Sustainability Concerns in EU Merger Control: From Output-Maximising to Polycentric Innovation Competition*

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Abstract

This paper examines whether sustainability concerns play and should play any role in EU merger control. While competition authorities have commenced exploring pathways to excuse prima facie anticompetitive mergers on sustainability grounds, little progress has been made in setting out whether and under which conditions mergers that adversely affect sustainability parameters can be found anticompetitive. Under the EU merger control regime, the adverse effects of mergers on sustainability are only cognizable as innovation-related issues, as recently evidenced in *Dow/Dupont* and *Bayer/Monsanto.* In these cases, the Commission pioneered a novel approach aimed at predicting the impact of a merger not only on prices, but also on innovation competition. This theory of harm, although being a welcome improvement to the current framework of merger analysis, fails to accommodate all competition-relevant sustainability concerns because of its exclusive focus on innovation capabilities, efforts and output. On this basis, we argue that innovation competition should not be understood only as an output-maximising device but also as a polycentric process under which independent decision-makers pursue various innovation paths. Such an approach gives prominence to the diversity, quality and direction of innovation and constitutes an alternative to the predominant output-centred understanding of innovation. To operationalise this notion of innovation competition as a polycentric process we explore four pathways: adopting quality-related and sustainability-sensitive innovation metrics; using indicators of industry-wide structural effects; endorsing a structural filter; and protecting nascent competitors. Adding such an approach to the existing analytical framework would, arguably, enable the Commission to deal with all sustainability concerns related to the notion of innovation competition.

Keywords: sustainability; merger control; innovation; innovation theory of harm; non-price effects; innovation diversity; polycentricity.

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1. INTRODUCTION

There is increasing awareness that the existing linear growth-centred model of production puts unprecedented stress on the planet's ecological boundaries, beyond which lie 'unacceptable environmental degradation and potential tipping points'.[1] In 2015, the United Nations General Assembly put forward its 'Transforming our world: the 2030 Agenda for Sustainable Development' in which it articulated a 'plan of action for people, planet, and prosperity' with the aspiration to attain 17 Sustainable Development Goals (SDGs) by 2030.[2] Along similar lines, the European Union intends to transition to a digital and green economy.[3] For this purpose, the European Commission (Commission) launched the European Green Deal aimed at making Europe the first carbon-neutral continent by 2050,[4] and currently explores how competition rules and sustainability policies could work together in pursuing this objective.[5] Against this backdrop, the question 'what is the appropriate role of sustainability in EU competition law?' has gained momentum. This question is by no means new and has already attracted considerable academic attention.[6] What is new, though, is the urgency to rethink EU competition law in light of the economic, environmental and societal challenges of the 21st century and to ensure that it is sufficiently responsive to the changing circumstances.[7]

While the current debate primarily focuses on the role of sustainability under Art. 101 and 102 TFEU, the way in which sustainability considerations can be taken into consideration under EU Merger Control (EUMR) has so far attracted only limited attention in the scholarly literature.[8] There seems to be some growing realisation that sustainability benefits could operate as a 'shield'[9] insulating otherwise anticompetitive mergers from competition law intervention.[10] Competition authorities indeed increasingly explore pathways to incorporate

[1] K Raworth, *Doughnut economics: Seven ways to think like a 21st-century economist* (London, Random House Business Books 2017) 12–13, 37. Drawing on several scientific studies Raworth identifies earth's 'ecological ceiling' by using certain planetary boundaries and key indicators. Beyond this ceiling lies planetary degradation such as climate change and biodiversity loss. Such ecological degradation is, according to Raworth, the result of degenerative industrial design.

[2] United Nations, 'Transforming our world: the 2030 Agenda for Sustainable Development'.

[3] M Vestager, 'Keeping the EU competitive in a green and digital worlds: Speech, 2 March 2020'.

[4] Communication from the European Commission – The European Green Deal COM(2019) 640 final.

[5] European Commission, 'Competition Policy in Support of Europe's Green Ambition' (2021) Competition Policy Brief 01.

[6] G Monti, 'Article 81 EC and Public Policy' (2002) 39(5) *Common Market Law Review* 1057; O Odudu, 'The Wider Concerns of Competition Law' (2010) 30(3) *Oxford Journal of Legal Studies* 599; O Odudu, *The boundaries of EC competition law: the scope of Article 81* (Oxford University Press 2006); H Schweitzer, 'Competition Law and Public Policy: Reconsidering an Uneasy Relationship: The Example of Art. 81' (EUI Working Papers 2007/30, Florence 2007); S Kingston, *Greening EU competition law and policy* (Cambridge, New York, Cambridge University Press 2012); C Townley, *Article 81 EC and public policy* (Oxford, Portland, Or. Hart 2009); J Nowag, *Environmental integration in competition and free-movement laws* (Oxford, Oxford University Press 2016); AC Witt, 'Public Policy Goals Under EU Competition Law–Now is the Time to Set the House in Order' (2012) 8(3) *European Competition Journal* 443.

[7] S Holmes, D Middelschulte and M Snoep, *Competition law, climate change & environmental sustainability* (Concurrences 2021); J Nowag, 'OECD Background Note–Sustainability and Competition' (2020) OECD Competition Committee Discussion Paper.

[8] See for a rare exception T Kuhn and C Caroppo, 'Sustainability in merger control – time to broaden the discussion' (2020) 41(12) *European Competition Law Review* 596; S Holmes, 'Climate change, sustainability, and competition law' (2020) 8(2) *Journal of Antitrust Enforcement* 354, 390–392.

[9] For the notion of sustainability considerations as a 'shield' and 'sword' Holmes (n 8) 355. Nowag proposes a similar framework, referring to 'supportive' and 'preventative' integration of sustainability considerations. J Nowag (n 6) 11.

[10] Kuhn and Caroppo (n 8) 597–599; Holmes (n 8) 391–392.

sustainability benefits into their merger analysis.[11] Mergers may for instance reduce carbon emissions by enabling a more efficient production and distribution of products or boost the development of technologies facilitating the transition towards a carbon-neutral economy. Some competition authorities, such as the UK Competition and Market Authority (CMA), recognise in their policy documents that this positive impact of mergers on sustainability should be accounted for as merger-specific efficiencies.[12]

In contrast, the potential function of sustainability as a 'sword', namely as a justification for competition law intervention against mergers that create harm to the environment or other sustainability parameters, remains understudied. A merger, for instance, could lead to greater levels of carbon emissions or entrench environmentally harmful modes of production.[13] It remains largely unclear whether competition authorities can legitimately challenge such mergers on the basis that they create sustainability harm, i.e. adverse effects on sustainability parameters.

To address this gap, the present study explores when sustainability considerations should operate as a 'sword' in merger appraisals justifying the conditional clearance or prohibition of mergers. It examines whether and how sustainability harm[14] plays out in EU merger control and assesses whether the current state of play is satisfactory. Two recent merger cases, *Dow/Dupont*[15] and *Bayer/Monsanto*[16], are particularly relevant in this regard. When examining these transactions, the Commission received thousands of petition emails and letters by experts, NGOs, civil society associations and politicians urging it to block them.[17] The various stakeholders were not only concerned about the adverse effects that these agrochemical mergers could have on prices or innovation. They were also wary that the concentration and consolidation of the agrochemical sector would make farmers increasingly dependent upon the products and services of vertically integrated global conglomerates, and thereby entrench an industrial model of agriculture heavily reliant on chemical crop protection products, fertilizers and genetically modified organisms. On this account, they warned that if these mergers were allowed to go forward, they would seriously undermine environmental protection, food safety, food security, biodiversity, and marginalise more sustainable models of agriculture.[18]

To the disappointment of many, the Commission in *Bayer/Monsanto* explicitly refused to challenge the merger on stand-alone sustainability grounds. Instead, it clarified that its merger

[11] Hellenic Competition Authority, 'Competition and Sustainability: Staff Working Paper' (2021) paras. 97–108; Merger Assessment Guidelines 2021 CMA 129 para. 8. 3.

[12] ibid paras. 8.3 and 8.21. Another way to account for sustainability benefits and harms would consist in treating them as 'public interest considerations' for instance under s. 42 and 58 of the Enterprise Act 2002 in the UK or the ministerial authorization process under s. 42 of the Competition Act (GWB) in Germany. Instead of 'integrating' sustainability considerations into merger assessment, this solution would rather move sustainability concerns outside the scope of the standard merger control regime. Kuhn and Caroppo (n 8) 600–601. For an insightful discussion, D Reader, 'Accommodating Public Interest Considerations in Domestic Merger Control: Empirical Insights' (2016) CCP Working Paper 16-3.

[13] For instance, the CMA recognizes that sustainability may constitute a non-price parameter of competition but provides little guidance on how it intends to ascertain the adverse effect of mergers on sustainability, see Merger Assessment Guidelines (n 11) para. 2.5.

[14] While this paper focuses primarily on environmental sustainability, our approach is consistent with the UN SDGs, and understands the term 'sustainability' broadly as encompassing environmental, economic and social sustainability. See for this definition J Nowag (n 7) 12–15.

[15] Case No COMP/M.7932 *Dow/DuPont* C(2017) 1946 final.

[16] Case No COMP/M.8084 *Bayer/Monsanto* C(2018) 1709 final.

[17] EU Commission, 'Response to a petition regarding the Bayer/Monsanto Merger' (22 August 2017).

[18] GT Gundlach and DL Moss, 'Non-Price Effects of Mergers' (2018) 63(2) *The Antitrust Bulletin* 155, 156.

assessment would focus exclusively on the competitive effects of the transaction at hand. [19] The Commission, however, did not entirely dismiss all sustainability concerns. Instead, it addressed the ones that could be the by-product of a 'significant impediment of effective competition'.[20] In other words, the Commission used a clear-cut 'threshold test' to determine which sustainability concerns are cognisable under the EU Merger Regulation. This marks a significant development, as the Commission signalled for the first time that it remains open to considering the adverse effects of the mergers on sustainability as long as these effects resulted from a decrease in competition between the merging and/or non-merging parties. Merger-driven harm to innovation thus became the key channel through which the Commission was willing to cognize the competition-relevant sustainability harm caused by mergers. The Commission emphasised the crucial relationship between sustainability and innovation in the agrochemical sector, highlighting that the development of new crop protection products or plant varieties significantly contributes to greater food safety, food system resilience and reduced pollution.[21] On this basis, it examined not only how the mergers at hand would affect prices, but also innovation competition. It, thereby, indirectly incorporated a wide array of sustainability effects in its merger analysis.

