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CLES
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Director: Professor Ioannis Lianos

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Faculty of Laws, UCL
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United Kingdom

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Executive summary

The Bayer/Monsanto merger forms part of the recent wave of mega-mergers that has transformed the structure of the factors of production segments of the global food value chain in recent decades. If it is approved, it will lead to the creation of a tight oligopoly of three multinationals that will control almost 2/3 of the global production in seeds and agro-chems, as well as the valuable Big Data and IT platforms that are crucial for "smart farming". This high level of concentration will undoubtedly lead to price rises for seeds and pesticides, the increase of the technological and economic dependence of farmers on a few global integrated one-stop shop platforms, the reduction of independent centres of innovation activity in the industry and consequently of innovation, due to reduced competition.

More importantly, this merger is about control of the global food value chains as well as of the direction of the innovative effort in this industry in the next few decades. Recent technological advances enable us to envision a future away from the agro-chem model of agricultural production, with the adoption of a production model that is respectful of the environment and biodiversity, and also providing smallholders more opportunities to increase their revenue and the independence to invest in innovative ways of farming. By ensuring that the global food value chain remains tightly controlled by three mega-corporations (and their integrated platforms), the recent merger wave in this industry will lead to entrench the market power of the dominant players for the decades to come and to freeze the innovative effort to R&D that is compatible with the business model of the incumbents.

EU competition law should intervene to make sure this does not happen. EU merger control should focus on the effects of the merger on innovation and the likelihood of constrained choice for farmers, which will be locked in integrated one-stop shop platforms. The absence of interoperability between the products of each platform, the farmers being offered packaged farming solutions, from IT and agricultural machinery to seeds and pesticides, and the foreclosure of existing and potential competition, may affect the development and diffusion of new technologies and of innovative ways of farming. The likelihood of collusion may also increase in view of the control of the tight oligopoly that will result from this merger by a limited number of institutional investors and the cross-ownership of competing agro-chem platforms.

* Ioannis Lianos is Professor of Global Competition Law and Public Policy and the Director of the Centre for Law, Economics and Society at the Faculty of Laws, UCL, as well as the chief researcher of the HSE-Skolkovo Institute for Law and Development. Dmitry Katalevsky is Associate professor of the Institute of Business Studies within the Russian Presidential Academy of National Economy and Public Administration and senior researcher at the HSE-Skolkovo Institute for Law and Development. This research paper has been prepared for, and with the funding of, Corporate Europe Observatory, Friends of the Earth Europe, Food&Water Europe, SumOfUS, and WeMove Europe. The views expressed in this paper are, however, strictly those of the authors.

More importantly, the recent mega-merger wave raises the question of the future control of global agricultural production, in view of the important progress of synthetic biology and the possibility of editing/constructing DNA. One of the most valuable productive asset in agricultural production will not anymore be the control of genetic material (e.g. seeds) but the control of genetic information (e.g. DNA sequences), the next generation biotech leading to revolutionary changes in bioengineering tools, enabling the systematic design of phenotypes by manipulation of genotypes. The economic actor that will control this strategically essential abstract information, for instance through Intellectual Property (IP) Rights, will finish by controlling physical living DNA designs. This may engender profound structural changes in the industry and will entrench the bargaining differential between farmers and the global oligopoly of agricultural and biotech firms, thus concentrating the control of global food production in a limited number of global corporations. This increased concentration of control may also lead to important risks for food security and safety, biodiversity, in addition to the more traditional parameters of consumer welfare (affordable food prices, high quality, variety and innovation). The mega merger wave to which the Monsanto/Bayer merger transaction significantly contributes to, would therefore, most likely, reduce the welfare of farmers, final consumers and the general public.

I. Introduction: Mega-mergers in the factors of production segment of the global food value chain

The Bayer/Monsanto merger forms part of the most recent mega-merger wave in the agricultural industry, after two large merger waves have transformed what was a competitive market in the early 1980s to a largely concentrated one today. The most recent merger wave was initiated in July 2014 when Monsanto made a number of acquisition offers to Syngenta. These offers were rejected. However, the Monsanto bid triggered a number of other M&A transactions in this sector that were announced in 2015 and 2016. In November 2015, Syngenta accepted the offer of ChemChina (which owns ADAMA, one of the largest agrochemical companies in the world). The merger was cleared with conditions by the European Commission in April 2017 (involving the divestiture of a significant part of ADAMA's existing pesticide business, plant growth regulator business for cereals, and all relevant intangible assets underpinning these businesses, including relevant personnel)[1]. In December 2015, Dupont and Dow announced their merger, which was cleared with conditions by the European Commission in March 2017[2]. In September 2016, Bayer put forward a merger deal with Monsanto, which is explored in detail in this paper. In September 2016, a deal was announced between two of the leaders in the market for synthetic fertilizers, Potash Corp and Agrium for US$30 billion. The deal is expected to close in mid-2017 and will create the largest fertiliser company in the world, which also plans to expand into seeds and crop chemicals. In November 2015, Deere & Co. (the leader in agricultural machinery) announced an agreement with Monsanto to buy its precision farming business, The Climate Corporation. This deal was, however, opposed by the US Department of Justice as it would have led Deere to control a significant part of the already highly concentrated

[1] European Commission, IP/17/882 (2017), available at http://europa.eu/rapid/press-release_IP-17-882_en.htm .
[2] European Commission, IP/17/772 (2017), available at http://europa.eu/rapid/press-release_IP-17-772_en.htm .

US high-speed precision planting systems market and it was eventually abandoned by the parties[3].

The projected mergers in the seed and agro-chem industry will greatly affect the future control of food production and innovation, which is essential in order to improve yields and feed the world. The European Commission, as many other competition authorities, is currently assessing how these mergers could lead to a significant impediment of effective competition (SIEC) by employing a narrowly designed substantive test that merely focuses on the effects of a merger on prices, output and innovation[4]. One may, however, ask if such important decisions for the control of food production should be based on such a narrowly confined test, or that one should consider more broadly the full social costs of such transactions to the extent that these may be assessed and eventually quantified. We therefore consider that in implementing competition law, the Commission has to take into account the broader impact of these mergers on environmental protection, as it is obliged to do by virtue of Article 11 TFEU[5], and the international obligations on biodiversity to which EU Member States and the EU should abide to[6].

To the extent that the Commission would choose to limit its analysis on the narrow competition issues, we consider that there are a number of arguments in favour of blocking the merger or, alternatively, imposing strict conditions for its approval. We will explore these in the following Sections.

II. The Bayer/Monsanto merger

The merger brings together two giants of the seeds and agro-chem industry and will create the global leader in Agriculture Industry[7].

[3] See, https://www.justice.gov/atr/case-document/file/905571/download (accessed May 29, 2017).

[4] Article 2 of Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings, [2004] OJ L 24/1.

[5] According to this provision, "Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities".

[6] Biological diversity is protected at the international level by the Convention on Biological Diversity adopted in 1992. The aim to guarantee a fair and equitable sharing of benefits arising from genetic resources is further implemented by the Nagoya Protocol on Access to Genetic Resources, a supplementary agreement to the Convention on Biological Diversity, adopted in 2010 (and which entered into force in 2014).

[7] Bayer, Acquisition of Monsanto to Create a Global Leader in Agriculture, Investor Presentation, June 2016, 13. On the basis of 2015 pro-forma sales, the industry being valued at approximately 85€bn, Bayer/Monsanto will be the market leader with 23.1€bn, followed by Syntenta/ChemChina Ag with 14.8€bn in the second position, Dow Ag and Dupont Ag with 14.6€bn in the third position, and in fourth position BASF Ag with 5.8€bn. Note that, with the exception of BASF, which is only present in crop protection, all other market leaders are present in both crop protection as well as seeds and traits. On October 13th, 2017, BASF announced that it signed an agreement to acquire significant parts of Bayer's seed and non-selective herbicide businesses, Bayer deciding to divest these assets in the context of its planned acquisition of Monsanto for an all-cash purchase price is €5.9 billion: see BASG press release, https://www.basf.com/en/company/news-and-media/news-releases/2017/10/p-17-336.html . If this merger goes through, the food value chain will therefore be dominated by four vertically integrated seed/trait/pesticide platforms, three of which are also present in digital/smart agriculture. It is possible that BASF invests in this segment as well, or develops a close relation with an agricultural manufacturing company, such as John Deere, with which they have signed on July 14th, 2014 an agreement for the joint development of integrated precision farming solutions: see https://agriculture.basf.com/en/Crop-Protection/News-Events/Press-releases/John-Deere-BASF-Sign-Contract.html .

Germany-headquartered *Bayer AG* is a "life science" company with core competences in the areas of health care and agriculture. Bayer has proceeded to a number of mergers and acquisitions in recent years (see Annex 1). Although Bayer's strength is in agrochemicals, it is present in seeds as well, in particular since its acquisition of Aventis and its AgrEvo subsidiary in 2002. Bayer is present in rice, cotton, oilseed rape / canola, and vegetable seeds, but also, at least before the merger transaction, it aimed to gain competitive positions in wheat and soybeans. Bayer controls popular seed brands, such as Arize for rice, Credenz for soybeans, Fibermax for cotton, InVigor for canola seeds, Nunhems for vegetable seeds, Stoneville for cotton seeds, seed treatment solutions, such as Gaucho, glyfosinate-ammomium based herbicides like Liberty and Basta, and fungicides, like Nativo. Since its acquisition of US organic pest control company AgraQuest in August 2012, Bayer Crop Science has heavily invested in establishing a Biologics (crop protection) platform. Bayer is also present in "digital farming", projecting to at least invest €200m in this area between 2015 and 2020, and currently selling and testing products in ten countries[8].

US-based *Monsanto* is an agrochemical and agricultural biotechnology corporation. Its Seed and Genomic segment produces germplasm, in particular row crop seeds (hybrid varieties and foundation seed) of corn, soybean, cotton, canola and other row crop seeds, as well as vegetable seeds, in particular open field and protected-culture seed for tomato, pepper, melon, cucumber, squash, beans, broccoli, onions and lettuce. Monsanto is a leader in germplasm positions in corn, soybeans, cotton and vegetables[9]. Furthermore, it disposes of a unique and patented seed chipping technology, which enables it to test improved seeds at the lab before the seed is even planted, thus reducing the time it takes to produce a new variety by more than two years[10]. Monsanto controls leading brands, such as Dekalb and Channel for corn, Asgrow for soybeans, Deltapine for cotton, Seminis and De Ruiter for vegetable seeds. Monsanto also develops biotechnology traits enabling crops to protect themselves from borers and rootworm and therefore assisting farmers in controlling insects and weeds. These products are distributed in various brands, such as SmartStax, YieldGard, YieldGard VT triple, VT triple PRO for corn, Intacta RR2 PRO for soybeans, Bollgard and Bollgard II for cotton. Its biotechnology traits enable crops, such as corn, soybeans, cotton and canola to be tolerant of Roundup branded and other glyphosate-based herbicides or dicamba herbicides and include brands such as Roundup Ready, RoundupReady 2 Yield, Roundup Ready 2 Xtend and Intacta RR2 PRO (for soybeans), and Genuity. It disposes of advanced technologies for better control of weeds, insects and viruses with its RNA (genetic)[11] spray technology (BioDirect Technology), without any "tinkering" with

[8] Bayer, Bayer's commitment to innovation and sustainability will help shape the future of farming (Sept. 7 2016), available at http://www.press.bayer.com/baynews/baynews.nsf/id/Bayers-commitment-to-innovation-and-sustainability-will-help-shape-the-future-of-farming .

[9] Monsanto is n° 1 in the US and Brazil with at least a 50% market share, n° 1 in Argentina with 60% and n° 2 in the EU with 20% market share for corn with its DeKalb brand. Monsanto also controls a 40% market share in the US for soybean through its Asgrow brand, 40% in the US for cotton germplasm through its brand Deltapine and is the global market leader with a 20% market share in vegetable seeds with its brands DeRuiter and Seminis : Monsanto, Accelerating the Future of Agriculture, Monsanto's 8thWhistle Stop Investor Field Tour (August 17-18, 2016) 16-20, available at https://monsanto.com/app/uploads/2017/05/whistle_stop_viii_day-1-session_materials.pdf

[10] C. Patterson, Monsanto's Seed Chipping Technology, AgAdvance (January 2013), available at http://www.agadvance.com/issues/jan-2013/monsantos-seed-chipping-technology.aspx .

[11] RNA interference (or RNAi) is a biological process where ribonucleic acid molecules inhibit gene expression or translation enabling the transfer of information from a gene to produce a protein.

the plants' genes being necessary, for instance with the use of a transgenic approach that would create a plant to deliver the RNA, and just with a topical application of the RNA[12]. Monsanto licences genetic material to other seed companies for their seed and forms the central node of a spider web of cross-licensing agreements between the 'Big Six'.

Monsanto has considerably expanded its activity through a number of M&As the last two decades (see Annex 2). More recently, Monsanto acquired The Climate Corporation, which may omen a possible future integration strategy towards precision agricultural machinery equipment. "Precision farming" makes use of sensors to collect information from soil (various parameters such as the level of moisture, fertilizers and pesticides, soil organic matter, various soil properties such as bulk density, texture, compaction, etc.), and satellite images about crop growth progress. It then combines all information using big data algorithms to analyse it, in order to plan and adjust in real-time the need for inputs (e.g. pesticides). It is promised that this may improve the crop yield, but it may also have the effect to lock in farmers in the Monsanto value chain, making them technologically dependent as Monsanto owns or controls the data generated.

