHEMICAL, *Elements of Success, The Dow Chemical Company 2008 10-K and Stockholder Summary*, http://www.dow.com/financial/fin_reports/index.htm
DU PONT, *2008 Data Book*, http://phx.corporate-ir.net/phoenix.zhtml?c=73320&p=irol-irhome
MAKHTESHIM AGAN INDUSTRIES LTD., *Condensed Consolidated Interim Financial Statements*, 30 September 2009, http://www.ma-industries.com/InvestorRelations/Financial-Reports/tabid/65/Default.aspx
MONSANTO, *Growing Together, 2009 Annual Report*, http://www.monsanto.com/investors/financial_reports/annual_report/2009/default.asp
NUFARM LIMITED, *Annual Report 2009*, 28 September 2009, http://www.nufarm.com/AnnualReports
SUMITOMO CHEMICAL COMPANY, *Consolidated Financial Results for the Year Ended 31 March 2009*, 11 May 2009, http://www.sumitomo-chem.co.jp/english/ir/tansin.html
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The estimate of the 1996 pesticide global market has been drawn from: OWEN MIKE, *Report of Global Pesticide Sales for 1996*, Iowa State University, http://www.weeds.iastate.edu/weednews/global.htm

Charts 5-12:

Chart 5: DUNKLE RIC, *Need for Nappo and Ippc Standards in the Seed Industry*, Presentation at the 33rd NAPPO Annual Meeting, 19-23 October 2009, Chicago, http://www.nappo.org/annualmtg/2009/AnnualMtg2009-e.htm

Chart 6: SHRIVASTAVA ARUN, *The Silent War on the People of India,* thepeoplevoice.org, 22 March 2009, http://www.thepeoplesvoice.org/cgi-bin/blogs/voices.php/2007/03/22/the_silent_war_on_the_people_of_india

Chart 7: CORDEIRO ANGELA, PEREZ JULIAN, GUAZZELLI MARIA JOSE, P*otential Impact of the Terminator Technology on Agricultural Production: Statement from Brazilian Farmers*, Florianopolis, December 2007, Centro Ecologico/ETC Group, pp. 7-9

Charts 8 and 9: HUBBARD KRISTINA, *Out of Hand, Farmers Face the Consequences of a Consolidated Seed Industry, Farmer to Farmer Campaign*, December 2009, pp. 8-9, http://farmertofarmercampaign.com

Chart 10: see chart 1's data and note 29 of the relevant chapter.

Chart 11: MUSHI DEOGRATIAS, "Improved Seeds Help Boost Crop Production", *Daily News*, August 20, 2008, http://dailynews.habarileo.co.tz/editorial/index.php?id=6711

Chart 12: SHAKCHAI PREECHJARN, *Grain and Feed, Grain Industry in Cambodia*, USDA, 2006, p.8.

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UNILEVER, *Annual Report and Accounts 2008*, http://www.unilever.com/investorrelations/annual_reports/annual_report_Form/index.aspx
TYSON FOOD INC., *2008 Annual Report*, http://ir.tyson.com/phoenix.zhtml?c=65476&p=irol-reportsAnnual

Unfortunately, we could not obtain updated figures for Mars and Cargill. We thus used 2007 data drawn from ETC GROUP, *op. cit.*, November 2008
The value of the global food processing market refers to 2007 sales and has been drawn from: ETC GROUP, *op. cit.*, November 2008

Source for 2001 food retail sales:
ETC GROUP, *op. cit.*, November 2008

Source for 2008 retail sales:
BUSINESS WIRE, *Research and Markets: The Top 10 Food Retailers Recorded Revenues of $1,057.1 Billion in 2008, an Increase of 6.4% Over 2007*, 28 October 2009.

Charts 15-18:

Chart 15: INDIA FDI WATCH, *Corporate Hijack of Retail Trade*,
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Chart 16: CHIKAZUNGA D., JORDAN D., BIENABE E., LOUW A., *Patterns of Restructuring Food Markets in South Africa: The Case of Fresh Produce Supply Chains*, University of

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Chart 17: UNITED STATES DEPARTMENT OF AGRICULTURE, *Food Marketing System in the US: Food Retailing*, Briefing Rooms, 22 August 2007, http://www.ers.usda.gov/Briefing/FoodMarketingSystem/foodretailing.htm

Chart 18: CONFEDERATION DES INDUSTRIES AGRO-ALIMENTAIRES DE L'UE, Data and Trends of the European Food and Drink Industry 2008, January 2009, p. 17

All websites have been accessed on 9 April 2010.