Without a doubt, by following such an approach, the Commission was able to account for a broad range of sustainability concerns. Yet, certain sustainability-related issues, such as the impact of the merger on regenerative agriculture or biodiversity, remained non-cognizable even though they would have met the threshold test. There are two reasons for this failure: First the Commission ascertained sustainability concerns only to the extent that they were related to innovation and innovation competition. Yet, mergers can have positive or negative competition-relevant sustainability effects without necessarily affecting innovation. Innovation effects are only one amongst a number of different and, at times, more important channels through which a merger may affect sustainability. Hence, innovation is not the only way for sustainability concerns to be considered within merger control and not all relevant sustainability concerns pertain to innovation.[22] Second, even though the Commission was able to account for several sustainability concerns through its innovation-sensitive theory of harm, it focused almost exclusively on how the merger will affect the innovation incentives, efforts and output of the merging parties. It spotlighted the adverse effects of the merger on the merging parties' incentives to invest in innovation paths that closely overlap or are adjacent to each other pre-merger. Nonetheless, the impact of the merger on the diversity, quality and direction of innovation was not sufficiently examined. Hence, by understanding 'innovation competition' as an output-maximising device the Commission turned a blind eye to sustainability concerns pertaining to the direction, diversity and quality of innovation.

Against this backdrop, we argue in this paper that there is an alternative way to conceptualise innovation competition which would allow merger analysis to incorporate the sustainability concerns that pass the threshold test but were 'left unheard' in *Dow/Dupont* and *Bayer/Monsanto*, due to the Commission's output-centred conceptualization of innovation

[19] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3020.
[20] ibid para. 3011.
[21] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 1972–1980; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 3007–3012.
[22] Merging parties may promote sustainability simply by reorganizing their distribution network or by reducing transportation costs and their environmental footprint. In addition, a merger may harm sustainability not only by reducing sustainability-relevant innovation competition, but also by generating unilateral price effects that have an adverse effect on sustainability by making more environmentally friendly products or services more expensive. Hence, the notions of innovation and innovation competition provide one way among others to factor sustainability concerns into merger analysis. We are indebted to the anonymous reviewer for this observation.

competition. Drawing upon the work of Michael Polanyi,[23] Friedrich August von Hayek,[24] and Elinor and Vincent Ostrom,[25] we maintain that innovation competition could be understood as a polycentric process driven by a multitude of autonomous decision-making centres which independently engage in scientific inquiries and embark on autonomous, often diverse avenues and discoveries. This understanding of innovation competition as a polycentric process suggests that enforcers should analyse the impact of a merger on the diversity, quality and direction of innovation paths in addition to its impact on innovation incentives, efforts and output. Such an approach could enhance enforcers' ability to deal with competition-related sustainability concerns that are independent of the impact of a merger on innovation output. In addition, such an approach could bring the EUMR more in line with a more 'holistic approach' which requires the EU institutions to take into account the so-called 'cross-sectional goals'[26] in all their policy actions and tasks.[27]

To operationalise the notion of innovation competition as a polycentric process, we explore four pathways. First, we argue that the Commission could use quality-adjusted and sustainability-sensitive innovation metrics. Second, we contend that the Commission could analyse the industry-wide impact of horizontal mergers and put greater weight on their structural effects. Third, we explore the use of structural rules of thumb or presumptions to ensure diverse and independent innovation choices and paths; and fourth we explain how the protection of nascent competitors could significantly contribute to polycentric innovation competition. The aim of these proposals is to show in practical terms how merger analysis could take into consideration not only the output-related dimensions of innovation but also its quality, direction and diversity. By incorporating such concerns into competition analysis, we argue, enforcers would be able to accommodate a broader range of competition-relevant sustainability concerns.

The paper unfolds as follows. Section 2 shows how the threshold test developed in *Dow/Dupont* and *Bayer/Monsanto* allows the Commission to discern from the general category of sustainability concerns the ones that are competition-relevant. Section 3 describes how the

[23] M Polanyi, *The Logic of Liberty* (London, Routledge 1951) 34–36.
[24] Hayek, Friedrich A. von, 'The Use of Knowledge in Society' (1945) 35(3) *American Economic Review* 519; Hayek, Friedrich A. von, *The Road to Serfdom* (London, Routledge 2001); Hayek, Friedrich A. von, 'Competition As A Discovery Procedure' (2002) 5(3) *Quarterly Journal of Austrian Economics* 9.
[25] V Ostrom, CM Tiebout and R Warren, 'The Organization of Government in Metropolitan Areas: A Theoretical Inquiry' (1961) 55(4) *American Political Science Review* 831; E Ostrom and V Ostrom, 'The Quest for Meaning in Public Choice' in F Sabetti and P Dragos Aligica (eds), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance* (Colchester. ECPR Press 2014); V Ostrom, 'Polycentricity: The Structural Basis of Self-Governing Systems' in F Sabetti and P Dragos Aligica (eds), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance* (Colchester. ECPR Press 2014); E Ostrom, 'Why Do We Need to Protect Institutional Diversity?' (2012) 11(1) *European Political Science* 128.
[26] These goals encompass for instance: environmental protection (11 TFEU), economic cohesion (174 (1) TFEU), culture (Art. 167 (1) TFEU), health (Arts. 168 (1) and 9 TFEU), industrial policy (Art. 173 (3) TFEU), development (Art. 208 (1) TFEU), employment (Art. 147 (2) and Art. 9 TFEU), consumer protection (Art. 12 TFEU), Services of General Economic Interest (Art. 14 TFEU), animal welfare (Art. 13 TFEU), non-discrimination (Art. 10 TFEU), social protection, inclusion and education (Art. 9 TFEU), good administration (Art. 15 TFEU), data protection (Art. 16 TFEU), gender equality (Art. 8 TFEU).
[27] Numerous commentators argue that a teleological and systematic interpretation of the Treaties as well as the introduction of the coherence principle by the Treaty of Lisbon (Art. 7 TFEU) demand a holistic approach under which economic and social policies should reconciled and integrated into one overall policy. According to Art. 7 ''the Union *shall* ensure *consistency* between its policies and activities, *taking all of its objectives into account*'. Monti (n 6) 1069; Townley (n 6) 47–55; Schweitzer (n 6) 5; Kingston (n 6) 97–126. This is also supported by Case 6/72 *Europemballage Corporation and Continental Can Company v Commission* ECLI:EU:C:1973:22 para. 24. See, however, for the opposite view Odudu (n 22) 169–171.

competition-relevant sustainability concerns were factored in *Dow/Dupont* and *Bayer/Monsanto* through a novel theory of harm relying on the notion of innovation competition. Section 4 reveals that such a theory of harm hinges on a broad-minded[28] consequentialist understanding of innovation competition as an output-maximisation device. In this section, we argue that, despite its analytical strengths and practical benefits, this approach cannot account for all 'innovation competition-relevant' (IC-relevant) sustainability concerns as it overlooks the direction, diversity and quality dimensions of innovation. Section 5 proposes an alternative conception of innovation competition as a polycentric process, suggesting that this approach is capable of accommodating the remaining IC-relevant sustainability concerns. Section 6 explores four pathways for operationalising the notion of innovation competition as a polycentric process maintaining that through these avenues enforcers will be able to integrate all IC-relevant sustainability concerns into merger control.

2. SUSTAINABILITY CONCERNS UNDER THE EUMR AND THE THRESHOLD TEST

Over the last three decades, the agrochemical sector has seen a steady wave of concentration and consolidation. Two merger waves in the 1980s and 2000s significantly diminished the number of producers in the pesticides, seeds, traits and fertilizer industries and triggered the emergence of large, integrated players active on various levels of the relevant value chains.[29] Before 2016, the agrochemical industry was dominated by the so-called 'big six' players: Syngenta, Bayer, Monsanto, Dow, Dupont and BASF. All six players were vertically integrated and benefited from large economies of scale. Apart from BASF, all players were also active on all stages of the relevant value chains (i.e. discovery, development, and commercialisation of crop protection products or seeds).[30]

Along with increased concentration and vertical integration, three major trends characterised the business model of the big six. First, most players increasingly offered integrated package solutions which would allow farmers to source seeds, crop protection products, fertilisers and technology from the same firm. Second, this trend towards one-stop-shop solutions was compounded by a growing shift towards the use of genetically modified (GM) crops with traits that are resistant to specific crop protection products often developed and sold by the same integrated firm. Recent advances in biotechnology, most notably with respect to RNA sequencing and gene editing, are likely to reinforce this move towards the use of genetically modified or so-called 'optimised' crops.[31] A third trend relates to the growing importance of data collection and analytics for farming. All large integrated players invested in the development of digital farming services analysing vast amounts of data to predict the specific needs of plants and soils and to optimise the use of crop protection products and fertilisers. In other words, the advent of 'big data' in the agrochemical sector prompted the main players to expand their integrated solutions by developing 'precision farming solutions'.[32]

[28] By this we mean that Commission's consequentialist approach is not exclusively focused on price effects and quantifiable parameters.

[29] See for a discussion of the consolidation waves I Lianos, 'The Interaction of Competition, Regulation and IP Rights in Agriculture: Towards a Dynamic Equilibrium?' in G Muscolo and M Tavassi (eds), *The interplay between competition law and intellectual property* (Wolters Kluwer 2019) 343–345.

[30] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 222.

[31] ibid paras. 248–249.

[32] ibid para. 246.

Sustainability concerns in the agrochemical sector

In 2016, the agrochemical sector experienced a new consolidation wave. Three mega-deals between Dow/Dupont, ChemChina/Syngenta and Bayer/Monsanto further reduced the number of industry players, thereby concentrating the control over the agrochemical market in the hands of three fully integrated players. Numerous competition experts and NGOs warned that all three deals may lead to substantial price increases in agricultural and foods products. They were also worried that industry consolidation could further dampen the already sluggish rate of R&D investments and output in the sector,[33] and centralise the industry leaders' control over a large amount of patents, inventions and data.[34] Furthermore, given the steady trend towards integrated farming solutions and digital agriculture, these stakeholders warned that horizontal and vertical integration combined with the accumulation of large amounts of data would further increase the economic and technological dependence of farmers on single platform solutions offered by a few agrochemical giants.[35]

Yet, the concerns aired against these three mega-deals went beyond price and innovation effects. Several stakeholders argued that these mergers, by increasing the dependence of farmers and by raising barriers to entry, would further entrench a model of agriculture that heavily relies on the intensive use of chemical products, genetically modified crops and monoculture at the expense of alternative modes of agriculture. They also noted that the said mergers could further decrease the pool of available agricultural products and increase the reliance of farmers and growers on the conventional tools and agricultural solutions provided by the large conglomerates. The increased role of these 'mainstream' solutions would, in turn, stymie the development and production of seeds and crop protection solutions for marginal products (e.g. 'orphan' crops or 'minor uses' crops), as the merged companies would concentrate their innovation efforts on major global crops such as maize, wheat and rice.[36] As a result, an increasing number of farmers and growers would be left without effective alternatives to an industrialised mode of agriculture.[37] This, in turn, would further reduce biodiversity and accentuate the growing resistance of pests against the existing crop protection solutions.[38] Further industry consolidation and homogenisation, it was feared, could cement the path-dependence of the agriculture and food sector towards an industrialised, large-scale mode of production, diminish consumer choice and protection, undermine food safety and security, harm biodiversity and degrade the environment.[39]

Against this background, numerous stakeholders urged the Commission during the market investigation in *Dow/Dupont* and *Bayer/Monsanto* to take into consideration the loss of biodiversity and harm to the environment which would be likely caused by the mergers.[40] They called upon the Commission to not only assess whether the merging parties would raise prices, reduce output, and discontinue their innovation efforts, but also to review the type and quality

[33] ibid para. 243.