The recent acquisition of the Climate Corporation by Monsanto is a bet to diversify beyond the traditional seeds and pesticides business model. The software developed by the Climate Corporation is aimed to become a powerful decision-support system and a crop progress monitoring tool for a typical farmer[13]. The idea is also to use the power of analytics (Big Data) and advanced marker technology to accelerate yield gains and digitize field testing[14]. The combination of big data metagenomics, bio-informatics, machine learning, and predictive analytics may lead to the development of next-generation insect-control solutions by re-targeting proteins[15]. Combined with the existing product portfolio of Monsanto (seeds, traditional and bio-pesticides, etc.), the data analysis and recommendation tool of the Climate Corporation will enable Monsanto to build an integrated 'beyond the seeds' platform to farmers, enabling it to exploit new sources of revenue relating to equipment, fertilizer, pesticides, and even software, providing "optimized seeding and fertility" insights to farmers through Climate FieldView and other products[16]. Monsanto intends to sell subscription to the software as a stand-alone service on a global scale. The other "big six" of the seeds industry – Syngenta, DuPont Pioneer, Bayer, BASF, and Dow – are rapidly catching up by developing their own IT-platforms[17].

Take-away

[12] A. Regalado, The Next Great GMO Debate (August, 11, 2015), MIT Technology Review, available at https://www.technologyreview.com/s/540136/the-next-great-gmo-debate/ .

[13] D. Friedberg, The Climate Corporation Platform Update (21 August 2014), available at http://www.monsanto.com/investors/documents/whistle%20stop%20tour%20vii%20aug%202014/the_climate_corporation_update.pdf. (accessed May 29, 2017).

[14] W. Vogt, Soybean Breeding Takes on Big Data (November 16, 2016), available at http://www.farmindustrynews.com/soybeans/soybean-breeding-takes-big-data ; Monsanto, Accelerating the Future of Agriculture, Monsanto's 8thWhistle Stop Investor Field Tour (August 17-18, 2016) 59, available at https://monsanto.com/app/uploads/2017/05/whistle_stop_viii_day-1-session_materials.pdf

[15] Monsanto, Press Release (Sept. 6, 2016), available at http://news.monsanto.com/press-release/corporate/monsanto-collaborates-second-genome-use-microbiome-technology-platform-accel .

[16] Boston Consulting Group, Crop Farming 2030 (2015) p. 12; J. Jansen, Unlocking Digital Ag and Seed Technology 6, available at http://files.constantcontact.com/fe439c1b001/3be810cd-551f-4ca4-8e4d-f812e2aef91a.pdf?ver=1474384793000

[17] ETC Group, Breaking Bad: Big Ag Mega-Mergers in Play, (December 2015), Communique 115.

The merger brings together two global giants in the seeds and agro-chem markets, following an extensive merger wave that further consolidates the factors of production segment of the global food value chain. The two companies produce an array of popular products and brands in seeds, seed treatment and pesticides and have been recently expanding to the lucrative data-driven "smart agriculture" market, constituting their own IT platforms, the merged entity also positioning itself as the global leader in the metagenomics era.

III. A horizontal, vertical and conglomerate merger

The Bayer/Monsanto merger involves horizontal, vertical and conglomerate integration[18], as the two companies focus their activities on different segments of the food value chain. Bayer is primarily present in pesticides, while Monsanto on trait/agro-biotech research, plant breeding and seed multiplication.

There are, however, important **horizontal overlaps** between Bayer and Monsanto, raising important risks for actual and potential competition.

Firstly, both companies compete in the seeds sector for various crops, in view of Bayer's presence in the seeds segment, since its acquisition of Aventis in 2002. For instance, the two companies compete "head-to-head" in seed and traits for cottonseed and soybeans[19].

Secondly, there are considerable overlaps in the pesticides segment of the value chain. Monsanto manufactures the glyphosate-based Roundup Ready brand herbicides and other herbicides, such as the Harness® brand for cotton and corn. Bayer produces Liberty, a glyfosinate-ammonium based pesticide that not only directly competes with Roundup, but also constitutes the main challenger in this market, in view of the recent concerns raised by the World Health Organization's International Agency for Research on Cancer (IARC), that re-classified glyphosate as "probably carcinogenic to humans" and the difficulties to extend the authorisation of glyphosate in the EU[20]. These overlaps may give rise to an important degree of horizontal consolidation, when two companies compete in the same relevant geographic markets.

Thirdly, although pesticides and seed treatment may be considered as complements to seeds and traits, and hence forming separate product markets, the development of genetically modified (GM) seeds with traits will lead to some form of substitution between GM seeds and pesticides. For example, this substitution effect becomes clear if one takes into account that Bt-corn varieties are registered as pesticides with the US Environmental Protection Agency (EPA)[21]. The development of GM plant varieties resistant to certain diseases may also lead to a substitution effect between GM-plants and certain herbicides that aim to control weeds that are

[18] A merger is considered as "horizontal" if it involves rivals selling substitutes products, "vertical" if it concerns firms along the supply-chain (eg, input supplier with product manufacturer, and upstream producer with downstream distributor), and "conglomerate" if it involves firms that are involved in totally unrelated business activities.

[19] AAI, Food & Water Watch, National Farmers Union, Proposed Merger of Monsanto and Bayer, (2017, July 26th), 6 & 12, available at https://nfu.org/2017/07/26/aai-fww-and-nfu-say-monsanto-bayer-merger-puts-competition-farmers-and-consumers-at-risk/

[20] For a summary see European Parliament, Renewing authorisation for glyphosate, (April 7, 2016), available at http://www.europarl.europa.eu/RegData/etudes/ATAG/2016/580894/EPRS_ATA%282016%29580894_EN.pdf (accessed May 29, 2017).

[21] See, https://www3.epa.gov/pesticides/chem_search/reg_actions/pip/smartstax-factsheet.pdf (accessed May 29, 2017).

usually harbouring diseases. To this extent, the merger could be considered as limiting a source of *actual* and *potential* competition for pesticide firms.

Fourthly, the two companies may have or develop overlaps in "digital farming", both disposing of leading innovation capabilities and R&D technology platforms[22]. Monsanto is quite active in tools for precision planting and high-tech weather prediction through its subsidiary Climate Corporation[23], while Bayer's "digital farming" unit is active in soil analytics and decision support tools for farmers, such as weather analytics, crop yield models, pest and disease models, product data (mode of action, genetics)[24]. The situation in this emerging but crucial, from a strategic perspective, market is even more complex in view of the links between the merging entities and their competitors in this segment of the agricultural value chain, following the global licensing agreement in October 2016 between Monsanto and Dow AgroSciences on the Exzact Precision Technology Genome-Editing Platform for research and commercial development of new crop solutions across Monsanto Company's research portfolio[25].

The **non-horizontal dimension** of the merger refers to the fact that the merging entity may have the ability and the incentive to foreclose competitors in upstream or downstream situated markets in the seeds, as well as in the crop protection value chain, and to produce exclusionary "portfolio effects" arising from the combination of the complementary businesses of Monsanto and Bayer in traits, seeds, pesticides, herbicides, and digital farming to the detriment of final consumers, in this case farmers.

The Commission is much less stringent on **vertical integration** than on horizontal overlaps as it believes more in the improvement of efficiencies and innovation through vertical integration. However, vertical integration may be problematic for competition, if it enables the new entity to strategically foreclose competitors[26], by offering packaged solutions in the seed and traits value chain (Annex 3) and in the agrochemical supply chain (Annex 4), therefore increasing prices and/or reducing consumer choice. Looking, more specifically, to the seed and traits value chain, to the extent that there is an upstream market for the development and commercialisation of traits and a downstream market for the breeding of traited seeds, and that the treatment of seeds can be considered as an upstream market to the downstream supply of seeds, the merging entity may have the incentive to engage in a foreclosure strategy against rivals downstream and/or upstream. As each trait offers "unique characteristics to the particular seeds", it cannot be excluded that "each company would have a monopoly on the trait

[22] AAI, Food & Water Watch, National Farmers Union, Proposed Merger of Monsanto and Bayer, (2017, July 26th), 6; Bayer, Investor Handout (Septemebr 14, 2016), 14.

[23] Fortune, Monsanto's Climate Corp to Expand Digital Farming Platform (August 17, 2016), http://fortune.com/2016/08/17/monsantos-climate-corp-to-expand-digital-farming-platform/ ; M. Stern, Digital Agriculture, (Speech, 2015), available at https://monsanto.com/app/uploads/2017/05/digital-ag-stern_2015.11.17.pdf . Monsanto has a significant presence in digital farming in Europe with the acquisition in November 2016 of Vitafields, a European farm management software company based in Tallinn, Estonia and present in seven European countries: Monsanto, The Climate Corporation Acquires VitalFields to Expand Digital Agriculture Innovation for European Farmer (November 21, 2016), available at http://news.monsanto.com/press-release/climate/climate-corporation-acquires-vitalfields-expand-digital-agriculture-innovation

[24] For more information, see http://www.digitalfarming.bayer.com/ .

[25] Dow AgroSciences Press Release, Monsanto and Dow AgroSciences Announce Global Licensing Agreement on Exzact Precision Technology Genome-Editing Platform (October 3, 2016), available at https://www.dowagro.com/en-us/newsroom/pressreleases/2016/10/monsanto-dow-agrosciences-global-licensing-agreement-exzact#.WY2qwoVOKUk .

[26] M. Whinston, Lectures on Antitrust Economics (MIT, 2007).

developed", in particular as this is also protected by patents and that other companies can only obtain access to it through licensing agreements[27]. Monsanto has a strong position in traits and, as highlighted above, forms the central node of the network of licensing agreements between the Big Six. The new entity will therefore have the ability to foreclose rivals from access to the traits licensed, and its incentive to foreclose will depend on a comparison of the revenues derived from foreclosure strategies with the foregone revenues derived from licensing to its downstream competitors.

It is also possible to conceive the two value chains as forming in reality one: a technological platform/system consisting of, for instance, a non-selective herbicide tolerant traited seed and a corresponding non-selective herbicide, which are used in combination in order to provide farmers the best protection against weeds. When farmers make decisions on which seeds to plant they make their choice on the basis of the various systems available for the specific crop, after which they are locked in the specific "technological pathway" provided by this system[28]. For instance, a Liberty herbicide is formulated to work in conjunction with the Liberty Link traits, which is the glufosinate ammonium tolerate trait. Hence, seed companies and crop protection firms will not be able to compete with the merging entity's platform "unless they are vertically integrated seed and crop protection firms who develop traits, breed seeds and develop active ingredients for herbicides" and they develop "their own traits for non-selective herbicide tolerance or license traits from the merging parties"[29].

The merger finally includes a **conglomerate dimension**, in view of Monsanto's and Bayer's presence in the seeds, crop protection and digital agriculture/smart farming value chains. In particular developing a new value chain, possibly integrating the three value chains on the basis of Big Data appears one of the main reasons motivating the merger transaction. It is clear that the acquisition of the Climate Corporation's data science engine and extensive field research networks was Bayer's principal drive to the merger[30]. The aim is to transform its core business from producing seeds, herbicides/pesticides and other products to providing an inclusive package of *service*s to farmers, guiding their choice in the "40 interlocked decisions that inexorably a grower is going to make every single year"[31], this of course to the greater benefit of the merging entity's management and its shareholders.

Big data also transforms crop genomics with new ways to measure, map, and share information for the development of new seed traits and new plant breeding methods. It becomes easier and cheaper to test varieties of genetics, crop inputs, and conditions across various different fields, soils, and climates. Farmers are also empowered by Big Data algorithms "creating visibility of pricing and performance of brand-name inputs", which enable them to combine a variety of inputs and to select outside packaged or recommended offers[32]. By

[27] Competition Commission of South Africa, Case 2017Feb004 (Bayer/Monsanto) (May 3, 2017), p. 117, para. 364.
[28] Competition Commission of South Africa, Case 2017Feb004 (Bayer/Monsanto) (May 3, 2017), p. 105, para. 317
[29] Ibid., p. 106, para. 320.
[30] On the importance of Big Data for "smart farming" and agricultural production, see S. Wolfert, L. Ge, C. Verdouw, M.-J. Bogaardt, Big Data in Smart Farming: A Review, (2017) 153 Agricultural Systems 69.
[31] A. Murray, Why Bayer Wants Monsanto, Fortune (May 19th, 2016) quoting an interview with Monsanto's CEO Hugh Grant.
[32] See, How Big Data is Disrupting Agriculture from Biological Discovery to Farming Practices, AgFunder news (June 9, 2016), available at https://agfundernews.com/how-big-data-is-disrupting-agriculture-from-biological-discovery-to-farming-practices5973.html

integrating into digital farming, the big agrochemical companies would thus enhance their ability to maintain a tight control over their value chains, while one could imagine that they may also have the incentive to avoid disruptive innovation that could challenge their position in the seed and crop protection value chains.

In the context of the development of new General Purpose Technologies (GPT), that may also present significant technology opportunities, such as CRISPR, conglomerate mergers may lead to significant barriers for new entrants in the various segments of the value chain, be that seeds, pesticides and/or (selective) herbicides, or precision farming. CRISPR-Cas9 and other genome editing technologies, such as the "more precise" CRISPR-Cpf1, allow scientists to manipulate the genetic makeup of an organism by de-activating or knocking out a gene function, eventually without the need to introduce genes from other organisms, as this is the case for classical GMO genetic engineering. These genome editing technologies may be used commercially for improvements in yield and pest resistance and other causes of crop loss, which may eventually reduce pesticide use, increased drought tolerance, and increased nutritional benefit. To the difference of conventional breeding techniques, genome editing makes it possible to reduce the time needed to generate the desired genetic characteristics in a plant population from 7-25 years to as few as 2-3 years as well as to bypass "the need to go through a number of plant generations to achieve a particular genetic combination"[33]. Another advantage of using CRISPR editing techniques is the recent USDA regulation suggesting that CRISPR modified seeds may not need regulatory approval as GMOs since in some cases gene manipulations may involve only deletions or modifications with existing DNA[34]. The competitive advantage of such genome editing technologies, should these not be subject to the existing restrictions of conventional GMO regulation, in comparison to conventional breeding methods, may significantly alter the market structure and industry dynamics.

The technology's unique advantage is that it allows multiple editing simultaneously in various parts of DNA able to inactivate up to tens of targets at once[35]. Therefore, CRISPR enables much faster products development. Monsanto has been researching for many years in genome editing technologies and has recently concluded licensing agreements for CRISPR-Cas 9 from the Broad Institute for use in seed development[36] as well as CRISPR-Cpf1, also from the

[33] See, Nuffield Council on Bioethics, Genome Editing: An Ethical Review (September 2016), 56-62.

[34] See, for instance, the recent controversy over the anti-browning mushroom developed by plant pathologist Yinong Yang at Pennsylvania State University using CRISPR-Cas9, which was not considered by the USDA as integrating any introduced genetic material and thus not regulated as a GMO (see https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-321-01_air_response_signed.pdf **).** Of course, the way GMOs are defined for regulatory purposes is different in Europe: see European Parliament, Briefing, New plant-breeding techniques (May 2016), http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/582018/EPRS_BRI(2016)582018_EN.pdf and the expected intervention of the Court of Justice of the EU in pending Case C-528/16 (judgment expected in 2018).

[35] L. Yang et al. Genome-wide inactivation of porcine endogenous retroviruses (PERVs) //Science. – 2015. – Т. 350. – №. 6264. – С. 1101-1104.

[36] S. Begley, Monsanto licenses CRISPR technology to modify crops — with key restrictions (September 22, 2016), available at https://www.statnews.com/2016/09/22/monsanto-licenses-crispr/ . Since 2013, the Broad Institute has been issuing licenses for commercial research using CRISPR-Cas9. The licensing agreement with Monsanto included restrictions on the use of the technology, Monsanto not being able to use the technology for "gene drive", thus spreading a trait through an entire population, or to create sterile ("terminator") seeds.

Broad Institute[37], in order to apply this technology across multiple crops. Monsanto's (and Bayer's) leading germplasm and genome libraries, as well as their strong position in traits, may provide the merged entity with a significant competitive advantage in the application of genome editing and Big Data technologies, thus entrenching their leading position in agricultural biotechnology for the years to come and affecting the incentives of would be entrants in the industry[38].

Combined with an opportunity to bypass a typically complex, lengthy and costly regulatory process of GMO approval as well as Monsanto's and Bayer's proprietary germplasm databases, the ability of merging companies to deliver new products to the market is expected to increase significantly. This conclusion complies with the finding of a recent study published by the US National Academy of Sciences that with the CRISPR breakthrough "the scope, scale, complexity, and tempo of biotechnology products are increasing"[39]. Combined with their digital platform solutions this will further add to the market power of both companies.

Control of genome editing technologies by biotech incumbents, such as Monsanto and Bayer, may also limit the disruptive potential of these technologies (drastic innovation) with regard to GM biotech (recombinant DNA) or conventional breeding tools. Indeed, the merged entity may not have less incentive to develop new genome editing technologies when these could reduce pesticide use, therefore challenging their dominant position in agro-chem market[40]. The development of genome editing technologies for plants and animals may engender profound structural changes in the industry, as these technologies are cheaper. This may provide more opportunities for new entry in the seed and traits value chain. Indeed, as a recent Nuffield Council on Bioethics report observes, "the potential of genome editing techniques (in terms of decreased cost and technical difficulty, and increased speed) may revive the opportunities for small and medium-sized biotech companies in the agricultural area and unlock development of a wider variety of traits"[41]. This likely emergence of a more competitive market structure, in view of reduced endogenous sunk costs, may be blocked by the business strategies of integrated agro-chem corporations that may try to establish one-shop platforms, combining traits, seeds, pesticides and smart agriculture or digital solutions for farmers in order to raise barriers to the independent entry of small and medium-sized start-ups in the various segments of the value chain.

New entrants would need to enter simultaneously in various segments of the value chain, which may block the most usual way disruptive innovation occurs in technology-driven

[37] Monsanto Press Release, Monsanto Announces Global Genome-Editing Licensing Agreement With Broad Institute For Newly-Characterized CRISPR System (January 4, 2017), available at http://news.monsanto.com/press-release/corporate/monsanto-announces-global-genome-editing-licensing-agreement-broad-institute .

[38] AAI, Food & Water Watch, National Farmers Union, Proposed Merger of Monsanto and Bayer, (2017, July 26th), 6; Bayer, Investor Handout (September 14, 2016), 6, note that "(t)he proposed merger of Monsanto and Bayer would combine the third and fourth largest firms, moving the merged firm to the top with $26,9 billion in combined revenue – 40% of combined industry revenue".

[39] National Academy of Sciences, Engineering, and Medicine. Preparing for Future Products of Biotechnology. Washington, DC: The National Academies Press. doi: 10.17226/24605. 2017, p. 53

[40] T. Greenaway, Monsanto's Driverless Car: Is CRISPR Gene Editing Driving Seed Consolidation? (April 10, 2017), available at http://civileats.com/2017/04/10/monsantos-driverless-car-is-crispr-gene-editing-driving-seed-consolidation/ reporting to the view expressed by Tom Adams, biotechnology lead for Monsanto, regarding gene-editing technology that "(w)e do not view it as a replacement for plant biotechnology".

[41] Nuffield Council on Bioethics, Genome Editing: An Ethical Review (September 2016), p. 62.

industries, that is, indirect entry outside the 'core' market cluster controlled by the incumbent firm[42]. Excluding these start-ups may raise the profitability of the merged companies, and their attractiveness to financial markets, but this is to the detriment of farmers and smaller mono-product rivals, which are obliged to either licence their technology to the merged entity or merge with the agro-chem behemoths. This has of course the effect of creating a "growth bottleneck" as incumbents finish by controlling the direction of technological change[43].

Take-away

The merger combines horizontal, vertical and conglomerate dimensions, and affects both actual and potential competition. This is a result of the ambition of the companies to constitute one-stop shop platforms for farmers, thus expanding the farmers' economic and technological dependence vis-á-vis global seed and agro-chem platforms for most of the inputs necessary for agricultural production.

IV. The consolidation of the factors of production segment

The first step in the Commission's assessment of the merger will be to explore the structure of the affected markets.

A. Concentration in the world and EU markets for seeds

The various segments of the factors of production markets have been progressively consolidated in (most frequently tight) oligopolies of six major players. The level of concentration varies according to the geographical market and the type of crop, but a constant is that markets in which penetration by genetically modified (GM) seeds is significant tend to be more concentrated than markets where the commercial use of genetically modified seeds is restricted. This becomes clear if one compares the level of concentration in the US, a GM seed market, to the European Union and China, which are largely conventional seed markets, although certain conventional crops may appear as concentrated[44].

The global consolidation of the crop seeds & biotechnology, agricultural chemical, animal health and breeding industries, as well as agricultural machinery has been duly noted by economic research[45]. High concentration in the food industry is not unusual. Fuglie et al. have

[42] T. Bresnahan & Y. Pai-Ling, Reallocating innovative resources around growth bottlenecks, SIEPR Discussion paper No. 09-022.
[43] Ibid., 8.
[44] See, I. Mammana, Concentration of Market Power in the EU Seed Market, (January 2014), Study commissioned by the Greens/EFA Group in the European Parliament; ETC Group, Who will control the Green Economy? (November 2011), 11, available at http://www.etcgroup.org/sites/www.etcgroup.org/files/publication/pdf_file/ETC_wwctge_4web_Dec2011.pdf (accessed May 29, 2017), noting that the conventional breeding sector in Europe is not only the world's biggest exporter, but is also highly concentrated. In particular, it concludes that the top 5 companies in the EU vegetable markets control 95% of the market.
[45] N. E. Hart, The Age of Contract Agriculture: Consequences of concentration in Input Supply, (2000) 18(1) Journal of Agribusiness 115-127; J. King, Concentration and Technology in Agricultural Input Industries, USDA, Agriculture Information Bulletin no. 763.; J. MacDonald et al., Contracts, Markets, and Prices: Organizing the

demonstrated that five-six leaders in such industries as agricultural chemicals, farm machinery and animal breeding have more than 50% of the global market sales[46]. The latest estimates suggest that 'the Big Six' (Monsanto, Syngenta, DuPont, BASF, Bayer, Dow) collectively control more than 75% of the global agrochemical market, 63% of the commercial seed market, and almost three quarters of R&D expenses in the seeds and pesticides sector (as the combined R&D budget of the Big Six was fifteen times more important than the USDA crop science research budget in 2013)[47]. The same is true for the farm equipment sector where the top three companies (Deere & Co, CNH, AGCO) control 49% of the market (2013)[48]. If the Bayer/Monsanto merger is approved, three companies (ChemChina-Syngenta, Du Pont-Dow and Bayer-Monsanto) will own and sell about 60 percent of the world's patented seeds and 64% of world's pesticides/herbicides, as even if some of their assets are divested there are few established economic actors that would be able to purchase them and develop an independent and sustainable competitive offer in the industry[49].

This broad picture of concentrated market structures at a global scale may, however, hide a more complex competitive landscape in Europe. If one looks to the overall situation in Europe, with regard to the sale of seeds, the market appears at first to be less concentrated (Table 1).

Table 1: Net sales of the world top 10 seed companies in Europe (percentage of net sales)[50]

Company	**2010**	**2011**	**2012**	**2013**	**2014**
Du Pont/Pioneer	13.4%	15%	16.5%	16.1%	14.3%

Production and Use of Agricultural Commodities, (2004) Agricultural Economic Report No. 837, 9; J. Fernandez-Cornejo, The Seed Industry in U.S. Agriculture, U.S. Dep't of Agric., Econ. Res. Serv., Agric. Info. Bull. No. 786 (2004), 4; N. Louwaars et al., Breeding Business: The future of plant breeding in the light of developments in patent rights and plant breeder's rights, Centre for Genetic Resources, Report 14 (2009); K. Fuglie et al, Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide, USDA-ERS Economic Research Report No. 130 (2011); D. L. Moss, Competition, Intellectual Property Rights, and Transgenic Seed, (2013) 58 South Dakota Law Review 543-559; I. Mammana, Concentration of Market Power in the EU Seed Market, (January 2014), Study commissioned by the Greens/EFA Group in the European Parliament; ETC Group, Who will control the Green Economy? (November 2011), available at http://www.etcgroup.org/sites/www.etcgroup.org/files/publication/pdf_file/ETC_wwctge_4web_Dec2011.pdf (accessed May 29, 2017); European Commission, Overview of the Agricultural Sectors in the EU Study (2015); M. M. Nesheim, M. Oria and P. Tsai Yin (eds.), A Framework for Assessing Effects of the Food System, National Academy of Sciences (2015), p. 54; Ph. H. Howard, Visualizing consolidation in the global seed industry: 1996-2008, (2009) Sustainability 1(4):1266-1287; Ph. Howard, *Concentration and Power in the Food System (Bloomsbury, 2016).*

ETC Group, Outsmarting Nature, November 2015;

Boston Consulting Group, Crop Farming 2030 – The Reinvention of the Sector (April 2015), available at https://www.bcgperspectives.com/content/articles/process-industries-innovation-crop-farming-2030-reinvention-sector/ (accessed May 29, 2017)

[46] K. Fuglie et al., Rising concentration in agricultural input industries influences new farm technologies, (2012) 10(4) Amber Waves 1-6, available at http://www.ers.usda.gov/amber-waves/2012-december/rising-concentration-in-agricultural-input-industries-influences-new-technologies.aspx#.VpYe1-9unct (accessed May 29, 2017).

[47] ETC Group, Breaking Bad: Big Ag Mega-Mergers in Play, (December 2015), Communique 115, available at http://www.etcgroup.org/content/breaking-bad-big-ag-mega-mergers-play, p.4 (accessed May 29, 2017).

[48] Ibid., p. 8.

[49] African Center for Biodiversity, The Bayer-Monsanto merger: Implications for South Africa's agricultural future and its small holder farmers (February 2017), 4.

[50] The table is based on European Commission, DG for Internal Policies, Overview of the Agricultural Inputs Sector in the EU (2015).