[34] D Moss, 'AAI Says Monsanto-Bayer Merger is Too Big to Fix – Enforcers Should Reject Proposed Remedies and "Just Say No"' (2018); I Lianos and D Katalevsky, 'Merger Activity in the Factors of Production Segments of the Food Value Chain: A Critical Assessment of the *Bayer/Monsanto* merger' (2017) CLES Policy Paper Series 2017/1 19–23.

[35] I Lianos and D Katalevsky (n 34) 23–28; P Woodall and TL Shannon, 'Monopoly Power Corrodes Choice and Resiliency in the Food System' (2018) 63(2) *The Antitrust Bulletin* 198, 206–216; Gundlach and Moss (n 18) 156.

[36] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 244, 2137.

[37] ibid para. 2136.

[38] ibid paras. 2017, 2136–2137.

[39] I Lianos and D Katalevsky (n 34) 23–24, 27–28.

[40] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3007.

of innovation to which these innovation efforts would be directed.[41] They also asked the Commission to examine whether the merged firms could engage in 'misuse of innovation',[42] as they would lack the incentives to deploy their innovation efforts to develop 'healthier' or more resilient farming solutions that require the use of fewer chemicals or GM-products.[43] Overall, these critical voices were alarmed by the prospect that the said mergers, by entrenching the path-dependence of the existing modes of agriculture, would not only entail environmental degradation, but also undermine the resilience of food systems.[44]

The threshold test

Confronted with this wide range of sustainability concerns regarding 'the potential implications of a possible reduction of competition caused by the merger on human health, food safety, consumer protection, environmental protection and climate,'[45] the Commission articulated a threshold test: for a sustainability concern to be considered a relevant consideration for merger enforcement, it has to be the consequence of a 'significant impediment of effective competition'.[46] This means that to be cognizable under the EU Merger Regulation (EUMR)[47] the adverse effect of the merger on sustainability must be caused by some form of restriction of competition effectuated by the merger.

In crafting this threshold test, the Commission made an important point of law that crucially advances the current debate on the role of sustainability concerns in competition law. The Commission made it clear that from the general category of sustainability concerns only competition-related sustainability concerns are relevant under the current EUMR regime, while stand-alone sustainability concerns would lie outside the scope of merger control.[48] Sustainability concerns are only relevant under EU merger control (and EU competition law in general) if, and only if, they stem from a decrease in competition between the merging firms.[49] If, for instance, a merger causes a reduction in competition by dampening the incentives of the merging or non-merging entities to compete with respect to a sustainability parameter or by eliminating a sustainability-relevant player, then it could lead to competition-related sustainability harm.

This threshold test does not mark any sea change.[50] Pursuant to the case law of the EU Courts, the Commission 'may declare a concentration incompatible with the internal market only if the

[41] ibid.
[42] ibid.
[43] ibid.
[44] Gundlach and Moss (n 18) 156.
[45] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3011.
[46] ibid para. 3020. The Commission said that it can only assess and block a merger based on the legal test and the assessment criteria set out in Art. 2 (3) and (1) of the EU Merger Regulation Council Regulation (EC) No 139/2004 on the Control of Concentrations between Undertakings [2004] OJ L 24/1.
[47] ibid Art. 2 (3).
[48] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3022. The Commission, moreover, pointed out that regardless of the outcome of the assessment of the merger under the EU Merger Regulation, the merged entity will continue to be bound by EU and national rules on human health, food safety, consumer protection and environmental and climate protection ibid para. 3029.
[49] Contrast this approach with the Commission's denial to take into consideration privacy concerns in Case No COMP/M.7217 *Facebook/Whatsapp* C(2014) 7239 final para. 164; Case No COMP/M.4731 *Google/DoubleClick* C(2008) 927 final para. 368.
[50] For instance, in *IAZ* the Court stroke down a collective standard setting process through which Belgian water suppliers and the producers of washing machines adopted a minimum standard for water pollution by washing machines. This standard prevented parallel imports of washing machines that complied with this standard and

significant impediment to competition is the direct and immediate effect of the concentration.'[51] Such would be the case if the alleged adverse effect results from future conduct that is 'made possible and economically rational by the alteration of the characteristics and the structure of the market caused by the concentration'.[52] Hence, accounting for sustainability harms flowing from a merger-induced reduction in competition is fully consistent with the existing case law,[53] as well as the legal test and assessment criteria set out in the EU Merger Regulation.[54]

The threshold test laid down in *Bayer/Monsanto* provides us with a yardstick to decide when, under the current legal framework, certain harms to sustainability are to be addressed by merger policy (and competition law in general), and when they should be tackled through specific regulation or other legislation. Figure 1 shows how the threshold test allows us to single out within the overall population of all conceivable sustainability concerns the relevant subset of competition-relevant sustainability concerns that ought to be addressed by competition law. All remaining 'stand-alone' sustainability considerations should fall outside the scope of competition law and within the exclusive realm of regulation.

Figure 1 - The 'threshold test'

If a merger dampens merging parties' incentives to compete on producing more sustainable or environmentally friendly products, which they would have otherwise produced absent the merger, *such* sustainability harm could be considered a valid concern under EUMR.[55] This is particularly important when the merger-driven reduction in the output of environmentally friendly products does *not* constitute a violation of any environmental standard or sector-specific regulation.[56] According to the EU Courts' case law, on such occasions antitrust enforcers remain competent to intervene, even though the merging parties remain subject to sector-specific regulation and the decrease in the level of environmental protection post-merger

thus, potentially, decreased competition on sustainability parameters (i.e. reduced water pollution) Case 96/82 *IAZ v Commission* ECLI:EU:C:1983:310 para. 25. The recent truck cartel and car emissions cases also show that EU competition law can address environmental harm that results from a restriction of innovation competition on sustainability parameters. In both cases, the Commission made it clear that coordinated efforts by truck/car manufacturers to delay the introduction of new emission standards and emission-reducing technologies constitute a restriction of competition within the meaning of Art. 101 (1) TFEU Commission Decision in Case AT.39824 *Trucks* C(2017) 6467 final paras. 214, 264, 302–304; Case AT.40178 *Car Emissions* C(2021) 4955 final paras. 89, 122, 124, 125, 128, 138.

[51] Case T-79/12 *Cisco v Commission* ECLI:EU:T:2013:635 para. 118.

[52] ibid; Case T-342/99 *Airtours v Commission* ECLI:EU:T:2002:146 para 58; Case T-102/96 *Gencor v Commission* ECLI:EU:T:1999:65 para. 94.

[53] However, how tenuous or strong the causal link between the alleged harm and the concentration has to be remains a contentious issue. See Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* ECLI:EU:C:2008:392 paras. 47, 50–53; Case T-79/12 *Cisco v Commission* (n 51) para. 47; Case T-399/16 *CK Telecoms UK Investments v Commission* ECLI:EU:T:2020:217 para. 118; Opinion of Advocate General Kokott in Case C-23/14 *Post Danmark II* ECLI:EU:C:2015:343 paras. 80, 94.

[54] Council Regulation (EC) No 139/2004 on the Control of Concentrations between Undertakings (n 46) Art. 2.

[55] However, this approach does not account for the scenarios where a merger enhances merging parties' incentives to engage in unsustainable commercial practices which they would have been unable to absent the merger. In other words, under this approach a merger that intensifies competition in unsustainable commercial practices would be cleared. Yet, sector-specific regulation may still apply or legislators could adopt new legislation to address the issue.

[56] For a similar reasoning Commission Decision in Case AT.39824 *Trucks* (n 50) para. 304; Case AT.40178 *Car Emissions* (n 50) paras. 123, 138.

does not fall short of the minimum thresholds set by environmental or other types of regulation.[57]

Under this test, competition law and sectoral regulation are given a clear division of labour (see Figure 1 and Table 1). Finding a competition law violation does not require an infringement of any other sector-specific legislation. Rather, competition law deals with the market failures that result from a reduction in competitive pressure and the ensuing alteration of the incentives of market players. Therefore, competition law applies to a practice that has a negative sustainability effect even if it respects the minimum regulatory requirements as long as that effect occurs due to market power or a restriction of competition (Scenario C). In addition, it applies when there is a negative sustainability effect that simultaneously constitutes a violation of sector specific regulation and an anticompetitive merger, an abuse of dominance or a restriction of competition (Scenario B, concomitant application).[58] Competition law is not applicable when the sustainability harm does not result from an alteration of the market structure or a restriction of competition but stems from the mere fact that there is no law or other regulatory measure (e.g. taxation or subsidy) prohibiting firms from causing a sustainability harm or creating incentives for more sustainable production (Scenario A). Such market failures, resulting from the fact that firms do not internalise negative or positive externalities, can be addressed only via sector-specific regulation or subsidies.

[57] Case C-280/08 P *Deutsche Telekom v Commission* ECLI:EU:C:2010:603 paras. 80–96; Case T-398/07 *Spain v Commission* ECLI:EU:T:2012:173 para. 55. Case C-457/10 P *AstraZeneca AB and AstraZeneca plc v European Commission* ECLI:EU:C:2012:770 paras. 74, 132; Case C-377/20 *Servizio Elettrico Nazionale and Others* ECLI:EU:C:2022:379 para. 67.

[58] The EU Court of Justice has also repeatedly clarified that the (non-) compliance with existing national or EU regulation can constitute an important reference point for the competitive analysis of certain practices. Case C-32/11 *Allianz Hungária Biztosító and Others* ECLI:EU:C:2013:160 paras. 46–47; Case C-457/10 P *AstraZeneca AB and AstraZeneca plc v European Commission* (n 57) paras. 74–75, 93; Case C-179/16 *F. Hoffmann-La Roche and Others* ECLI:EU:C:2018:25 paras. 92–93.