Hi-Breed					
Monsanto	10.0%	10.4%	11.7%	11.8%	11.3%
Syngenta	11.4%	10.1%	10.3%	10.2%	9.7%
Group Limagrain/Vilmorin	7.5%	7.9%	8.0%	7.4%	7.3%
KWS	6.7%	7.0%	7.2%	7.0%	6.5%
Bayer Crop Science	4.9%	4.8%	5.0%	4.5%	4.5%
Dow	2.1%	3.5%	4.3%	4.4%	4.2%
DLF Trifolium	2.6%	2.5%	2.5%	2.8%	2.7%
Sakata (not among the top 10 in Europe)	0.5%	0.5%	0.5%	0.4%	0.5%
CR3[51] European seed market	35	35	38	38	35
CR5 European seed market	49	50	54	54	49
CR9 European seed market	59	62	66	65	61
HHI	705	685	764	755	673

However this picture varies for certain types of crop. For instance, it is reported that the European seed market for sugar beets shows the largest concentration with the first three companies (CR3) controlling a staggering 79% of the market (HHI: 2444), while for Maize seeds CR3 is 56% (HHI: 1425). High levels of concentration are also noted in the market for tomato seeds with Monsanto controlling 20% on registered seed varieties[52]. These figures of course do not take into account the recently approved mergers between Dow/Dupont and Syngenta/ChemChina, as we will explain in the following Section.

A striking feature of these figures is the speed of this consolidation process, as most of this increase of the concentration level of the industry occurred the last twenty years, since the mid-1990s, the levels of concentration in the mid-1990s being close to those in 1985.

Table 2: Evolution of the consolidation process in the global seed industry[53].

Year	**1985**	**1996**	**2012**

[51] CR3, CR5 and CR9 are indexes measuring concentration and refer to the level of the combined market shares of the largest 3, 5 and 9 companies in the relevant market. HHI is another concentration index which is calculated by summing the squares of the individual market shares of all the firms in the market. For example, in a market with five symmetric firms (each having a 20% market share) the HHI is 2,000; whereas in a market with six firms, but where one leading firm has half the market, a second has a market share of 20% and the remaining four have each 5%, the HHI is 2,950.

[52] European Commission, DG for Internal Policies, Overview of the Agricultural Inputs Sector in the EU (2015), 28.

[53] See, Figure 6, European Commission, DG for Internal Policies, The EU Seed and Plant Reproductive Material Market in Perspective: A Focus on Companies and Market Shares - Note (2013), 20.

CR1[54]	4.1%	5%	21.8%
CR2	5.7%	8%	37.3%
CR3	6.8%	10.2%	44.4%
CR4	7.9%	11.7%	48.2%
CR5	8.9%	13%	48.2%
CR6	9.9%	14.1%	54.6%
CR7	10.9%	15.1%	57.5%
CR8	11.7%	16%	59.7%
CR9	12.5%	16.8%	60.7

This has been particularly significant during the last decade for certain national markets in Europe. For instance, in France, the largest market in the EU, the 9 largest seed companies account for 69% of the total turnover of the sector[55], gaining more than 10 percentage points since 2006[56]. Concentration levels in France for some field crops are also quite high, in particular for sugar beets (HHI: 3353), vegetable seeds (HHI: 2019) and oilseeds (HHI: 1908).

Seed markets are highly fragmented by crop and by geographic area. Although there are almost 7,000 seed companies operating on the EU seed market[57], there are considerable country and market niche variations. The concentration level of the EU's largely conventional seed markets may be subject to a sudden increase. It suffices that a hybrid with a high yield is introduced in the market for farmers to prefer this instead of local varieties, the farmers being pushed, because of intensive competition, to choose the high-yielding seeds as these may provide higher rates of return on investment (of labour and capital). It follows that one should not take a static picture of the level of concentration of the market, but should aim to understand the competitive dynamics of capitalist agricultural production.

This has led in the past to significant levels of concentration in certain markets. We include some examples only in view of the absence of other publicly available information. For instance, a single company controls 45 percent of the wheat market in the UK; while 5 companies control 95% of the EU vegetable seed market. The maize seed sector, a vital part of the EU seed market is controlled by 5 companies whose collective market share amounts to 51.4%: the maize varieties of DuPont Pioneer accounting for a 12.2% market share, Syngenta for 11.5%, Limagrain for 9,7%, Monsanto for 8,95%, and KWS for 8,9%, from a total of 4975 maize varieties registered in the European Common Catalogue[58].

[54] CR1 denotes the market share of the largest in terms of turnover or sales undertaking in the relevant market, CR2 the market share of the two largest in terms of turnover or sales in the relevant market and so on.

[55] European Commission, DG for Internal Policies, Overview of the Agricultural Inputs Sector in the EU (2015), 14.

[56] European Commission, DG for Internal Policies, The EU Seed and Plant Reproductive Material Market in Perspective: A Focus on Companies and Market Shares - Note (2013), 10.

[57] Official controls: Impact on food business operators - seeds and plants, the European Seed Association's presentation to the European Parliament, 14 October 2013, http://www.europarl.europa.eu/meetdocs/2009_2014/documents/envi/dv/envi20131014_doc14_biloni_/envi20131014_doc14_biloni_en.pdf (accessed May 29, 2017).

[58] I. Mammana, Concentration of Market Power in the EU Seed Market, (January 2014), Study commissioned by the Greens/EFA Group in the European Parliament.

B. Pesticides

Although there are between 630 and 655 companies present in this segment of the food value chain in Europe, the market may be characterized as concentrated, both at the world level and at the EU level.

Table 3: Market shares and concentration ratios for top 7 crop protection agents' companies operating in the EU-27 market[59]

Company	2001 (% of market shares)	2005	2008	2009	2010
Syngenta	19.4	24.1	24.7	25.5	24.4
Bayer	13.5	22.5	22.0	23.6	21.0
BASF	22.3	26.5	15.6	16.4	15.9
Dow	-	-	10.2	11.3	12.8
Adama	-	-	6.63	6.48	6.91
Du Pont	6.44	5.29	4.35	3.99	4.29
Monsanto	3.63	2.94	3.02	3.97	2.70
CR3	55.3	68.4	62.6	65.6	61.4
CR5	-	-	80.8	83.4	81.2
CR7	65.4	92	90	91.4	88.2
HHI	-	-	1646	1717	1566

Most of the agro-chemical companies present in the pesticides market are also present in the seed sector, controlling a large part of the sales (around two-thirds)[60]. The same companies are also the incontestable leaders in R&D in agricultural research in seeds and chemicals[61]. The number of firms actively involved in R&D in this industry in Europe has decreased from 8 in 1995 to 4 in 2012 (Bayer, Syngenta, BASF, and Isagro), with the number of new active ingredients in the development pipeline and new product launches going from 70 in 2000 to fewer than 30 in 2012[62]. This may be explained by the fact that the cost of developing new varieties is quite high[63], and that it is more profitable for firms to stick to existing products, proceeding to incremental innovations, rather than taking risks and developing new products that could cannibalize their older products. The sector has also been marked by a number of M&A transactions, in particular initiated by Bayer and BASF.

[59] European Commission, DG for Internal Policies, Overview of the Agricultural Inputs Sector in the EU (2015), 76.
[60] BASF is present in seeds R&D, but does not sell seeds
[61] K. Fuglie, P. Heisey, J. King, C.E. Pray, D. Schimmelpfennig, The Contribution of Private Industry to Agricultural Innovation, (2012) 338 Science 1031.
[62] European Commission, DG for Internal Policies, Overview of the Agricultural Inputs Sector in the EU (2015), 77.
[63] This is particularly costly for GM seeds, some estimating this to be US$136 million and thirteen years, seven years of which will be spent for regulatory approval: J. Deering, Senate analyses competition among a consolidating seed industry (2016), available at http://seedworld.com/senate-analyzes-competition-among-consolidating-seed-industry/ (accessed May 29, 2017).

An important characteristic of this market is the regulation of the various chemical products. As commercial and legal barriers to entry are considerable, one may expect a low likelihood of new entry in the industry, market structure being entrenched to a tight oligopoly.

C. Which concentration level will be considered for merger purposes?

Market structure and concentration is, of course, just one step in the assessment of mergers and is usually followed by a more thorough analysis of the possible anticompetitive effects and efficiencies, if the level of concentration resulting from the merger raises concerns. Although the EU market for seeds may not at the moment be characterized as highly concentrated, if one applies the conventional measures of HHI[64], it is possible that following the mergers recently approved by the European Commission, the concentration level that is taken into account by the Commission in the affected markets will respectively increase.

One may project that, as the Dow/Dupont and ChemChina/Syngenta mergers have been recently cleared, the first without conditions relating to the seeds' market(s), and the second with only some conditions relative to the plant growth regulator products, it will be more difficult for the Bayer/Monsanto merger that will be last examined to be approved without conditions relating to the affected relevant markets. In its press release announcing its decision on the Dow/Dupont transaction, the Commission made clear that it "examined each case on its own merits", according to the "so-called priority rule", on a first come, first served basis and on the basis of "currently prevailing market situation"[65]. The "currently prevailing market situation" in which the Bayer/Monsanto merger will be assessed will be certainly more concentrated than that of the Dow/Dupont and ChemChina/Syngenta mergers.

In assessing a merger, the Commission ultimately examined if it would give rise to a Significant Impediment of Effective Competition (SIEC). It bases its analysis on a counterfactual scenario comparing the post-merger scenario a hypothetical scenario absent the merger in question.[66] The Commission also takes into account future changes to the market that can "reasonably be foreseen".[67] The identification of the proper counterfactual is complicated when there are more than one merger occurring in parallel in the same relevant market. Under the mandatory notification regime, the Commission does not factor into the counterfactual analysis the merger notified after the one under assessment.[68]

It is unclear from the Dow/Dupont press release if the Commission took into account, when considering the level of concentration and the competitive effects of the merger on the various markets affected, the market situation resulting at least from the notified merger between ChemChina and Syngenta, which has been notified to the Commission a few months after the notification of the Dow/Dupont merger.

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[64] On HHI see footnote 51.
[65] European Commission, Press Release, IP/17/772 (emphasis added).
[66] Horizontal Merger Guidelines [2004] OJ C31/6, para 9.
[67] Id.
[68] See, eg, *TUI/First Choice* Case COMP/M.4600 [2007], paras 66–68; *TomTom/Tele Atlas* Case COMP/M.4854 [2008], paras 187 and 188.

When approving the Dow/Dupont merger transaction[69], the Commission did not include any specific remedy concerning the seed segment of the value chain, all remedies focusing on a number of markets for existing pesticides and certain petrochemical products. These were markets on which the two merged companies held high market shares and the merger would have reduced the number of competitors from four to three. The parties agreed to divest a significant part of DuPont's existing pesticide business, some manufacturing facilities for petrochemicals products and the grant of an exclusive license to DuPont's product for rice cultivation in the European Economic Area, thus enabling a buyer to replace the competitive constraint exerted by DuPont in these markets. These remedies have not dealt with the increasing concentration in seeds markets.

Company confidentiality makes it difficult to ascertain market-specific market shares, but as the ChemChina/Syngenta merger went ahead without conditions in the seed segment, the Monsanto/Bayer merger will intervene at a market where competition has already been significantly weakened.

D. *Furthering existing consolidation in this sector*

The merger will involve two companies with a considerable patent and plant variety rights' portfolio. Bayer is particularly strong in the plant genetic engineering arena in the EU, 'holding more patents on transgenic plant traits (206) than Monsanto (119)'[70]. Monsanto owns 96% of cotton traits patented in the United States, being a *de facto* monopolist regarding the setting of prices and terms through cross-cutting licensing agreements[71].

The combination of these various IP portfolios may lead to entrenched market power, and thus stifle cumulative innovation on this sector. The merger will reinforce the existing contractual consolidation in this sector which has taken, so far, the form of cross-licensing and other joint ventures[72]. Mergers usually lead to a more permanent combination of assets that cannot be easily undone, in case the consummated merger leads to anticompetitive effects and reduces cumulative innovation. Existing forms of contractual consolidation include the following:

- *Cross-licensing and trait licensing agreements:* Some recent research has documented a spider web of cross-licensing agreements of proprietary traits and technologies between the "Big Six"[73]. This form of collaboration is particularly linked to the development of crops stacking multiple transgenic traits, some of them combining transgenic traits owned by different companies, within a single seed. By licensing traits to one another, companies can sell their own technologies as well as the technologies of their

[69] Commission's Press Release on Dow/Dupont, http://europa.eu/rapid/press-release_IP-17-772_en.htm (accessed May 29, 2017).
[70] African Center for Biodiversity, The Bayer-Monsanto merger: Implications for South Africa's agricultural future and its small holder farmers (February 2017), 4.
[71] M.E. Stucke & A.P. Grunes, *An antitrust review of the Bayer-Monsanto Merger* (Washington DC: The Konkurrenz
Group, 2016).
[72] ETC Group Communiqué 115, Breaking Bad (December 2015), 11.
[73] Ph. Howard, Intellectual Property and Consolidation in the Seed Industry, (2015) 55(6) Crop Science 1-7.

competitors. Monsanto's traits are the central node in this network of agreements, as it is the only firm to have agreements with each of the other 5 firms, with the result that, according to some estimations, "more than 80% of the land planted with major field crops in the US contained transgenic traits owned or licensed by Monsanto"[74].

- *Joint ventures:* Joint ventures in the sector have already been analyzed by the European Commission.[75].

- *Distribution agreements:* In order to distribute their own products on the national and local markets, a large seed company can make a deal with smaller seed companies without owning them. This may dampen competition between them to the detriment of consumers.

- *Collaborations, research agreements and R&D strategic alliances:* A number of inter-firm alliances have also developed in recent years. BASF and Monsanto have collaborated since 2007 on R&D partnerships worth $2.5 billion in breeding, biotech, pesticides, ag microbials, ag biologicals, and precision agriculture[76]. Microbial products are a new opportunity and potentially a game changer and a disrupting technology at the global scale. Although currently the industry is still in its infancy (less than USD 2bn of global sales in 2014), going forward it represents a huge potential, especially given the growing demand for organic farming globally. Realizing this, in 2014 Monsanto announced an alliance known as BIOAG Alliance with Novozymes, one of leaders in biotech industry. Novozymes is responsible for the production of the microbial products while Monsanto serves as the lead for field testing, registration, and commercialization for the Alliance's products[77].

- *Patent litigation truces:* Following a period of patent war about who controls the technology for making soybeans resistant to the weed-killer Roundup, known generically as glyphosate, DuPont and Monsanto agreed in 2013 to drop antitrust and patent claims against each other. Commenting on the agreement, Brett D. Begemann, Monsanto's president and chief commercial officer, noted in a joint news release: "(t)his signals a new approach to our companies doing business together, allowing two of the leaders in the industry to focus on bringing farmers the best products possible"[78]. This culture of "doing business together" may increase risks of collusion or parallel exclusion of actual and/or potential competitors.

[74] Ph. Howard, Visualizing Consolidation in the Global Seed Industry:1996-2008, (2009) 1 Sustainability 1266, 1279.
[75] Case No COMP/M.6454 - LIMAGRAIN / KWS / GENECTIVE JV (2013).
[76] ETC Group Communiqué 115, Breaking Bad (December 2015).
[77] BIOAG Alliance Fact Sheet, available at http://www.novozymes.com/en/about-us/brochures/Documents/BioAg-Alliance-factsheet.pdf (accessed May 29, 2017).
[78] A, Pollack, Monsanto and DuPont Settle Fight Over Patent Licensing, New York Times (March 26, 2013).

- *'Post-Patent' Generic trait agreements:* One may also mention as an illustration of the extensive collaboration between the Big Six the generic trait agreement aiming to put in place a "post-patent" regulatory regime, laying down the rules for access to generic biotech traits at patent expiration[79]. The expiration of some of the first biotech patents granted in the mid to late 1980s makes it theoretically possible that generics may enter these markets. The Big Six may attempt to delay such entry, using exclusionary strategies, such as failing to renew the regulatory approval of a biotech trait before expiration of the patent or that of existing regulatory approvals. In order to pre-empt any regulatory or competition law initiative in this area, the industry leaders put in place a "unique private sector solution to address the transition of regulatory and stewardship responsibilities for biotech"[80]. Their aim is to ultimately control the terms of access to expired traits.

Take-away

Consolidation has been on the rise in recent years, both globally and in Europe. If the merger is approved, three companies (ChemChina-Syngenta, Du Pont-Dow and Bayer-Monsanto) will own and sell up to 60 percent of world's patented seeds and 64% of world's pesticides/herbicides. Although the EU is a conventional seeds market and thus relatively less concentrated than the US market, the concentration level is high for certain products, such as vegetable seeds, and in certain geographic areas. The concentration level will of course increase following the approval of the Dow/Dupont and ChinaChem/Syngenta mergers, in particular as this was done without conditions relating to the seeds market. Consequently, the Bayer/Monsanto transaction will be assessed in a market where competition has already been weakened. Increasing concentration is one side of the story, as the market is characterized by a significant number of contractual forms of consolidation, in the form of cross-licensing agreements, joint ventures, and other R&D strategic alliances.

V. A significant impediment to effective competition and relevant markets affected

The merger will produce effects on various markets, such as pesticides, including non-selective herbicides (Glyphosate and Glufosinate), fungicides, seed treatment products and plant growth regulators, of course a variety of seeds for various crops, as well as the market for precision farming equipment and data-driven solutions in agriculture. Market leaders in this industry have made the choice of positioning themselves as fully integrated providers, the orchestrators of a network, or partners of an established network. By developing an "integrated offering of equipment and services for farmers," enabling them to "gradually build a compelling

[79] ETC, Issue # 110, Gene Giants Seek "Philanthrogopoly (March 2013).
[80] See, http://www.agaccord.org/ (accessed May 29, 2017). The Generic Event Marketability and Access Agreement (GEMAA) that entered into force in November 2012 and the Data Use and Compensation Agreement (DUCA) that was opened for signature in December 2013 and will become operational once it is signed by six parties.

one-stop solution that will allow them to compete for the lion's share of the market"[81]. By offering a package of 'complementary' products and technologies, they will be able to establish and control their own value chain, change the way competition takes place in this industry[82].

Firms have the choice to either opt for an open system in which different complementary assets (such as genetic traits and seed germplasm) interoperate well with rival technology, or to develop "closed" platforms. This choice involves "fundamental decisions to promote open source versus proprietary technologies, "plug-and-play" versus non-standardized components, and tactics that are designed to frustrate rivals' access to needed technology"[83].

The emergence of integrated technology/traits/seeds/chemicals platforms may place barriers to new entry, as companies wishing to enter the market(s) would need to offer an integrated solution to farmers. This may stifle disruptive innovation, if in the absence of the merger, firms were able to enter one or two segments of the market (e.g. research and breeding) without the need to offer an "integrated" platform product that would offer significant economies of scale, but would also require high fixed costs. This may eventually protect the existing market position of these market leaders from the risk of disruptive entry at another segment of the value chain[84].

A. Effects on product markets: price, output and consumer choice

The merger will affect competition in the markets for crop seeds, by increasing, in particular the levels of market concentration in the control of seed traits technology and germplasm. Although this will certainly be a major concern in GM seeds' dominated markets, such as the US, where more than 90% of corn, cotton and soybean acreage is planted with transgenic varieties, it could also be a concern in more traditional seed markets, which are expected to be the fastest growing segment of the total seed sales. The new entity will control 70% of the cottonseed market in the US[85]. As most of the stacks of transgenic traits constitute combinations of traits from different companies (inter-firm stacking), in which Monsanto constitutes, thanks to its cross-licensing agreements, the central node (at least for traited cotton, soybean and corn seeds), the merger may further dampen competition, reinforcing Bayer's and Monsanto's market position in genetic traits and related herbicides[86].

Although Bayer and Monsanto are primarily active in different segments of the food value chain, the two companies also compete in specific seed markets. For instance, Monsanto's Deltapine brand competes with Bayer's Fibermax and Stoneville brands for cotton seed.

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[81] Boston Consulting Group, Crop Farming 2030 – The Reinvention of the Sector (April 2015), available at https://www.bcgperspectives.com/content/articles/process-industries-innovation-crop-farming-2030-reinvention-sector/, p. 10 (accessed May 29, 2017).

[82] D. L. Moss, Transgenic Seed Platforms: Competition Between a Rock and a Hard Place?, AAI Submission, October 23, 2009, p. 2.

[83] Ibid., p.12

[84] JP Choi 'Preemptive R&D, Rent Dissipation and the 'Leverage Theory' [1996] 110 *Quarterly Journal of Economics* 1153; JP Choi and C Stefanadis 'Tying, Investment, and the Dynamic Leverage Theory' [2001] 32 *Rand Journal of Economics* 52.

[85] Financial Times, Bayer-Monsanto sows seeds of doubt among regulators (May 30, 2016), available at: https://www.ft.com/content/e76f4d8a-23f2-11e6-9d4d-c11776a5124d (accessed May 29th, 2017.

[86] See, for instance, the combination of Herculex I-Liberty Link – Roundup Ready 2 for corn, or the SmartStax GM seed made through a collaboration between Monsanto and Dow.

Following the merger, Bayer will have access to more than 2000 varieties of seeds for crops[87]. It will also gain a leadership role in the big data in agriculture, enabling it to integrate its expertise with precision planting[88]. The merger will lead to the geographic expansion of the Bayer/Monsanto integrated platform, Monsanto disposing of a dominant share of the markets for seeds in the United States and Latin America, while Bayer being strong in Europe and the Asia-Pacific region[89].

It is also clear that the merger will affect competition in the pesticides markets, in view of the competitive relation between Bayer's Liberty and Monsanto's Roundup (glyphosate). Suffice to note that the market for pesticides was covered by the commitments the Commission accepted in the Dow/Dupont merger.

One of the major concerns in this sector is that further industry concentration will increase the risk of collusive pricing. Coordination between few market players (around 3) is easier. This is particularly the case in the context of markets with significant barriers to entry resulting from the important sunk costs for R&D and the need to offer an 'integrated' one stop solution to farmers requiring entry in various market segments. Almost the same institutional investors simultaneously hold large blocks of shares in both firms, as well as some of their competitors, which may also be a factor facilitating collusion[90]. In particular,

- BlackRock Inc. controls 5.97% of Monsanto, 6.31% of Dupont and 6.58% of Dow Chemical;
- the Vanguard Group controls 6.82% of Monsanto, 6.99% of Dupont and 6.65% of Dow Chemicals
- State Street Corp. controls 4.59% of Monsanto, 4.91% of Dupont and 3.97% of Dow Chemicals[91].

The new more consolidated market structure presents increasing risks for the adoption of strategies of 'parallel exclusion'[92] or cumulative foreclosure effect[93], as the remaining platforms, which are linked through a wide network of cross-licensing and other cooperation agreements, in addition to the common ownership highlighted above[94], may attempt to raise the costs of potential rivals, including biotechnology start-ups researching the plant-microbiome for biological agriculture products and products based on genome editing technologies.

Market leaders may also opt for a strategy of integrating these disruptive start-ups within their global value chains once the latter's R&D investments may begin to mature into innovative

[87] K. Calamur, Bayer and Monsanto's mega merger, (Sept. 14, 2016), available at https://www.theatlantic.com/news/archive/2016/09/bayer-and-monsantos-mega-merger/499919/ (accessed May 29, 2017).

[88] African Center for Biodiversity, The Bayer-Monsanto merger: Implications for South Africa's agricultural future and its small holder farmers (February 2017), 13-14.

[89] Financial Times, Bayer-Monsanto sows seeds of doubt among regulators (May 30, 2016), available at: https://www.ft.com/content/e76f4d8a-23f2-11e6-9d4d-c11776a5124d (accessed May 29th, 2017)

[90] J Azar, 'Portfolio Diversification' Market Power, and the Theory of the Firm, (2016) unpublished manuscript, available at dx.doi.org/10.2139/ssrn.2811221 ; M Anton, F Ederer, M Gine, & M Schmalz, 'Common Ownership, Competition, and Top Management Incentives' [2016] Ross Sch. of Bus. Paper No. 1328.

[91] *Bloomberg* as of March 31, 2017 (command "HDS" – all larger shareholders). See also, I. Lianos, D. Katalevsky & G. Ovchinikov, The limits of competition law - exploring the recent agro-chem merger wave, UCL CLES Research Paper 3/2017 (forth.)

[92] C.S. Hemphill & T. Wu, Parallel Exclusion, (2013) 122 Yale Law Journal 1182.

[93] I. Lianos with V. Korah & P. Siciliani, *Competition Law: Analysis, Cases and Materials* (OUP., forth. 2018).

[94] Common ownership refers to the situation where direct competitors are owned by overlapping common investors.

products[95]. Companies would thus spend their money in defensive ways by buying potential competition leading to a considerable acceleration of M&A activity, which because of the high turnover thresholds for merger control may not satisfy the jurisdictional criteria for merger control, and would thus escape from the scrutiny of competition authorities. The merger may also facilitate their access to cheap capital and debt-based external growth, facilitating these practices of buying potential competition.

Depending on the market power of the merged entity in various product markets, the merger may lead to unilateral effects if the two merging parties are the closest competitors in the specific relevant market (e.g. Bayer's Liberty competing with Monsanto's Roundup).

It is likely that IP rights will be strategically employed in order to block new entry, in particular from generics. This will likely occur if the merged entity controls indispensable technologies, germplasm or data packages. Monsanto's Roundup and Roundup Ready technology has entered the public domain, when the patent on the trait for soybeans expired in 2015. Competitors were thus able for the first time to introduce a generic version of the trait. However, Monsanto has patented the Genuity™ Roundup Ready 2 Yield trait technology, these seeds being protected by a different utility patent which will not expire until the end of the next decade. Even if patents expire on transgenic traits there are still patents protecting breeding technologies, germplasm and conventional ("native") traits[96].

The speed of the entry of generics in this market will depend on the access generic seed companies may have to Monsanto's and other Big Six' data packages allowing them an advanced development and testing. Similar concerns arise also in the crop protection agents segment, where the registration of a crop protection product may take a significant amount of time and money, (between 8-10 years and around $260 million before commercial launch)[97].

Of course, following a well-established case law of the CJEU, such restrictions may come under the scope of *ex post* control under Article 102 TFEU. Thus, a mere possibility that such conduct could be adopted by the parties should not lead to the prohibition of the merger, as it cannot be assumed that the parties will infringe Article 102 TFEU. The Commission has nevertheless the competence to examine comprehensively whether it is probable that the merged entity may impose a significant impediment of effective competition, taking into account the Merger Regulation's purpose of prevention[98]. Since the adoption of the new SIEC test under Regulation 139/2004, a merger may also be prohibited even if it does not lead to an abuse of a dominant position that could eventually be caught, or deterred, by the *ex post* enforcement of Article 102 TFEU.