Table 1 - The division of labour between sector-specific regulation and competition law

In addition, this threshold test is in line with a 'holistic approach' to EU competition law. The text of the Treaties, their teleological and systematic interpretation, and the introduction of the 'coherence principle' with the Treaty of Lisbon (Art. 7 TFEU)[59] direct the EU institutions to take into account the 'cross-sectional clauses' (one of which is the protection of the environment) in all their policy actions and tasks. In *Bayer/Monsanto*, the Commission examined for the first time this argument and acknowledged that the said clauses and Recital 23 EUMR[60] compel it to carry out its assessment within the general framework of the fundamental objectives of the EU Treaties.[61] Yet, the Commission considered that, when asserting the impact of mergers on sustainability parameters, the constitutional principle of conferral and the legal basis of the EUMR required it to act within the contours of Art. 2 EUMR and within the perimeters of competition policy 'in order to achieve, and "not go beyond", the objective of ensuring that competition in the Internal Market is not distorted.'[62] On this basis, the Commission concluded that it was precluded from engaging in a freewheeling analysis of the effects of mergers on stand-alone, competition-unrelated sustainability or other public interest considerations.[63] The Commission's reading of Art. 7 TFEU in light of the constitutional limiting principles of the Treaty does not only respect the cross-sectional clauses but it also strikes a fair balance between EU competition law's openness and integrity since it allows competition law to take into consideration new societal challenges and epistemic change (e.g. new research on the relationship between innovation and sustainability), but in a principled way that would not undermine legal clarity, predictability, coherence and the principle of conferral.[64]

3. A NOVEL APPROACH: ASSESSING A MERGER'S IMPACT ON INNOVATION COMPETITION

At this stage, it is worth asking how the Commission analysed the sustainability concerns that passed the threshold test (i.e. that are 'competition-relevant). In *Dow/Dupont* and *Bayer/Monsanto*, the Commission addressed only one subset of competition-relevant sustainability concerns: the ones that were related to the concepts of innovation and innovation competition. Specifically, the Commission (i) forged a link between sustainability and innovation and (ii) articulated a theory of harm aimed at assessing how the said mergers might affect price and non-price innovation effects. While the Commission had examined in the past how a merger might affect dynamic competition, it did so without carrying out a separate, fully-fledged analysis of these innovation effects. Rather, it simply mentioned that the merger would reduce innovation in addition to causing prices to rise.[65] This approach changed radically in *Dow/Dupont* and *Bayer/Monsanto* where the Commission decoupled for the first time the assessment of price and non-price innovation effects and developed a stand-alone (non-price-based) theory of harm that revolved around the notion of innovation competition.

[59] S Kingston (n 6) 126.
[60] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3011.
[61] ibid para. 3010.
[62] ibid para. 3016.
[63] This strict interpretation of the assessment criteria is also supported by the express reference to a public interest exception in Art. 21 (4) EUMR ibid para. 3022.
[64] For a discussion of the concepts of openness and integrity of competition law S Makris, 'Openness and Integrity in Antitrust' (2021) 17(1) *Journal of Competition Law & Economics* 1.
[65] See for instance I Kokkoris and T Valletti, 'Innovation Considerations in Horizontal Merger Control' (2020) 16(2) *Journal of Competition Law & Economics* 220.

Linking sustainability with innovation

In *Dow/Dupont* and *Bayer/Monsanto*, the Commission clarified that at least some of the sustainability concerns raised by the numerous stakeholders – e.g. issues related to the impact of the mergers on environmental protection, biodiversity, food safety and food-security – could be tackled by assessing the effects of both mergers on innovation competition.[66] The Commission's analysis relied on the premise that a high level of post-transaction innovation would alleviate any competition-relevant sustainability issues.[67]

In particular, the Commission noted that innovation in the form of developing new and better active ingredients (AIs) is necessary to ensure effective crop protection as pests develop resistance to existing AIs.[68] By boosting the effectiveness of crop protection and crop varieties, innovation in the agrochemical sector contributes to food security and improves the resilience of food systems. In other words, innovation can enhance the effectiveness of crops and crop protection and help the sector address the twin challenges of an increasing global population and decreasing available arable land per capita.[69] In general, the Commission pointed out that innovation in the agrochemical sector contributes to environmental protection,[70] food safety and human health as the development of more effective AIs leads to a reduction in toxicity of crop protection and a better management of chemical residues.[71] Furthermore, for the Commission, innovation was considered to be essential in this sector due to the role of regulation: by imposing increasingly stricter environmental and food safety requirements, regulations drive market participants to invest in R&D and compel them to come up with better and safer crop protection. Such investments are necessary for companies to obtain the renewal of the market authorisation for their AIs.

The Commission, thus, postulated that there is a link between innovation and sustainability in the agrochemical sector assuming that more innovation is always good and without questioning the broader direction of the relevant innovation efforts.[72] The Commission also considered that by assessing the impact of the said mergers on innovation, it would be able to address all the competition-relevant sustainability concerns. On this basis, the Commission considered that if the said mergers do not undermine post-merger innovation efforts, they could lead to 'the emergence of more effective, healthier, safer and more environmentally-friendly products.'[73]

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[66] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3011.

[67] As already noted, while this approach constitutes a welcome improvement from a sustainability point of view, it misses the fact that a merger can have non-innovation related but still competition-relevant sustainability effects.

[68] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 1975–1980, 1986.

[69] ibid para. 1978.

[70] For the need to streamline agricultural policies, productivity and environmental sustainability see OECD, 'Exploring the Linkages between Agricultural Policies, Productivity and Environmental Sustainability' (2019). COM/TAD/CA/ENV/EPOC(2019)4/FINAL.

[71] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 1977, 1980; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 3007.

[72] Such a link is not controversial. There is a wide consensus that there is a need for 'integrated policy approaches that will better enable farmers and the food sector to simultaneously improve productivity, increase competitiveness and profitability, improve resilience, access markets at home and abroad, manage natural resources more sustainably, contribute to global food security, and deal with extreme market volatility, while avoiding trade distortions'. OECD, 'Outcomes of the Meeting of the Committee for Agriculture at Ministerial Level on 7-8 April 2016: Annex: Declaration on Better Policies to Achieve a Productive, Sustainable, and Resilient Global Food System' (2016) C(2016)71 4.

[73] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 3011–3012.

A novel theory of harm

Against this backdrop, the Commission developed a new framework for assessing the impact of a merger on innovation competition.[74] The Commission assessed the extent to which innovation rivalry was driving innovation efforts by identifying the 'innovation spaces' in which R&D active industry players compete on the development of new crop protection products, seeds and plant varieties. A key concern was whether the elimination of overlapping research efforts could cause a reduction in overall innovation competition in the agrochemical sector especially in light of the increased concentration levels, the existing barriers to entry, and the overall fall of R&D output and spending as a proportion of revenue.

The Commission's assessment of the stand-alone impact of mergers on innovation competition in the agrochemical sector was closely modelled upon the standard analysis of unilateral price effects. As in the context of the analysis of unilateral price effects, the Commission identified two channels through which a merger could affect innovation competition: first, it can reduce the innovation incentives of the merging parties by suppressing innovation competition between them (first-order effect); and second, it can reduce the merging and non-merging parties' incentives to innovate by reducing the overall competitive pressure within the market (second-order effect).[75]

With regards to the first-order effect, the Commission noted that, prior to the merger, the merging parties have an incentive to innovate because they capture current and future sales from each other when introducing new and improved products ('business stealing effect'[76] or 'innovation diversion effect'[77]).[78] At the same time, firms face a disincentive to innovate because the introduction of a new product could lead to the cannibalisation of their own existing product lines ('cannibalisation effect' or 'replacement effect').[79] Hence, firms must trade off their profits from the business stealing effect against the opportunity costs resulting from the cannibalisation effect before engaging in innovation projects.[80] If a merger combines firms that compete closely with respect to the development of new products pre-merger, the merging

[74] The Commission's attempt to incorporate innovation effects into the unilateral effects analysis has been importantly shaped by the theoretical work by M Motta and E Tarantino, 'The Effect of Horizontal Mergers, When Firms Compete in Prices and Investments (2017) Working Paper 1570, Department of Economics and Business, UPF; G Federico, G Langus and T Valletti, 'A simple model of mergers and innovation' (2017) 157 *Economics Letters* 136; G Federico, G Langus and T Valletti, 'Reprint of: Horizontal mergers and product innovation' (2018) 61 *International Journal of Industrial Organization* 590.

[75] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2005, 2044–2048, 3285.

[76] Kokkoris and Valletti (n 65) 228.

[77] B Jullien and Y Lefouili, 'Horizontal Mergers and Innovation' (2018) 14(3) *Journal of Competition Law & Economics* 364, 374–379.

[78] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2043; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1013, 1025–1033, 1058.

[79] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2001; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1013, 1022, 1037. For this replacement effect KJ Arrow, 'Economic Welfare and the Allocation of Resources for Invention' in National Bureau Committee for Economic Research (ed), *The Rate and Direction of Inventive Activity: Economic and Social Factors* (Princeton. Princeton University Press 1962).

[80] This trade-off estimation is quite similar to the trade-off firms face in the context of price competition. On the one hand, firms have an incentive to compete more fiercely on prices to capture sales from other competitors. On the other hand, cutting prices creates opportunity costs for them as it leads to the cannibalisation of the profitability of the existing sales base. RD Willig, 'Merger Analysis, Industrial Organization Theory, and Merger Guidelines' [1991] *Brookings Papers on Economic Activity. Microeconomics* 282, 299; C Shapiro, 'The 2010 Horizontal Merger Guidelines: From Hedgehog to Fox in Forty Years' (2010) 77 *Antitrust Law Journal* 701, 724; J Farrell and C Shapiro, 'Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition' (2010) 10(1) *The BE Journal of Theoretical Economics* 1, 7–9.

firms may have less incentives to compete fiercely and engage in post-merger innovation. This is because the merger will allow each party to internalise the negative externalities that the other poses on its profitability by engaging in innovation efforts. As a result, the merging parties' incentives to innovate post-merger will be reduced.[81] The internalisation of such externalities will increase the opportunity cost of the cannibalisation effect, and depress the merged entity's incentives to innovate.[82]

Under this line of reasoning, the merged entity is likely to have a stronger incentive to discontinue or reposition one line of research to prevent the cannibalization effect if it acquires a closely competing innovator. Consequently, the first-order effect is likely to be significant if the merger brings together two out of a limited number of effective innovators, who in the absence of the merger would have been likely to divert significant sales from each other by investing in innovation.[83] The Commission's analysis of innovation competition, thus, considers that the first-order effect of the merger on non-price competition could be measured in a similar way as its effect on price competition, by establishing some type of 'innovation diversion ratio' that gauges the extent to which the merging parties impose important competitive constraints on each other. This entails that the focus of the analysis is on the degree of substitutability or closeness of competition between the merging parties' innovation projects, lines of research and pipeline products.[84] The degree of closeness of competition between their innovation activities constitutes a metric to gauge the 'downwards innovation pressure' caused by the merger and assess the likelihood and magnitude of the merger's adverse effect on innovation competition.[85]

The Commission's analysis of the second-order effect of mergers on innovation also followed the standard model used in the assessment of unilateral effects on price competition.[86] The Commission considered that the second-order effect tends to compound the first-order effect and further reduces the incentives of the merged entity and the non-merging parties to innovate because the merger will reduce the overall level of competition in the product market.[87] Therefore, according to the Commission, the anti-competitive effect of the mergers would not consist solely in the loss of innovation competition between the merging parties but also in the reduction of competitive pressure exerted by the remaining competitors.[88]

The key insight of the Commission's analysis is that the extent to which a merger could generate adverse first- and second-order unilateral effects on innovation depends on the

[81] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2002, 2043; 3017-3022; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 281, 1041.
[82] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2856 fn. 2016; 3018; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 1059. This analysis closely follows the model developed by Federico, Langus and Valletti (n 74); Federico, Langus and Valletti (n 74); Kokkoris and Valletti (n 65) 228–229.
[83] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2007; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 281, 1164–1170.
[84] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2006.
[85] Federico, Langus and Valletti (n 74) 597; Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2009, 2043 (from this perspective, if the merger is likely to remove an important competitive force or a 'maverick firm', the likelihood and scale of the adverse effects on innovation competition are likely to be even higher).
[86] R Deneckere and C Davidson, 'Incentives to Form Coalitions with Bertrand Competition' (1985) 16(4) *The RAND Journal of Economics* 473, 475; M Ivaldi et al, 'The Economics of Unilateral Effects: Interim Report for DG Competition, European Commission' (2003) 12, 22 ff.
[87] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2005, 2044–2045, 3005, 3285. For further discussion of the analysis of the second order effect in the context of innovation competition, Federico, Langus and Valletti (n 74); Federico, Langus and Valletti (n 74); Kokkoris and Valletti (n 65).
[88] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2044.

innovation-based contestability of pre-merger sales. If competitors have the prospect of successfully capturing each other's sales by introducing a novel product – i.e. if their sales are contestable by engaging in inventive activities – rivalry (or competitive pressure) drives innovation, and, therefore, a loss in rivalry – e.g. a merger between two close competitors with overlapping innovation efforts – is likely to reduce innovation.[89] This is why the Commission emphasized the degree of closeness of innovation competition between the merging parties as a central factor to determine how the merger affects innovation.

In line with the standard model of unilateral effects analysis, the Commission also considered whether the merger's first- and second-order anti-competitive effects on innovation competition could be alleviated or offset by countervailing factors, such as entry, expansion or efficiencies. However, in both decisions, it found that high barriers to entry[90] and expansion,[91] characteristic to the agrochemical sector, prevent new entrants and existing competitors from defeating the reduction of the merging parties' incentives to innovate.[92] On the contrary, due to the strategic complementarity between the merging and non-merging parties, competitors may also have an incentive to reduce their innovation efforts post-merger.[93] Moreover, the Commission acknowledged that a horizontal merger may, at least in theory, enhance innovation by increasing the merging parties' ability to appropriate or license their innovations, [94] or by creating important spill-overs, synergies and complementarities between the parties' research efforts.[95] For this reason, the Commission examined whether the appropriability effect of the merger and any other merger-specific efficiencies could mute the adverse effects of the merger on innovation-based market contestability.[96] But it concluded that the merging parties had failed to proffer evidence of such merger-specific efficiencies.[97] Based on this analysis the Commission concluded that the transactions would likely reduce rivals' incentives to innovate,

[89] C Shapiro, 'Competition and Innovation: Did Arrow Hit the Bull's Eye?' in J Lerner and S Stern (eds), *The Rate and Direction of Inventive Activity Revisited* (Chicago. University of Chicago Press 2012) 362, 364, 386.
[90] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2007; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1062–1080.
[91] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 3240–3256.
[92] ibid paras. 2008, 2019.
[93] ibid para. 2018; Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings [2004] OJ C 31/5 para. 31.
[94] Bourreau et al., show that mergers may lead to increase research efforts by allowing the merging firms to internalise the demand-enhancing spill-over effects of innovation for competitors. M Bourreau, B Jullien and Y Lefouili, 'Mergers and Demand-Enhancing Innovation' (2018 (revised 2019)).
[95] Challenging the model developed by Federico/Langus/Valletti/Denicolò and Polo show that mergers may lead to an increase of R&D efforts, by allowing the merging parties to eliminate (inefficient) duplication of their research efforts post-merger V Denicolò and M Polo, 'Duplicative research, mergers and innovation' (2018) 166 *Economics Letters* 56; V Denicolò and M Polo, 'The Innovation Theory of Harm: An Appraisal Symposium: Innovative Antitrust' (2019) 3(82) *Antitrust Law Journal* 921. See also M Bourreau, B Jullien and Y Lefouili (n 94). Jullien and Lefouili (n 77) 385, 388–389.
[96] Shapiro (n 89) 365, 389 (noting that a merger-induced reduction in rivalry may intensify innovation competition, if it enhances the merged entity's capabilities to appropriate post-merger innovation).
[97] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 3264–3278; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 70, 76, 87, 99. This conclusion is in line with the findings by Motta/Tarantino and Federico/Langus/Valletti that even though horizontal mergers may lead to innovation-enhancing efficiencies, they are unlikely to outweigh the adverse first-order effect of the merger on innovation incentives. M Motta and E Tarantino (n 74); Federico, Langus and Valletti (n 74); Federico, Langus and Valletti (n 74).

eliminate duplicated R&D infrastructure and overlapping innovation efforts, and reduce overall innovation.[98] It cleared, though, both mergers subject to behavioural and structural remedies.[99]

The key takeaway of the Commission's innovation theory of harm is that a merger could adversely affect innovation if the following elements are present: (i) the innovation-based contestability of pre-merger sales is large; [100] (ii) the appropriability of post-innovation rents is high due to strong IPR protection, and ,therefore, rivalry stimulates innovation;[101] (iii) consolidation between rival innovators is unlikely to be associated with efficiencies in the form of greater appropriability or innovation synergies; (iv) the parties are close and important innovation competitors; (v) the parties' fear of cannibalisation of own existing products is sufficiently large to create a disincentive to innovate; (vi) the structure of the market is already oligopolistic; and (vii) the remaining R&D players are unlikely to significantly increase or reposition their innovation efforts to profitably offset the reduction of innovation competition from the parties. Under these conditions rivalry drives innovation and a merger-induced reduction in competitive pressure can generate first- and second- order unilateral effects, and thereby diminish innovation competition on the market.[102]

4. INNOVATION COMPETITION AS AN OUTPUT-MAXIMISING DEVICE

The previous section highlighted the key elements of the Commission's novel theory of innovation harm in these two landmark decisions. In this section, we identify and critically reflect on the conception of innovation competition underlying this theory of innovation harm.[103] Our main point is that *Dow/Dupont* and *Bayer/Monsanto* suggest that the Commission is well versed in the consequentialist tradition as it understands innovation competition as an output-maximising procedure. Owing to this output-based understanding of innovation, the Commission analysed innovation competition in terms of innovation incentives, capabilities, efforts, and output. According to this approach the elimination of closely competing innovation projects can cause merger-driven innovation harm. To identify such harm the Commission examined primarily the behavioural effects of industry concentration on firms' incentives to invest in innovation efforts. In so doing, it uses backward-looking metrics and remains focused on directed and commercially relevant innovation. This emphasis on the closeness of innovation competition and the merging firms' incentives and ability to innovate, however, fails to accommodate a wide range of 'innovation competition-relevant' (IC-relevant) sustainability concerns as it turns a blind eye to the direction, quality and diversity of innovative activity. To demonstrate this point, the rest of this section unpacks and assesses the Commission's understanding of innovation competition.

[98] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 3264–3278; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 70, 76, 87, 99.
[99] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 3264–3278; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 70, 76, 87, 99.
[100] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 2001.
[101] ibid para. 2046.
[102] Shapiro (n 89) 364–365.
[103] A concept can have multiple conceptions and certain concepts can be essentially contested. Gallie; Hart. We argue here that innovation belongs to these essentially contested concepts. WB Gallie, 'Essentially Contested Concepts' (1955) 56 *Proceedings of the Aristotelian Society* 167, 167, 179, 189, 191; Hart, H. L. A, *The concept of law* (Oxford, New York, Clarendon Press 1961) 157–160.

An outcome-based understanding of innovation competition

In both mergers, the crucial question the Commission sought to address was whether the combination of the two merging parties will lead to less innovative efforts, and hence to less innovation output. The Commission, therefore, relied on quantitative metrics, which exclusively focused on innovation output, such as the number of patent citations[104] and new AI launches.[105] Some effort was made to incorporate a quality dimension in the analysis of innovation output. Rather than focusing exclusively on the number of patent filings or size of patent portfolios (i.e. the sum of patents granted and pending patent applications) as a proxy for innovation output, the Commission took into account how often a given patent was cited in subsequent patent applications by other firms (so-called 'external patent citations'[106]). It thus accounted for the heterogenous quality of filed and granted patents which is not picked up by purely quantitative measures. Instead of focusing exclusively on the number of patents filed or granted, the (external) patent citations index provides a much more faithful representation of a patent's quality, in terms of its technological relevance and contribution to the state of knowledge and subsequent inventions.[107]

Despite the fact that this approach attributes greater weight to patents that are cited more often, it remains skewed towards innovation efforts that contribute to the currently predominant innovation path. It, therefore, tells us little about the direction or diversity of a firm's innovation ventures. Similarly, the 'new AI launch' benchmark, which weighs the number of newly launched AIs against their turnover generated within a given period,[108] focuses on innovation output and gauges its quality exclusively with respect to its commercial success. It measures, thus, how a firm maximises output within the predominant and commercially most successful innovation paradigm. But it fails to reveal any meaningful information on whether the firms are about to break new grounds or discover new innovation paths.

The key concern of this consequentialist understanding of innovation that underpins the Commission's approach is whether post-merger the parties will produce more or less 'innovation quantity and quality'. Quality is understood in single-dimensional terms as commercial success or technological relevance. Such an approach ignores the multi-dimensional aspects of quality of innovation as it examines only whether a merger can undermine the process of innovation that is geared towards conventional agriculture.[109] Yet, quality-related questions such as whether the firms will, after the merger, still have an incentive to explore more diverse innovation paths or whether it will have a greater ability to block alternative innovation paths (e.g. non-chemical or non-GMO driven forms of plant protection and traits) fall outside the realm of the Commission's analysis. In addition, by focusing on innovation output, the Commission refrained from second-guessing the quality of innovation efforts and their environmental impact (e.g. their positive or negative environmental

[104] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 387–395, 2436–2446, Annex I; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 271–273, 1109–1163.
[105] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 396–398, 401, 2332, 2570. Based on both proxies, the Commission calculated the innovation competition market shares of the merging parties, as well as their most important innovation competitors, which turned out to be the remaining integrated R&D players (in Dow/Dupont: Bayer, Syngenta and BASF; in *Bayer/Monsanto*: Dow/Dupont, Syngenta, BASF and FEC).
[106] For a discussion of the role of 'external' and 'internal' (i.e. citations by subsequent patents of the patent-holding firm) citations ibid Annex I, paras. 34–36.
[107] ibid para. 392.
[108] ibid para. 2332.
[109] For a discussion of the analysis of various non-price parameters of competition in merger control OECD, 'Considering non-price effects in merger control – Background note by the Secretariat' (2018).

externalities on biodiversity). As a result, sustainability concerns pertaining to the quality of innovation paths were overlooked.[110]

Under the Commission's consequentialist approach, only if the merging parties are close or very close competitors prior to the merger, their integration within a single firm is likely to reduce innovation competition. This approach entails that a scenario where a merger reduces the incentives or efforts of the merging and non-merging parties to pursue more divergent innovation paths will not raise any concerns. The potential 'crowding-out' effects of a merger on the innovation efforts of firms competing in more remote innovation paths will also be deemed largely irrelevant. Furthermore, under the current approach the Commission might even challenge mergers where the merging parties were to redirect their innovation efforts from the conventional towards more remote and alternative innovation paths. Although such repositioning increases the variety of innovation output, it would entail a reduction of innovation efforts in closely overlapping conventional agricultural technologies and product lines, and soften price competition through increased product differentiation.[111] Likewise, innovation competition would be deemed intensified if the non-merging parties would, in response to the merger, reposition their efforts towards more established innovation paths, and thus render their innovation efforts *less* diverse. However, under such an approach, merger control is more likely to thwart than promote sustainable innovation that deviates from the existing paradigm.