Most of the merger activity in this sector has occurred outside the radar of competition authorities, and in particular the Commission. There has only been one seeds merger case since 2006, Syngenta's acquisition of Monsanto's sunflower seed business, which has been subject to

[95] Comanor and Scherer point out to how M&A may have been used as a safety net for companies against the uncertain prospects of innovation projects or to acquire synergies in R&D, W. S. Comanor and F. M. Scherer, Mergers and innovation in the pharmaceutical industry, (2013) 32 *Journal of Health Economics* 106-113. Similar analyses can also be found in P. Gleadle et al., Restructuring and innovation in pharmaceuticals and biotechs: The impact of financialisation, (2014) 25 *Critical Perspectives on Accounting* 67-77.

[96] For instance, 'most Roundup ready soybeans in the US are protected by utility patents covering specific varieties': Monsanto 2016 Annual Report, Form 10-K, 6.

[97] Syngenta, Our Industry 2016, 70.

[98] Case C-12/03, Commission v. Tetra Laval BV, ECLI:EU:C:2005:87, para. 75.

remedial conditions. The Commission expressed concerns over the possible exclusionary effects of the merger, which would have removed a considerable competitor in the market for the commercialisation of sunflower seeds in Spain and Hungary. It also expressed concerns with regard to the exchange and licensing of sunflower varieties, insofar as the merging parties would have been in a position to restrict the access of competitors to inputs necessary for the commercialisation of sunflower seeds. The foreclosure of competitors in the markets for the commercialization of sunflower seeds would have led to the reduction of innovation, and the subsequent reduction of consumer choice in sunflower seed hybrids. To address these concerns Monsanto agreed to divest its sunflower hybrids[99]. The focus of the Commission on the foreclosure of competitors and the reduction of innovation and consumer choice are likely to influence the approach it will follow in the Bayer/Monsanto merger.

The effect of the merger on prices may lead to considerable effects for the viability of smallholder farming. The share of seeds in total farm cost ranges between 2% and 15% among EU Member States[100]. EU farmers have faced increases in prices of seeds and planting stock by 30% between 2000 and 2010[101].

Higher levels of consolidation may also lead to a decrease in the number of available cultivars, with a shift in focus to crops and hybrids more profitable to companies, and the termination of breeding programs for regionally relevant crops[102], thus restricting consumer (farmer) choice. It has also been noted that consumer choice might become illusory if the same few companies own the largest number of the most popular brands. For instance, Monsanto owns Seminis and De Ruiter in the vegetable seeds market, and Dekalb and Asgrow in the agricultural seeds market[103].

Following the announcement of the merger, Bayer and Monsanto have been considering the sale of some of their assets that could be considered as raising the risk of competition law concerns in order to push for regulatory clearance of their merger. It is expected that these assets to be divested will relate to soybean, cotton and canola seeds, where the two companies have significant overlaps, as well as Bayer's LibertyLink-branded crops, in view of the fact that this is an alternative to Monsanto's Roundup ready seeds. However, it is unclear if such pre-emptive structural (divestiture) remedies, as well as remedies that may eventually be imposed by the European Commission and other competition authorities, would be effective to deal with these horizontal overlaps and eventual portfolio effects. The divested assets need to be acquired by third parties without that acquisition raising competition concerns, something that may be difficult in the context of the Bayer-Monsanto merger as it would be difficult to find a viable competitor outside the three market leaders[104]. More importantly, such divestitures of chemical

[99] Case No COMP/M.5675-Syngenta/Monsanto's Sunflower Seed Business, C(2010) 7929 final.
[100] European Commission, Overview of the Agricultural Sectors in the EU Study (2015), 12.
[101] Report of the European Parliament on the farm input supply chain: structure and implications 2011/2114(INI), rapporteur José Bové, available at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A7-2011-0421+0+DOC+XML+V0//EN (accessed May 29, 2017)
[102] S. Ø. Solberg & L. Breian, Commercial cultivars and farmers' access to crop diversity: a case study from the Nordic region, (2015) 24 Agricultural and Food Science 150 (proceeding to a study of five Nordic countries from 1950 to the present).
[103] European Commission, DG for Internal Policies, The EU Seed and Plant Reproductive Material Market in Perspective: A Focus on Companies and Market Shares - Note (2013), 15.
[104] D. Moss, Mergers, innovation, and agricultural biotechnology: Putting the squeeze on growers and consumers?, Truthonthemarket Blog Ag-Biotech symposium, (March 31, 2017), available at

products, that may become obsolete in view of the recent progress of genome editing technologies, will not address the negative effects of the merger on future competition in these markets and innovation. Indeed, the three mega agro-chem corporations that would dominate the market if Bayer/Monsanto merger goes through, would control large patent portfolios, would employ specialised personnel, dispose of well-known brands and would have an installed (and dependent) customer base (farmers) for various products (through long-term contract agriculture). They would thus maintain their ability to conquer back market shares and expand in any segment of the agricultural value chain.

B. Effects on innovation

The Big Six usually develop an integrated strategy for R&D for all types of crops, working on "traditional" market-assisted breeding, or the more recent forms of predictive breeding that have become commercially possible with the reduction of the cost of genome sequencing and the use of IT, as well as on genetically engineered seeds. It is clear that the effects of this merger on innovation will not only be limited in the genetically engineered traited seeds, but will inevitably expand to conventional seeds. As it is explained by a recent report commissioned by the American Antitrust Institute, the Food&Water Watch and the National Farmers Union, following the acquisition by the largest agricultural biotechnology companies of independent conventional and hybrid seed breeders in the last two large merger waves in this sector, the agro-chem companies cut back their non-biotech offerings, or even altogether dropped them, limiting choice for farmers[105]. One may not exclude the significant interlinkages between R&D in both bio-tech and conventional plant breeding and the need to ensure that there would be sufficient incentives to innovate in conventional plant breeding, which is still the dominant method of breeding in the EU.

Assessing the possible effects of each merger on innovation will be a quite complex exercise, in view of the various perspectives one may take on innovation and its interaction with market structure. Innovation could refer to investment in new technologies, but also on the broader direction of the R&D effort in the industry in the future. Investment in seed saving and seed diversity, rather than standardisation of traits, or in non-agro-chemical pest management approaches constitutes a business model that farmers may be less likely to choose, if they are forced to take their advice from the same agro-chem giants. Indeed, one may not exclude the possibility that the latter will have a material bias to promote the type of productive model for farmers, as this would enable them to increase the farmer's technological dependence on them and acquire a larger share of the total surplus value produced by the agricultural value chain, in comparison to the conventional breeding model.

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https://truthonthemarket.com/2017/03/31/mergers-innovation-and-agricultural-biotechnology/ (accessed May 29, 2017) (raising concerns over the possibility to find a viable competitor to acquire the divested assets outside of the Big 6), Hence, should other mergers be cleared without conditions in the traits and seeds business, Big 6 would have become Big 3, as the Bayer/Monsanto merger will be the last one examined, thus raising even more questions about the possibility to find a buyer outside the three market leaders.

[105] AAI, Food & Water Watch, National Farmers Union, Proposed Merger of Monsanto and Bayer, (2017, July 26th), 5.

The effect on innovation will certainly be a crucial aspect of the European Commission's merger assessment. The innovation potential of the merging firms, in particular if "one or more merging parties are important innovators in ways not reflected in market shares", is taken into account, irrespective of the levels of concentration that are usually considered by the Commission's Horizontal Guidelines as raising competition concerns[106]. Similarly, the EU non-horizontal merger guidelines list the diminishing of innovation as a competition concern for vertical and conglomerate mergers[107] and also state that mergers involving innovative companies that are likely to expand significantly in the near future will be extensively investigated even when the post-merger market share is below 30%[108]. In a recent Competition Policy Brief, the European Commission explains that harm to innovation may justify the Commission to consider that a merger between a firm present in the relevant market with a firm that is not actually present in the relevant market could lead to a significant impediment of effective competition[109]. Hence, negative effects in innovation may not only be produced by mergers leading to important horizontal overlaps, but also by vertical or conglomerate mergers.

In its recent decision on the *Dow/Dupont* merger, the European Commission found that the merger may have reduced innovation competition for pesticides by looking to the ability and the incentive of the parties to innovate. The Commission found that the fact that two parties were competing head-to-head in a number of important herbicide, insecticide and fungicide innovation areas may have affected, after the merger, the incentive of the new entity to innovate and may have led it to discontinue some of these costly development efforts. The Commission emphasised that this analysis was not general but was based on "specific evidence that the merged entity would have lower incentives and a lower ability to innovate than Dow and DuPont separately" and "that the merged entity would have cut back on the amount they spent on developing innovative products"[110].

European Commission, Press Release on Dow/Dupont, (2017)

"(o)nly five companies (BASF, Bayer, Syngenta and the merging parties) are globally active throughout the entire R&D process, from discovery of new active ingredients (molecules producing the desired biological effect), their development, testing and regulatory registration, to the manufacture and sale of final formulated products through national distribution channels. Other competitors have no or more limited R&D capabilities (e.g. as regards geographic focus or product range). After the merger, only three global integrated players would remain to compete with the merged company, in an industry with very high barriers to entry. The number of players active in specific innovation areas would be even lower than at the overall industry level"[111].

[106] EU Horizontal Merger Guidelines [2004] OJ C31/5, paras 8 & 20.
[107] EU Non Horizontal Merger Guidelines [2008] OJ C 265/7, para. 10.
[108] Ibid., para. 26.
[109] European Commission, Competition Policy Brief, 2016-01, p. 3.
[110] European Commission, Press Release on Dow/Dupont, (2017), available at http://europa.eu/rapid/press-release_IP-17-772_en.htm (accessed May 29, 2017).
[111] Ibid.

This type of assessment looks close to the filter of the existence of at least four independent technologies that constitute a commercially viable alternative, in addition to the licensed technology controlled by the parties to the agreement that the Commission usually employs in its Transfer of Technology Guidelines[112]. This is used in order exclude the possibility that a licensing agreement may restrict competition and thus infringe Article 101 TFEU. There is no reason why the Commission should apply a different approach in the context of merger control. The above indicates that the Commission may view more negatively mergers that lead to less than three or four independent technologies commercially available on the market, which is exactly what the Monsanto/Bayer merger will have as effect on the seed markets.

It has been alleged that by looking to the broader effects on the direction of innovation in the industry the Commission may establish a novel theory of harm, that of a significant impediment to industry innovation (SIII), in particular if it does not assess this effect on specific innovation markets that could be affected by the merger[113]. According to this view, the Commission's SIII theory is based on a presumption that regulatory intervention is warranted when a merger removes a "parallel path R&D", this being not in line with the standard of proof in EU merger control, which would require, according to these critics, to define a specific innovation market that would be affected by the merger[114].

These criticisms are far-fetched. First, it is quite difficult to explain why the competition authority should not assess, when examining the merger, what would be its effects on the innovation incentives in the industry. This has already been done, without necessarily defining a specific "innovation market". Second, the Commission's approach, as it has also been expressed in the context of the Transfer of Technology Guidelines, indicates that the main concern is the existence of sufficient choice in terms of independent technologies available in the market. Such analysis need not be hypothetical and it can be based on plausible effects. It is possible to take into account the patent portfolio strength of the merging parties, as well as the existence of licensing and cross-licensing agreements with rivals and internal strategy documents in order to assess the possible effects of a specific merger on innovation. Defining "innovation markets" is just one of the various methodologies at the disposal of the Commission to assess the effects of a merger transaction on innovation. Such an approach may not work well in mergers involving various segments of the value chain, and involving the development of integrated farming solutions that could be used by the farmers. There is a high risk that the use of "innovation markets" in this competitive context could omit some possible innovation effects.

The market for agricultural biotechnology development is particularly concentrated, with the Big Six accounting for a significant number of agricultural bio-technology patents issued in the US, as well as more than 80% of crop field trials for regulatory release in the US[115]. There is empirical evidence of the inverse relationship between firm concentration in corn, cotton and soybean seed markets, and R&D intensity in these markets, research finding that as the number

[112] European Commission, *Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements*, [2014] OJ C 89/3, para. 157.
[113] N. Petit, Significant Impediment to Industry Innovation: A Novel Theory of Harm in EU Merger Control?, ICLE White paper 2017-1, 22.
[114] Ibid., p. 21.
[115] J.L. King & D. Schimmelpfenig, Mergers, acquisitions, and stocks of agricultural biotechnology intellectual property, (2005) 8(2&3) *AgBioForum*, 83-88. Available: http://www.agbioforum.org (accessed May 29, 2017).

of firms declined following the M&A waves, the intensity of R&D fell[116]. Similar evidence exists for the effect of mergers on innovation in the pharmaceutical industry[117]. Although synergies and efficiencies have often been put forward as the main rationale for mergers, the empirical evidence that these are effectively realized remains rather poor[118]. The companies may argue that they will increase spending on R&D. However, there may be doubts on these increases in R&D research materializing, in view of the fact that their R&D expenses have been going down recently[119]. Having three instead of six important market players may restrict the possibilities of joint collaboration on R&D, in view of the prevalence of cross-licensing in this sector, thus increasing the risk of tacit collusion, in particular as most stacks are inter-firm stacks. Overlaps in biotech innovation could also lead to size down research capabilities and thus restrict the number of R&D poles. Finally, a recent drop in research intensity in this sector may be related to the increasing consolidation of the industry, thus showing an inverse relation between market concentration and innovation.