The Commission's consequentialist understanding of innovation, hence, ignores that mergers may not reduce (or even increase) the amount of innovation efforts and still undercut another important dimension of innovation competition, namely innovation diversity understood as variety of innovation paths or projects. Reductions in innovation diversity may have key sustainability implications in the context of food value chains, as they can tip the agrochemical sector towards a certain innovation path or paradigm. On this basis, it could be argued that by clearing the *Dow/Dupont* and *Bayer/Monsanto* mergers the Commission may have facilitated the entrenchment of a conventional model of innovation and agriculture that relies heavily on chemicals and GMO crops, and may have further homogenised or standardised agriculture and food systems. This is because the said mergers were capable of reducing the number of innovation projects that could lead to alternative (more sustainable) technological solutions. In such a context, product and innovation output – within a specific model of agriculture – could

[110] W Kerber, 'Competition, innovation and maintaining diversity through competition law' in R Podszun, W Kerber and J Drexl (eds), *Competition Policy and the Economic Approach: Foundations and Limitations* (Edward Elgar 2011) 193–194 (criticising mainstream economic analysis for focusing on the impact of industry concentration on firms' incentives to innovate and ignoring quality and direction). The mainstream economic approach focuses on the scale of R&D investments as innovation input and innovation as output. S Bhattacharya and D Mookherjee, 'Portfolio Choice in Research and Development' (1986) 17(4) *The RAND Journal of Economics,* 594; DL Rubinfeld and J Hoven, 'Innovation and Antitrust Enforcement' in J Ellig (ed), *Dynamic competition and public policy: Technology, innovation, and antitrust issues* (Cambridge. Cambridge University Press 2001) 74; CA Tisdell, 'Mainstream Analyses of Innovation: Neoclassical and New Industrial Economics' in S Dowrick (ed), *Economic Approaches to Innovation* (Edward Elgar 1995) 30; I Letina, 'The road not taken: Competition and the R&D portfolio' (2016) 47(2) *The RAND Journal of Economics* 433, 435; I Kwon, 'R&D Portfolio and Market Structure' (2010) 120(543) *The Economic Journal* 313, 318–319.

[111] A Gandhi et al, 'Post-Merger Product Repositioning' (2008) 56(1) *The Journal of Industrial Economics* 49, 60. Note that the overall impact of such a merger on consumer welfare depends on whether the gains in surplus consumers derive from greater product variety outweigh the losses of consumer surplus due to relaxed price competition. M Draganska, M Mazzeo and K Seim, 'Beyond plain vanilla: Modeling joint product assortment and pricing decisions' (2009) 7(2) *QME* 105, 107, 140-144.

well increase. What could decrease, though, is the degree of decentralised and diverse innovation that would yield more sustainable forms of crop protection products or traits. [112]

Focusing on directed innovation

Another crucial element of the Commission's output-focused understanding of innovation is its emphasis on directed innovation (i.e. innovation efforts that are already directed at specific discovery targets and innovation spaces). The Commission relied on the merging parties' 'innovation capabilities' and considered 'development efforts for product innovation' and 'discovery efforts for new products' as indicators of innovative behaviour.[113] It analysed the impact of the mergers on existing lines of research in which the R&D organisations were active and worked towards given discovery targets.[114] It also examined the impact of the concentrations on early pipeline products, whose likelihood of successful launch was much lower than that of products which have already reached the development stage.[115] Thus, the Commission understood innovation in broad consequentialist terms as an activity that is channelled towards specific discovery targets and could be maximised if rational agents have the right incentives. If the expected benefits of innovation efforts outweigh the expected costs, then the activity will be undertaken.[116] This was the fundamental assumption of the Commission's analysis.

The Commission's focus on directed innovation efforts is also apparent in its novel approach towards market definition. Instead of delineating clearly circumscribed 'innovation markets' or 'research and development markets',[117] the Commission identified and analysed the impact of the merger on a number of 'innovation spaces',[118] loosely defined as spaces in which innovation competition occurs between R&D players.[119] The Commission followed this approach because it considered that innovation is better understood as an 'input activity for both the upstream technology markets and downstream markets' rather than as a separate market in its own right.[120] This focus on innovation spaces allowed the Commission to account for the fact that innovation competition does not only take place at the very bottom, but across

[112] I Lianos and D Katalevsky (n 34) 23–28; Woodall and Shannon (n 35) 206–216; Gundlach and Moss (n 18) 156.
[113] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 349; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 53, 59, 60, 165-170, 836–841, 866, 870–876.
[114] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 1958; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1017–1019.
[115] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 1959; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) para. 1020.
[116] It should be noted that by examining the impact of the mergers on early pipeline products the Commission went beyond its traditional short-term (2-5 years) time frame for investigating potential anticompetitive effects and instead adopted a long-term time frame of 10-15 years Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2032–2034.
[117] This approach is followed by the US Federal Trade Commission (FTC) and the Antitrust Division of the US Department of Justice (DoJ) Antitrust Guidelines for the Licensing of Intellectual Property 2017 11. See also Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 346 quoting the US Guidelines. The concept of 'research and development' or 'innovation markets' has first been coined by RJ Gilbert and SC Sunshine, 'Incorporating Dynamic Efficiency Concerns in Merger Analysis: The Use of Innovation Markets' (1995) 63(2) *Antitrust Law Journal* 569. The DoJ and FTC referred to this concept for the first time in the 1995 Antitrust Guidelines For The Licensing Of Intellectual Property 10–11.
[118] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 342.
[119] ibid para. 350.
[120] ibid para. 348; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 279, 867, 1008–1023, 1089. These 'technology markets' referred to the sale or licensing of technology developed by companies conducting research and development.

various levels of the relevant value chains.[121] In doing so, the Commission was able to examine how the merger will affect the parties' R&D efforts as important inputs for product innovation.[122]

Nonetheless, analysing innovation competition in clearly delineated innovation spaces where the R&D activities of the merging parties are closely overlapping has a serious shortcoming. Inventive activity within innovation spaces is directed towards very specific discovery targets which have been – at least to some extent – already clearly defined by the parties pre-merger. Under this lens, 'directed innovation' (i.e. innovation paths whose direction has been pre-defined at an earlier stage) becomes the focal point of the analysis.[123] The uncertainty characterising direct innovation does not concern the features of the discovery target but rather the best way or method to reach this target. As a result, by exclusively focusing on directed innovation the Commission turned a blind eye to 'undirected innovation' (i.e. innovation paths whose final technological applications are still unspecified) [124] that may be particularly relevant for the discovery and development of alternative technological solutions departing from the predominant conventional model of agriculture.[125] In addition, by analysing innovation competition in innovation spaces the Commission focused on the innovation efforts of closely competing parties. This approach, however, examines exclusively whether the merger will reduce the duplication of innovation efforts with respect to similar or identical research projects. Yet, it leaves aside the effect of a merger on the number and diversity of alternative innovation paths.

Consequently, under the current approach a merger will appear suspicious only if the merging parties are close or very close competitors prior to the merger and their integration into a single firm is likely to reduce innovation efforts and output towards a specific target. By contrast, a merger that reduces the incentives or efforts of the merging and non-merging parties to pursue more divergent innovation paths will not raise any concerns. The potential 'crowding-out' effects of a merger on the innovation efforts of firms competing in more remote innovation paths will be deemed largely irrelevant.

Backward-looking metrics

Another feature of the Commission's assessment of innovation in *Dow/Dupont* and *Bayer/Monsanto* is that it remained largely backward-looking.[126] For instance, the Commission

[121] Case No COMP/M.7932 *Dow/DuPont* (n 15) para. 351; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1090. For instance, in the case of crop protection products, the R&D players focus on certain lead crops and/or lead pests to develop active ingredients that can, then, be used in a number of downstream (formulated) product markets. The Commission, therefore, underlined that these innovation spaces might be often broader than an individual downstream (crop protection) product market.

[122] In this respect, the Commission adopted an approach that differs from the current practice of the US competition authorities of analyzing innovation effects.

[123] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1010, 1018,1090, 113. Directed innovation could for instance, pertain specific functionalities of crop protection products (e.g., tolerance of a specific crop to a specific herbicide; or crop/pest combination).

[124] For the distinction between directed and undirected innovation P Régibeau and KE Rockett, 'Mergers and Innovation' (2019) 64(1) *The Antitrust Bulletin* 31, 41, 45; Antitrust Division of the US Department of Justice/Federal Trade Commission - Merger Guidelines 2010 section 6.4.

[125] M Blakeney, 'Agricultural Innovation and Sustainable Development' (2022) 14(5) *Sustainability* 2698.

[126] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2032–2034. To address the criticisms about the long timeframe of its analysis, the Commission affirmed that the consumer harm identified was an immediate effect of the merger which materializes within the regular timeframe of 2-5 years, although it might be felt by consumers only in 10-15 years' time.

used backward-looking innovation metrics such as patent shares[127] and new AI shares and launches.[128] Both metrics rely on historic data, and put the emphasis on commercially successful innovation.[129] However, as noted by Bower and Christensen, 'most well-managed, established companies (…) are rarely in the forefront of commercializing new technologies that don't initially meet the needs of mainstream customers'.[130] In general, incumbent firms who owe their market position to successful innovation in the past are most likely to further pursue the predominant, conventional or commercially most successful innovation paths in the industry. This backward-looking approach may overlook how the combination of two key industry players might affect the incentives and ability to venture on alternative and perhaps more sustainable innovation paths of other, commercially less successful innovators. For instance, it may lose sight of how a merger could affect innovation in relation to non-conventional crop protection products or traits/seeds which are less commercially successful but also less detrimental to the environment. As a result, it could reduce the preconditions for disruptive innovation and enhance the risk of path-dependency. Thus, under the Commission's current approach, merger control may end up forestalling instead of spurring innovation.

Furthermore, under the said backward-looking approach, the acquisition of a nascent, distant competitor with low market shares by an incumbent would not raise any red flags. Yet, such acquisitions could be particularly harmful for competition as they can eliminate important innovation players.[131] The latter could significantly contribute to economic growth[132] as they may come up with new valuable inventions, exercise significant pressure on incumbents to innovate, facilitate the entry of new players in the relevant innovation spaces and replace competition in the market with competition for the market.[133] Hence, the adverse impact of further consolidation of the agrochemical industry may not (only or primarily) consist in reducing the existing innovation paths that are already directed towards specific innovation targets but also in reducing the diversity of future and, hence, still undirected innovation. Such adverse effects on undirected innovation could be particularly detrimental in the context of the agri-food sector, where the preservation of undirected innovation is crucial for ensuring the existence of alternative forms of agriculture that enhance sustainability, food safety, environmental protection, food security and biodiversity.

[127] ibid paras. 387–395; Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 271–273, 1109–1163.
[128] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 396–398, 401.
[129] ibid para. 401.
[130] CM Christensen and JL Bower, 'Disruptive Technologies: Catching the Wave' (1) 1995 *Harvard Business Review* 43, 43–44.
[131] *United States v. Microsoft Corporation* 253 F.3d 34 (D.C. Cir.2001) 79. ('it would be inimical to the purpose of the Sherman Act to allow monopolists free reign to squash nascent, albeit unproven, competitors at will . . . .'). Recent economic research on so-called 'killer acquisitions' has propelled this concern about the elimination of nascent competitors as the result of unilateral conduct and mergers to the forefront of the current competition policy debate. The issue of the elimination of nascent competitors is considered in further detail in Section 6 (Option 4) of this article. The discussion about killer acquisitions has been importantly initiated by C Cunningham, F Ederer and S Ma, 'Killer Acquisitions' (2021) 129(3) *Journal of Political Economy* 649.
[132] Small and large firms have different advantages and disadvantages when it comes to innovation: the relevant point here is that both have been, over history, important contributors. T Wu, *The Master Switch: The Rise and Fall of Information Empires* (London, Atlantic Books 2010) 19–20.
[133] Antitrust Division of the US Department of Justice/Federal Trade Commission - Merger Guidelines 2010 (n 124) section 6.4. (describing, as possible effects from a horizontal merger, a "reduced incentive to continue with an existing product-development effort or . . . to initiate development of new products");T Wu (n 132) 18–22, 159.

The hidden foundation of the Commission's output-maximisation approach: a narrow conception of consumer welfare

Another feature of the Commission's theory of innovation harm is its focus on a narrow conception of consumer welfare. For example, the Commission was concerned about the impact of the mergers on innovation competition not only because the merged entities would likely discontinue existing lines of research and pipeline products, but also because they would face reduced competitive pressure to innovate in the long-run, harming thereby consumers.[134] Consumers were also assumed to likely suffer not only due to reduced product variety but also due to reduced intensity of future product market competition.[135] Therefore, the ultimate measure of the social value of innovation was couched in consumer welfare terms. However, this understanding of consumer welfare ignores that environmental gains can be part of consumers' welfare and casts a blind eye to 'objective sustainability harms' and 'out-of-market' effects (e.g. positive or negative environmental or economic externalities).[136]

Recently the Dutch competition authority has pioneered a fresh approach to calibrate the relationship between sustainability and competition law. In one of its key documents, the Dutch enforcer describes 'objective sustainability benefits' as the benefits that are useful not only to consumers, but to society in a broader sense. These sustainability benefits could pertain to a reduction of so-called negative externalities. Such benefits may also involve 'reducing operational costs, increased innovation, quality improvements, or a greater diversity of products on offer, including the introduction of, for example, animal-friendly products or products that guarantee a fair income'.[137] Along similar lines, in *Dow/Dupont* and *Bayer/Monsanto*, the Commission could have identified objective sustainability harms and demonstrated how they can lead to diminished consumer welfare. Such an exercise is feasible under the merger control counterfactual which examines how a concentration might *alter* the factors which determine the state of competition *by comparing* the competitive conditions that would result from the notified merger with the conditions that would have prevailed in the absence of the merger.[138]

There is a wide range of economic methods which the Commission could have used to assess more fully the environmental benefits or costs of the said mergers for consumers. For instance, it could have used existing data to map out consumers' revealed preferences about a state of

[134] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 283, 2016.
[135] ibid paras. 2032, 2034, 3019.
[136] Such an approach is pioneered by the Dutch Competition Authority. Dutch Competition Authority (ACM), 'Guidelines: Sustainability Agreements: Opportunities within Competition Law' (26 January 2021) 12–21. The EU Commission recently followed suit by publishing its draft revised Horizontal Cooperation Agreement Guidelines that dedicate an entire new chapter to the assessment of 'sustainability agreements' and recognise the category of 'collective benefits'. According to the Commission's approach horizontal agreements that pursue a genuine sustainability objective will be granted a soft safe harbour as long as (1) the procedure for developing the sustainability standard is transparent and open; (2) participation is voluntary; (3) participating undertakings should be free to exceed the sustainability standard; (4) any information exchange is limited to what is strictly necessary; (5) access to the standard is non-discriminatory; (6) the sustainability standard does not lead to a significant increase in price (or a significant reduction in the choice of products); and (7) there is a monitoring system ensuring that the participating undertakings comply with the sustainability standard. Draft Communication from the Commission - Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements 2022 C(2022) 1159 final paras. 541–621 and notably 601–608. See contra L Peeperkorn, 'Competition Policy is not a Stopgap!' (2021) 12(6) *Journal of European Competition Law & Practice* 415 (arguing that taking into consideration out-of-market effects would undermine the predictability, rigour and uniformity of EU competition policy).
[137] Dutch Competition Authority (ACM) (n 136) 11.
[138] Commission Guidelines on the assessment of horizontal mergers (n 93) para. 9.

affairs with and without the mergers; conduct contingent valuation (i.e. ask consumers how much they would be willing to pay for the beneficial products deriving from the mergers); run a conjoint analysis (i.e. ask consumers to rank various desirable alternatives); estimate 'defensive expenditures' to value the environmental degradation caused by the mergers as consumer welfare reductions; or attach 'bequest value' to certain environmental resources to account for future consumers.[139] These economic tools would have enabled a type of environmental impact assessment that would be able to account for a wide array of sustainability concerns while simultaneously being fully in line with consumer welfare (understood broadly).[140]

The Commission's narrow understanding of consumer welfare in these cases could also be traced in its assumption of a positive link between innovation maximisation and sustainability. The Commission was adamant in pointing out that more innovation efforts and output within the *existing* innovation paths will generate considerable positive externalities and contribute to the attainment of sustainability goals. For instance, the Commission observed that a higher level of innovation activity and output may have positive externalities on food security and food safety by leading to higher crop yields or lower toxicity rates.[141] Yet, this approach leaves aside the crucial question of whether maximising innovation output in certain lines of research could be sustainability-inimical, and thereby harm other dimensions of consumers' welfare. In other words, a holistic notion of consumer welfare may warrant a merger analysis that distinguishes between sustainable and unsustainable innovation and takes into consideration the quality, diversity, and direction of innovation.[142] Hence, the Commission used merger control to protect output-related innovation competition as if the maximisation of innovation output is the one and only dimension of consumer welfare. It thereby ignored that the diversity, direction, and quality of innovation competition are also crucial for consumers' welfare.

5. INNOVATION COMPETITION AS A POLYCENTRIC PROCESS

The previous section showed that the Commission's theory of harm failed to accommodate all IC-relevant sustainability concerns because it underplayed the impact of the merger on the quality, direction, and diversity of innovation. The main reason for this failure lies in the fact that the Commission conceptualised innovation competition as a process whereby close rivals compete with each other in similar or adjacent lines of research, innovation spaces and paths and strive towards roughly similar innovation targets. Under such an approach, if a merger does not reduce merging and non-merging parties' innovation incentives, capabilities, efforts and output in specific innovation spaces, it does not harm innovation, and should be cleared. The problem with this output-oriented approach is – as already noted – that competition enforcers may end up thwarting instead of protecting or promoting forms of innovation that can lead to more sustainable technological solutions by disregarding the potential impact of a merger on the diversity, quality, and direction of innovation.

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[139] It is not beyond the capacity of environmental economics to find rigorous ways of measuring a wider range of benefits as part of consumers' welfare. AM Hussen, *Principles of Environmental Economics* (Taylor & Francis 2018) Chapters 7 and 8.

[140] These points are not a critique to the Commission's consequentialist approach as such but to its narrow contours. Hence the concerns raised here could be accommodated by a broader output-maximization approach.

[141] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 1977, 1980.

[142] AM Rietveld, JCJ Groot and M van der Burg, 'Predictable patterns of unsustainable intensification' (2021) 3(1) *International Journal of Agricultural Sustainability* 1 (showing that the intensification of banana production increased the average income level indicating improvement in the economic dimension, but it did not yield sustainable outcomes in the other dimensions).

Hence, understanding innovation competition as an output-maximising tool may tilt innovation paths towards the more conventional paradigms of industrial agriculture at the expense of agricultural diversity and sustainability. We, therefore, argue in this section that taking into consideration all IC-relevant sustainability concerns warrants complementing the current approach with an alternative conception of innovation competition consisting in understanding innovation as a polycentric process. Such an approach gives more weight to the quality, direction, and diversity of innovation. Figure 2 shows how the Commission's understanding of innovation in terms of output limited its analysis to an extremely narrow subset of competition-relevant sustainability concerns, and left aside a whole range of other IC-relevant concerns pertaining to innovation diversity. Adopting a broader understanding of polycentric innovation competition is therefore necessary to address this blind spot and bring all remaining IC-relevant sustainability concerns within the purview of the Commission's analysis. Such concerns are associated to the direction, quality and diversity of innovation.