J. Fernandez-Cornejo & D. Schimmelpfennig, Have Seed Industry Changes Affected Research Effort?, Amber Waves (2004), available at https://www.ers.usda.gov/amber-waves/2004/february/have-seed-industry-changes-affected-research-effort/

'Calculations for corn, soybeans, and cotton indicate that as the seed industry became more concentrated during the late 1990s, private research intensity dropped or slowed. Was there a connection between the concentrating industry and the slowing intensity? Further ERS analysis, using econometric methods, found a simultaneous self-reinforcing relationship. Those companies that survived seed industry consolidation appear to be sponsoring less research relative to the size of their individual markets than when more companies were involved. This finding runs counter to the hypothesis that dominant firms in consolidated industries conduct more new product research than they otherwise would in order to expand the size of their markets (because of less risk of being outcompeted during the long time periods required to bring new products to market)'.

Take away

[116] D. E. Schimmelpfennig et al, The impact of seed industry concentration on innovation: a study of US biotech market leaders, (2004) 30 Agricultural Economics 157–167.

[117] W.S. Comanor & F.M. Scherer, Mergers and innovation in the pharmaceutical industry, (2013) 3291) Journal of Health Economics, 106-113; J. Haucap & J. Stiebale, How Mergers Affect Innovation: Theory and Evidence from the Pharmaceutical Industry, DICE DISCUSSION PAPER 218 (2016), available at http://www.dice.hhu.de/fileadmin/redaktion/Fakultaeten/Wirtschaftswissenschaftliche_Fakultaet/DICE/Discussion_Paper/218_Haucap_Stiebale.pdf .

[118] For recent empirical evidence: see B.A. Blonigen & J.R. Pierce, 'Evidence for the Effects of Mergers on Market Power and Efficiency' [2016] Finance and Economics Discussion Series 2016-082. Washington: Board of Governors of the Federal Reserve System, available at doi.org/10.17016/FEDS.2016.082.

[119] For instance, Monsanto' expenses for R&D have been going down in recent years: from $1,725 million in 2014 to $1,580 million in 2015 and $1,512 million in 2016: Monsanto 2016 Annual Report, Form 10-K, p. 8. It therefore looks that, as a percentage of sales, R&D spending has actually slumped back down to mid-1990s levels. The level of R&D in this sector (between 8.5-11.4% of sales) [Bayer, Acquisition of Monsanto to Create a Global Leader in Agriculture, Investor Presentation, June 2016, 17] is also much lower than the level of R&D in the pharmaceutical sector (between 16-20% of sales), even if the level of costs of launching an innovative product (including the costs associated to the regulatory approval pipeline) are comparable.

The merger risks producing a significant impediment to effective competition. First, it may lead to price increases and output restrictions. This may be due to the ability and incentive of the merged entity to develop exclusionary strategies, in particular against disruptive small innovators. High overall consolidation and the presence of three integrated platforms may also dampen competition. The high risks of collusion in a three competitors market where firms have significant links, either in the form of cross-licensing agreements and shared genetic trait varieties, or in the form of interlocking shareholding by more or less the same institutional investors, may also facilitate collusion between the existing players in this tight oligopoly. Finally, the merger will produce significant effects on innovation, as the two companies will reduce their R&D expenses and merge competing R&D programmes, further reducing research intensity in this sector.

VI. Farmers and global food value chains

The consumers that would be primarily affected by the merger are farmers, who already dispose of a limited bargaining power. Traditionally, competition law has dealt with such unbalances of power by reinforcing the bargaining power of farmers so as to counter-balance that of other segments of the food value chain, downstream but also upstream, by enabling them to form agricultural cooperatives. These specific exceptions/regimes have nevertheless been under attack lately and their scope limited, as a result of the rise of a specific view of the consumer welfare paradigm in competition law. It is also another issue to deal with a dozen seed and agro-chem players compared with just three integrated platforms across all segments of the value chain. The exclusion and marginalization of competitors through anticompetitive practices of input or customer foreclosure[120], may lead to increasing exploitation of farmers. The rise of "contract agriculture"[121] has led farmers to enter into "take it or leave it" long-term exchanges with only a few companies controlling germplasm. This may reinforce their technological dependence vis-à-vis a small number of agro-chem companies, rendering switching to another

[120] Input foreclosure occurs when the merging firm operating at the upstream level no longer supplies its important input to rivals of the merging firm operating at the downstream level at the same terms and conditions that would have prevailed absent the merger. The resulting restriction of access to the important input can range from higher supply prices, lower quality or quantity supplied, to outright refusal to supply. The rivals of the merging firm active at the downstream level are therefore disadvantaged because of the resulting increase in the cost (or decrease in the quality) of supply. Hence, to the extent that the rivals cannot absorb the cost increase, but have to pass this on their consumers by increasing their prices, the merged entity will be able to raise its own prices in parallel, causing consumer harm. Customer foreclosure arises when the downstream division of the merged entity stops purchasing from rival upstream suppliers. If there are economies of scale at the upstream level, and if the downstream division of the merged entity accounted for a large enough share of rival suppliers' sales before the merger, then the costs of rival upstream suppliers will go up due to the loss of economies of scale caused by the reduction in output sold to the downstream division after the merger. To the extent that this cost increase is then passed on to downstream rivals through higher upstream prices, the downstream division of the merged entity will benefit by being able to raise its own prices and/or capture some of the sales diverted from downstream rivals, thus causing consumer harm.

[121] N. E. Hart, The Age of Contract Agriculture: Consequences of concentration in Input Supply, (2000) 18(1) Journal of Agribusiness 115-127; J. McDonald et al., Contracts, Markets, and Prices: Organizing the Production and Use of Agricultural Commodities, (2004) Agricultural Economic Report No. 837 9, available at http://www.ers.usda.gov/media/284610/aer837_1_.pdf (accessed May 29, 2017).

(new) product or package of products particularly difficult, even if new entrants may offer more personalized service and products developed for local soils and climates.

The consolidation of the agricultural manufacturing industry that may be expected from these strategies to develop one-stop shop solutions for farmers will further reduce the bargaining power of farmers. Farming as an industry will become increasingly *commoditisized*, meaning that farmers will find themselves outsourcing more and more critical inputs (i.e., seeds) and decisions (through IT decision-support systems) to global agriculture solutions providers. The farmers will thereby increasingly lose control of seed materials (this decision in turn defines the mix of crop protection products and other inputs), and very soon they may be forced to outsource other decision-making capabilities. This will have devastating effects on local varieties and non-standardised agricultural products. In the long run, to stay competitive farmers will be forced to use standardised seeds supplied to them from a limited number of global players, and an associated array of complementary products to these seeds from the same companies. Also, they will be using relatively the same agriculture machinery from the other limited group of global equipment providers such as John Deere, CNH, AGCO, Claas, etc, or eventually be locked in data-driven agricultural equipment platforms managed by Bayer/Monsanto. In view of the commitment of the EU to support farmers and enhance their bargaining power, these concerns should be taken into account when assessing the merger.

Take away

Farmers will pay the price of an increase in concentration in this sector. Not only will they be technologically, and eventually economically dependent, on an integrated seed/agro-chem/smart agriculture platform, but their work risks becoming increasingly commoditised. Consequently, they will lose control over decisions concerning the use of inputs, such as seeds and pesticides, as well as outsourcing other decision-making capabilities. This may have important implications on variety and choice in these markets.

VII. Conclusions

If it is approved, the proposed Bayer-Monsanto merger will create a tight oligopolistic market of three global agri-tech platforms that will control almost 2/3 of the global production of seeds and agrochemicals, and an important position in the agricultural equipment markets related to Big Data and "smart agriculture". These three integrated platforms will become a one-stop shop for farmers, who will be technically and economically dependent on them, for all important decisions, thus ceasing effectively to operate as independent economic actors.

The merger will not only have effects on the prices of inputs, as well as the amount of inputs (e.g. pesticides) used by the farmers, with possibly negative environmental implications, but will also influence the direction of the innovative effort in the industry, as most R&D investments will focus on the agro-chem model of agricultural production, consistently with the dominant business model of these companies, and not on seed saving and seed diversity, as well as non-agro-chem pest management technologies.

Innovation in the industry will also be reduced, with only three (or four in the best-case scenario) independent private R&D poles (that is, independent centres of R&D) actively present in the world. This is particularly damaging as public funding in agricultural R&D has either faller or stayed stagnant in recent decades, the main research effort being accomplished in the private sector[122], and as new technologies, including CRISPR, are applied in the sector. In order to promote innovation, we need multiple competing R&D poles rather than a concentrated R&D structure.

It may be argued that humanity is doomed to face famine and malnutrition, unless considerable amounts of investment are made in R&D. In view of the fall of public investments and increasingly more important role of private investments in this sector the argument has been put forward that a higher level of consolidation could lead to higher profitability (at the expense of farmers) without necessarily leading to immediate effects on food prices. Indeed, the farmer segment is driven by atomistic competition in most markets, and therefore does not have the ability to pass on, at least immediately, the eventual overcharges to the final consumers. Such an approach may not factor in the effects to the livelihood of around half a billion farmers in the world and their families, most of whom do not benefit from subsidies guaranteeing an acceptable standard of living. It also assumes that higher profitability would lead to higher investments in R&D, a claim that has been recently questioned by research indicating that large firms prefer to retain earnings and distribute them to shareholders and the management rather than invest them in R&D[123]. But, more generally, a simple question that one may ask is "is this projected merger *necessary* in order to promote innovation in this sector"?

Our answer is negative. The main reason efficiency gains were put forward by these mergers relates to synergies (estimated to US $1,5 billion by 2020[124]) and cost cutting made possible because of the integration of Monsanto's and Bayer's research expertise in seeds and pesticides. One may, first, question the benefits to dynamic efficiency and innovation of cost cutting in traits research, which constitutes one of the three major categories of cost synergies expected by the merger[125]. Cutting R&D and the pursuit of diverse research programmes and routes does not constitute an "efficiency gain" public authorities should easily accept. Second, should we accept such efficiency gains, this will orient the research effort towards agro-chem models of agricultural production. However, these admittedly lead to a decrease in agricultural biodiversity. A "combined R&D pipeline" may also reduce the need to explore different innovation avenues that would have been possible if multiple innovation channels competed in the industry.

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[122] K. Fuglie, P. Heisey, J. King, C.E. Pray, D. Schimmelpfennig, The Contribution of Private Industry to Agricultural Innovation, (2012) 338 Science 1031.

[123] See, for instance, some recent research on big pharma: W. Lazonick, Profits without prosperity, (2014) 92(9) *Harvard Business Review* 46-55; W. Lazonick and M. Mazzucato, The risk-reward nexus in the innovation-inequality relationship: Who takes the risks? Who gets the rewards?, (2013) 22(4) *Industrial and Corporate Change* 1093-1128; P. Gleadle et al., Restructuring and innovation in pharmaceuticals and biotechs: The impact of financialisation, (2014) 25 *Critical Perspectives on Accounting* 67-77; M. Mazzucato, Financing innovation: creative destruction vs. destructive creation, (2013) 22(4) *Industrial and Corporate Change* 851-867.

[124] Monsanto, Bayer and Monsanto to Create a Global Leader in Agriculture 9September 14, 2016), available at http://news.monsanto.com/Bayer-Monsanto-acquisition (accessed May 29, 2017).

[125] AAI, Food & Water Watch, National Farmers Union, Proposed Merger of Monsanto and Bayer, (2017, July 26th), 4.

The main rationale for the transaction is the constitution of integrated platforms raising the opportunities to gain a larger percentage of the global food value chain to the detriment of farmers. It also provides these integrated platforms the power to manage the process of innovation in the sector, by giving them the ability to impede the entry of smaller disruptive innovators and/or marginalize them, in case they are not able to integrate them, possibly by buying them out, in their value chains. This "long term value creation potential" of the merger, is merely associated to future profits that will be generated by their packaged sales of seeds, traits, pesticides and IT, and is merely financed through debt with US $ 57 billion committed by Bank of America, Merrill Lynch, Credit Suisse, Goldman Sachs, HSBC and JP Morgan[126].

The affected markets are highly concentrated. The negative effects of this merger on innovation are more than plausible. The difficulty to find independent purchasers of the divested assets may also limit the attraction of a conditional approval solution. The existence of less competition-restrictive alternatives to achieve the synergies put forward by the parties is also clear, if one looks to the different forms of contractual collaboration occurring in the industry. All these factors together argue for the Commission to take action and to block the merger. Should this not happen, it becomes crucial to devise a remedial package that will address, if not all, most of the competition concerns. This calls for the divestiture of assets, in particular linked to the R&D capabilities of the companies, *as well as* their IT business, that would avoid reducing the technological dependence of farmers. It is clear that these divestitures should engage with *all* the possible theories of harm, something that no competition authority examining this merger has done so far. For instance, the recent global divestiture remedy for the Liberty Link traits business and Bayer's Liberty business, imposed by the South African Competition Commission as a condition for the clearance of the merger[127], does not specifically deal with the exclusionary portfolio effects and the possible effects on innovation that may result from the combination of germplasm, traits, breeding technologies, crop protection, Big Data and digital farming, neither takes into account the strength of the merging entity on traits and smart agriculture. In view of the significant effects of this merger on the EU market(s) and the presence of significant assets (in particular in R&D) in Europe, the European Commission is ideally placed to conduct this detailed analysis of the various theories of harm and to block the merger, in case, as we argue in this study, no other remedial option is appropriate. This will enable the development of a variety of R&D channels, further promoting innovation in this industry, to the greater benefit of the final consumers and the general public.

[126] Ibid.
[127] Competition Commission of South Africa, Case 2017Feb004 (Bayer/Monsanto) (May 3, 2017).

Annex 1- Bayer's recent M&A Activity

Year	Company purchased/target	Main Geographical markets involved	Product/Main activity of target company
2015	SeedWorks India Pvt. Ltd	India	Breeding, production and marketing of hybrid seeds of tomato, hot pepper, okra and gourds
2015	proPlant Gesellschaft für Agrar- und Umweltinformatik mbH	Germany	Agricultural digitalization: provider of plant health diagnosis and infection level warning service
2014	Biagro Group	Argentina, Brazil	Production and distribution of biological seed treatment solutions
2014	Granar S.A.	Paraguay	Breeding, production and marketing of improved seed (especially soybean seed) adapted to the growing conditions in subtropical regions
2014	E. I. DuPont de Nemours and Company (acquisition of land management assets)	United States. Canada, Mexico, Australia, New Zealand	Forestry and range & pasture business segments
2013	PROPHYTA Biologischer Pflanzenschutz GmbH	Germany	Supply of biological crop protection products
2013	Wehrtec Tecnologia Agricola Ltda	Brazil	Production of soybean seed
2013	Agricola Wehrmann Ltda	Brazil	Soybean business
2013	Melhoramento Agropastoril Ltda	Brazil	Soy Germplasm Bank
2013	FN Semillas S.A.	Argentina	Breeding, production and marketing of improved soybean seeds
2012	Abbott & Cobb Inc.	United States, Mexico, Australia	Watermelon and melon seed business

		and Asia	
2012	AgraQuest, Inc.	United States, Global	Supply of innovative biological pest management solutions based on natural microorganisms
2011	Hornbeck Seed Company, Inc.	United States	Supply of soybean, rice, and wheat varieties; in-house soybean breeding program and a proprietary soybean germplasm.
2011	Raps GbR	Germany	Oilseed rape seed business and breeding material
2009	Athenix Corporation	United States	Herbicide tolerance and insect control trait development platform, particularly for corn and soybeans
2007	Stoneville Pedigreed Seed Company	United States	Cotton seed production
2006	California Planting Cotton Seed Distributors, Inc.	United States	Development, production, and distribution of cotton planting seeds
2006	Reliance Genetics LLC	United States	Cotton production
2005	Associated Farmers Delinting, Inc. (acquisition of intangible assets and the property, plant and equipment required for the production of cotton seeds)	United States	Cotton seed production
2004	Gustafson	United States, Canada and Mexico	Manufacture and marketing of seed treatment products and related technical equipment.
2004	Bilag Industries Private Ltd, India (shares buy-back in a joint venture)	India	Manufacture of agrochemicals
2002	Aventis CropScience Holding S.A.	Global	Crop protection, biotechnology and agrochemical specialties
2001	Syngenta AG (acquisition of corn herbicide **MIKADO**®)	Europe	Crop protection and herbicide
2000	Novartis (acquisition of **FLINT**® line	Global	Crop protection

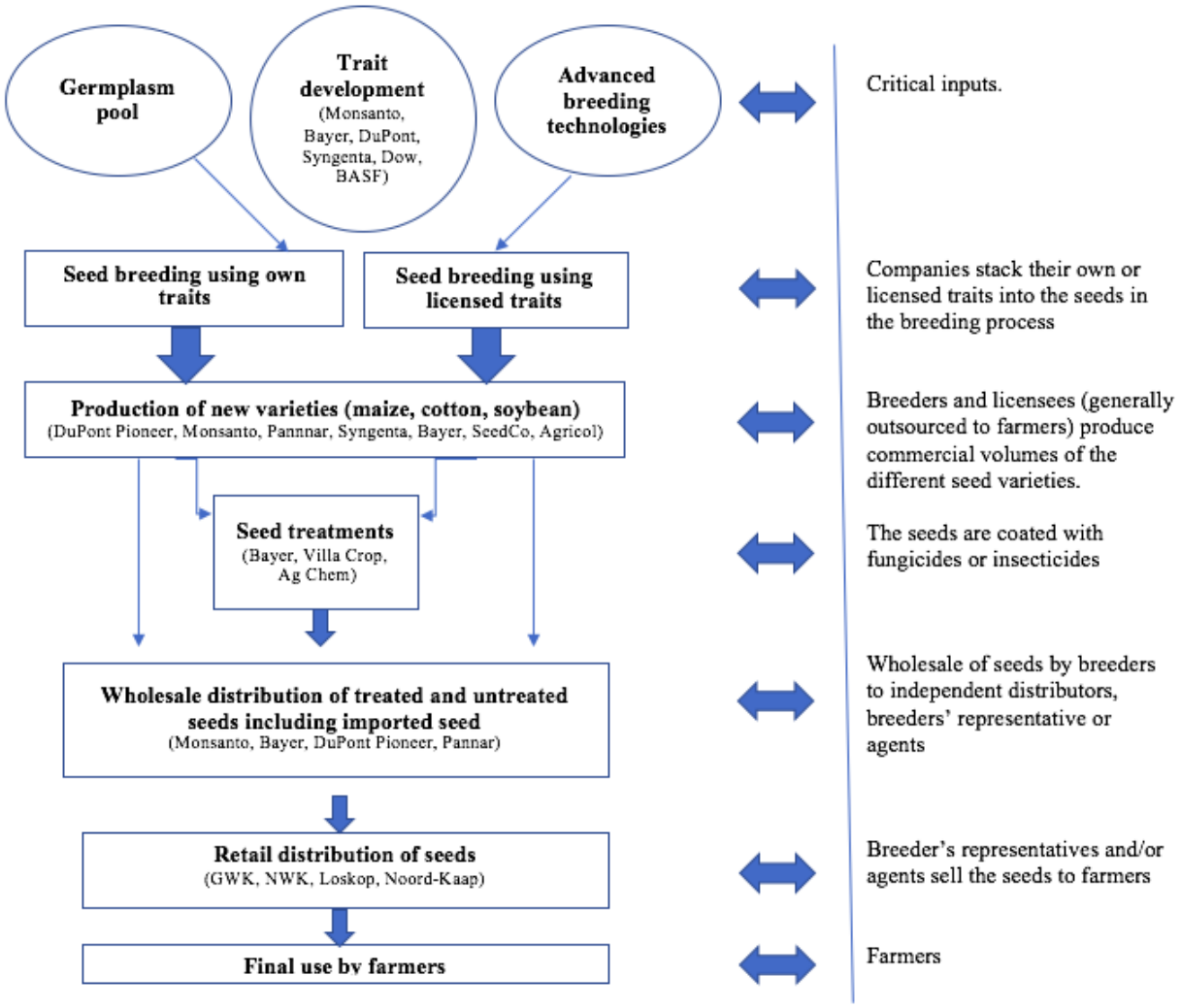
	of crop fungicides)		
2000	Misung Ltd. (acquisition of remaining interest of Joint Venture)	South Korea	Development and marketing of a wide range of crop protection products
1999	pbi Home & Garden Limited	United Kingdom	Supply of plant protection products and fertilizers for amateur gardeners
1998	Zeneca (acquisition of seed treatment business)	United Kingdom	Crop protection

Annex 2 – Monsanto's recent M&A Activity

Year	Company purchased/target	Main Geographical markets involved	Product/Main activity of target company
2016	Vitalfields	Europe	Digital agriculture innovation and farm management software
2016	TargetGene (acquisition of undisclosed equity stake)	Israel	Genome-editing technologies
2014	BioAgAllicance	United States	Alliance with Novozyme to work on microbial solutions
2013	Agradis, Inc.	United States	Development of sustainable agricultural solutions. Includes a collection of microbes that can improve crop productivity
2013	Rosetta Green Ltd	Israel	Identification and use of unique genes to guide key processes in major crops including corn, soybeans and cotton
2013	Grass Roots Biotechnology	United States	Gene expression and other agriculture technologies
2013	Dieckmann GmbH & CO. KG	Germany	Breeding of oilseed rape and rye seeds
2013	The Climate Corporation	United States	Weather data analysis
2012	Precision Planting, Inc.	United States	Planting technology development
2012	Beeologics	Israel	Development of biological tools to provide targeted control of pests and diseases
2011	Divergence, Inc.	United States	Research and development services for genomics and informatics on agriculture and infectious diseases, as well as products for the control of parasites
2011	Pannon Seeds	Hungary	Seed processing plant
2010	Anasac	Chile	Corn and soybean processing plant
2009	Westbred	United States	Focus on wheat germplasm

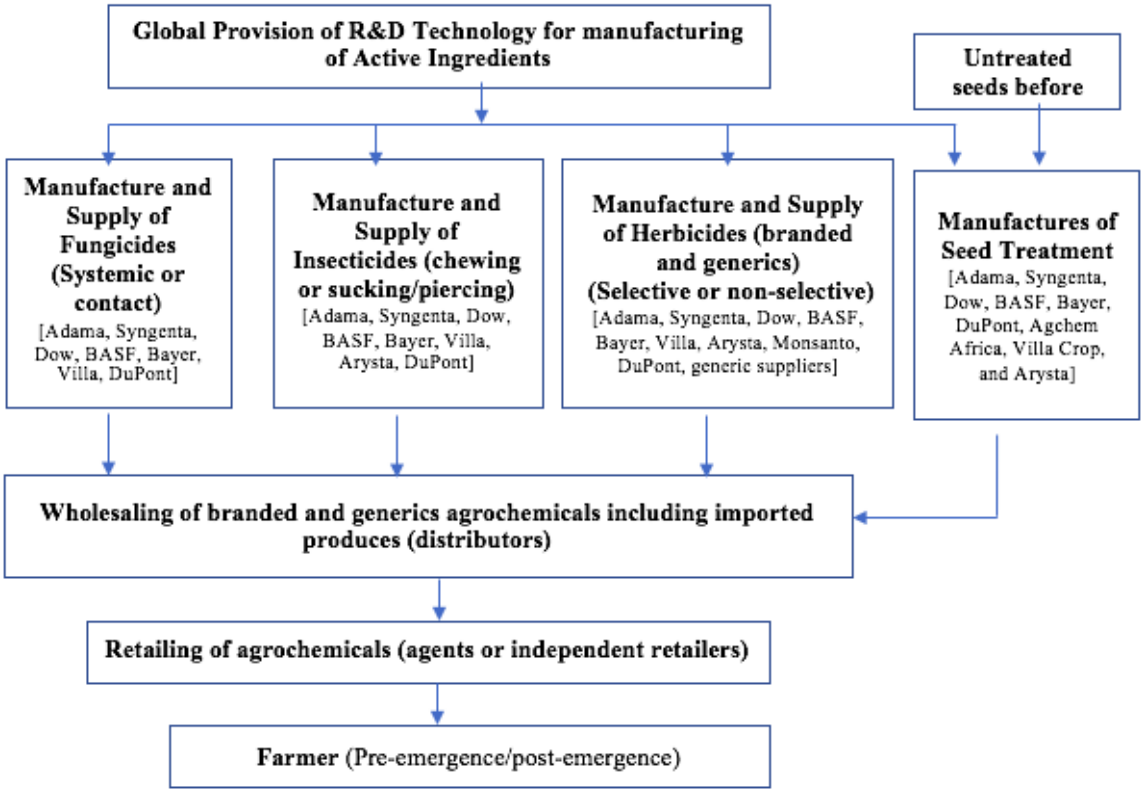
2009	MDM (acquisition of equity stake)	Brazil	Cotton seed business
2008	Aly Participacoes Ltda	Brazil	Sugarcane breeding and research and development in plant applied genomics
2008	Marmot, S.A.	Guatemala, Central America, and South America	Hybrid corn seed production and provider of corn, sorghum, forage sorghum, soybeans, and pastures (grass-type seeds)
2008	De Ruiter Seeds Group B.V.	Europe, Global	Breeding and production of hybrid vegetable seeds (including crops such as tomatoes, cucumbers, melons, peppers and rootstock). Provider of products to growers within the protected-culture vegetable seed market.
2008	Evogene Ltd (acquisition of equity stake)	Israel	Focus on crop productivity
2007	Agroeste Sementes	Brazil	Hybrid corn seed production
2007	Delta and Pine Land Company	United States	Commercial breeding, production and marketing of cotton planting seed. Also breeding, production and marketing of soybean planting seed.
2005	Emergent Genetics, Inc.	United States, India	Cotton seed business
2005	Icoria (agricultural division)	United States	Biotechnologies
2005	Seminis, Inc.	United States, Global	Development, growth and marketing of fruit and vegetable seeds
2004	Channel Bio Corporation	United States	Production and marketing of seeds (specialising in corn)
1998	Plant Breeding International Cambridge Ltd. and PBI Saatzucht GmbH	Europe	Production and marketing of new and improved crop varieties. Includes significant breeding programs for winter wheat, barley, oil seed rape, beans, peas and potato

Annex 3: Seed and traits value chain[128]



[128] Competition Commission of South Africa, Case 2017Feb004 (Bayer/Monsanto) (May 3, 2017), p. 34, para. 76 (figure based on third parties and merging parties' submissions).

Annex 4: Schematic representation of the agrochemicals supply chain[129]



[129] Competition Commission of South Africa, Case 2017Feb004 (Bayer/Monsanto) (May 3, 2017), p. 40, para. 92 (figure based on third parties and merging parties' submissions).