Figure 2 - Innovation output and diversity as subsets of competition relevant sustainability concerns

The concept and its value

We suggest that concerns pertaining to the quality, direction and diversity of innovation can be best understood through theories that concentrate on the process of innovation and scientific discovery itself rather than on quantifiable innovation outputs. This process-oriented notion of innovation has been emphasized by Michael Polanyi and Friedrich August von Hayek. Polanyi considered that scientific discovery and knowledge creation are trigged by the interaction between decentralised and autonomous decision-making centres which pursue diverse approaches and paths to solve a given problem. He described this process of spontaneous coordination of decentralised, independent decision-making as 'polycentricity'.[143] Polycentricity – further refined by the Nobel Laureate in economics Elinor and her husband Vincent Ostrom – refers to processes of social organisation that are structured around many decision-making centres which are formally independent of each other and coordinate their activities through mutual self-adjustment.[144] In other words, polycentric processes are shaped by '(1) many autonomous units formally independent of one another, (2) choosing to act in ways that take account of others, (3) through processes of cooperation, competition, conflict and conflict resolution.'[145]

Central to Polanyi's account of scientific discovery and innovation is the proposition that decentralised, polycentric interactions between scientific teams as independent decision-making centres are more effective in exploring the avenues of potential discovery than any centrally-administered process of knowledge creation and scientific research. Polanyi posited that a scientific problem is more effectively solved if all scientists or teams of scientists choose their 'own problems' and set their discovery targets independently and in a decentralised

[143] M Polanyi (n 23) 34–36.
[144] ibid 170–180. Ostrom, Tiebout and Warren (n 25) 831; Ostrom (n 25) 45.
[145] Ostrom (n 25) 46.

manner.[146] This mode of spontaneous self-coordination is more effective especially in solving tasks whose ultimate solutions are uncertain.[147]

Along similar lines, Hayek stressed that the decentralised processing of knowledge does not only harness more – often unorganised and localised – knowledge than centralised planning, but it also enhances the capacity of the relevant system to adapt to change.[148] This capacity of decentralised, polycentric systems in generating knowledge and discoveries is prominently captured by Hayek's concept of competition as a 'discovery procedure'.[149] Hayek, like Polanyi, underlined the importance of decentralised, polycentric and competitive decision-making for new discoveries and innovation, and put the emphasis on the process of parallel experimentation rather than on outcomes and output.[150] For both thinkers, a polycentric and versatile structure and process that relies on and triggers different mixtures of cooperation and competition is what enables shifts of scientific paradigms, adaptations and mutual learning. Both also perceived the existence of multiple and diverse parallel trials pursued by independent decision-makers as a key reason explaining why competition as an evolutionary trial-and-error process enhances society's welfare and facilitates its technological progress.[151]

Two are the main virtues of the polycentric systems and processes. First, polycentricity can enhance the endogenous capability of a system to develop better solutions to existing problems.[152] A decentralised pursuit of innovation paths by multiple teams ensures that, within the same time, multiple alternative approaches and experiments are undertaken. Such a 'parallel paths' strategy is likely to be much quicker in solving technological problems than a process where a few teams engage in sequential phases of trial-and-error within an already entrenched paradigm.[153] The pursuit of a greater number of parallel approaches by independent teams creates more opportunities of simultaneous mutual learning than the sequential pursuit of a single research project at a time. Simultaneously, a larger number of independent players

[146] M Polanyi (n 23) 36.
[147] ibid 37.
[148] In *The Use of Knowledge*, Hayek develops a knowledge-based argument in favour of capitalism. His key point is that capitalism is essential a process of decentralized information processing and that this process is superior to centralized information processing. The reasons for this superiority lie in the fact that polycentric decentralized planning by individual decision-makers has a greater capacity of gathering and processing information and localized knowledge than a central planning authority. Thus, it would be simply impossible for the central planner to collect and process a sufficient amount of information in order to be in the position to coordinate and micro-manage the economic decisions of the individual market participants. Hayek, Friedrich A. von (n 24) 36.
[149] Hayek, Friedrich A. von, 'Competition as A Discovery Procedure: Translated by Marcellus S. Snow' (2002) 5(3) *The Quarterly Journal of Austrian Economics* 9.
[150] On Hayek's notion of competition as process of parallel experimentation and mutual learning Kerber (n 110) 173, 176–177. W Kerber and NJ Saam, 'Competition as a Test of Hypotheses: Simulation of Knowledge-generating Market Processes' (2001) 4(3) *Journal of Artificial Societies and Social Simulation,* 2.1–2.20.
[151] Kerber (n 110) 173. By progress, here, we mean revolutionising the means and modes of production. Such progress has a value in itself yet it is also likely to bring dynamic efficiency gains that by far outweigh static efficiency and, therefore, has an independent value irrespective of welfare considerations. Robert Solow won the Nobel Prize in economics for demonstrating that gains in wealth are due primarily to innovation – not to marginal improvements in the efficiency of what already exists. See Royal Swedish Academy of Sciences, *Press Release* (1987).
[152] Kerber (n 110) 174, 178–179.
[153] M Polanyi (n 23) 171–175. The virtues of 'parallel path strategies' relative to sequential strategies has been further analysed by RR Nelson, 'Uncertainty, Learning, and the Economics of Parallel Research and Development Efforts' (1961) 43(4) *The Review of Economics and Statistics* 351; WJ Abernathy and RS Rosenbloom, 'Parallel Strategies in Development Projects' (1969) 15(10) *Management Science* B-486-B-505; FM Scherer and WS Comanor, 'Mergers and innovation in the pharmaceutical industry' (2013) 32(1) *Journal of Health Economics* 106.

may lead to a higher number and variety of research projects.[154] Thus, a polycentric innovation process increases the probability of 'doing things better' and 'doing better things'.[155]

The second virtue of polycentric processes lies in the fact that they can increase a system's capacity to absorb or respond to endogenous and exogenous shocks.[156] Polycentric processes decentralize and diversify errors and risks. The more polycentric a system or organisation is, the lower the probability of simultaneous system-wide failure would be, as there will be several parallel, redundant teams striving to find the best solution to a certain problem.[157] If one team choses the wrong path, there will still be numerous other teams pursuing a different path. By contrast, if all teams were to follow the same path, the risk of system-wide failure would increase. Consequently, by mitigating the risk of errors through decentralisation, duplication of efforts and redundancy, the polycentric pursuit of parallel paths reduces the probability of simultaneous failure.[158] Such diversification of the risk of failure across various research paths[159] makes the relevant system more 'resilient'[160] and capable of responding to unexpected changes.[161]

The virtues of this notion of innovation competition that turns on innovation diversity and polycentricity raise the question whether and to what extent the size and number of rivals present in a market affect innovation diversity. This issue is relevant here because even a reader that is convinced about the value of polycentricity as a complement to the Commission's understanding of output-focused innovation competition, could reasonably argue that an industry with a few large players engaging in various innovation paths can perform this function.[162] However, several economic studies suggest that a large number of small firms is

[154] Kerber and Saam (n 150) 1.4–1.5, 2.4–2.8.
[155] Kerber (n 110) 182–185; WM Cohen and S Klepper, 'The tradeoff between firm size and diversity in the pursuit of technological progress' (1992) 4(1) *Small Business Economics* 1, 2.
[156] K Carlisle and RL Gruby, 'Polycentric Systems of Governance: A Theoretical Model for the Commons' (2017) 47(4) *Policy Studies Journal* 927, 936–937; Polanyi (n 23) 117–122; Ostrom (n 25), 139.
[157] Ostrom (n 25) 129; Carlisle and Gruby (n 156) 944–947; Nelson (n 153); Abernathy and Rosenbloom (n 153); Scherer and Comanor (n 153).
[158] Ostrom (n 25) 129; Carlisle and Gruby (n 156) 944–947. On the relationship between decentralised decision-making, multiplicity and diversity of sources of innovation Kerber (n 110) 183–184.
[159] ibid 178–179, 184–185; J Farrell, 'Complexity, Diversity, and Antitrust' (2006) 51(1) *The Antitrust Bulletin* 165, 167. For the positive contribution of diversification of sourcing as an 'insurance strategy' to the resilience of systems and integrated value chains P Régibeau and K Rockett, 'Economic analysis of resilience: A framework for local policy response based on new case studies' (2013) 11(1) *Journal of Innovation Economics* 107, 131, 133–134; V Babich, 'Vulnerable Options in Supply Chains: Effects of Supplier Competition' (2006) 53(7) *Naval Research Logistics Quarterly* 656; V Babich, AN Burnetas and PH Ritchken, 'Competition and Diversification Effects in Supply Chains with Supplier Default Risk' (2007) 9(2) *Manufacturing & Service Operations Management* 123; LV Snyder et al, 'OR/MS models for supply chain disruptions: A review' (2016) 48(2) *IIE Transactions* 89, 96-97, 102; S Hosseini, D Ivanov and A Dolgui, 'Review of quantitative methods for supply chain resilience analysis' (2019) 125 *Transportation Research Part E: Logistics and Transportation Review* 285, 293–294.
[160] We use the term 'resilience' in line with the definition provided by Régibeau/Rockett as 'ability of an economy, society, organisation, or individual to *recover* effectively from an unexpected shock' Régibeau and Rockett (n 159) 109; Kerber (n 110) 178–179, 185; Régibeau and Rockett (n 159) 131, 133–134; Babich (n 159); Babich, Burnetas and Ritchken (n 159); Snyder et al (n 159) 96–97, 102; Hosseini, Ivanov and Dolgui (n 159) 293–294.
[161] The number of relations or actions adjusted per decision-maker per minute in polycentric, self-coordinated orders or teams is thus higher than in monolithic authoritatively controlled teams or social orders. M Polanyi (n 23) 115–117; Nelson (n 153); FM Scherer, 'Time-cost tradeoffs in uncertain empirical research projects' (1966) 13(1) *Naval Research Logistics Quarterly* 71; Abernathy and Rosenbloom (n 153); Scherer and Comanor (n 153) 107–109; Carlisle and Gruby (n 156) 936–937.
[162] A seminal paper by Sah and Stiglitz makes this point showing that the diversity of innovation approaches does not necessarily depend on market structure and that the portfolio of innovation projects undertaken in a given

more likely to pursue a more diverse portfolio of research projects than a small number of large firms.[163] This greater degree of innovation diversity is not – as it has been often argued – the result of greater creativity of small firms, but simply the consequence of a greater number of firms pursuing various approaches. This is the case because an increase in the number of parallel experimenting competitors enhances the knowledge and mutual learning within an industry.[164]

This conclusion is also supported by several studies that examine the role organisational factors play in undertaking inventive activity.[165] Decision-making on innovation projects in large firms is often characterised by a greater number of hierarchical levels compared to small firms. For example, within large firms innovation projects are first proposed by the technical staff, then reviewed by several decision-making levels, and finally approved by a single or a few high-level decision-makers. Given the greater number of hierarchical decision-making levels, the likelihood of a research project being approved decreases with firm size. Hence, even in a scenario where a large firm pursues (or wishes to pursue) multiple research projects, organisational dynamics may prompt each intramural organisation to rely on one or a cluster of similar approaches.[166] On this basis, it could be argued that while a positive relationship between a greater number of firms and innovation diversity does not always hold,[167] there are, at least, some reasons to believe that the greater the number of firms, the greater would be the variety of innovation projects and the more intense polycentric innovation competition.[168] In a similar vein, it seems reasonable to assume that a decrease in the number of firms through a

market does not necessarily vary with market structure. Hence a highly concentrated market structure may thus give rise to the same total number of research projects as a less concentrated one. See RK Sah and JE Stiglitz, 'The Invariance of Market Innovation to the Number of Firms' (1987) 18(1) *The RAND Journal of Economics* 98, 98–99. For a critique of this model see ibid 106–107; SS Reynolds and MR Isaac, 'Stochastic innovation and product market organization' (1992) 2 *Economic Theory* 525, 526–527; RJ Gilbert, J Farrell and ML Katz, 'Market Structure, Organizational Structure, and R&D Diversity' in JE Stiglitz and R Arnott (eds), *Economics for an imperfect world: Essays in honor of Joseph E. Stiglitz* (Cambridge, Mass. MIT Press 2003) 195; Letina (n 110) 436, 442; RJ Gilbert, 'Competition, Mergers, and R&D Diversity' (2019) 54(3) *Review of Industrial Organization* 465, 469; Kerber (n 110) 184–189.

[163] Cohen and Klepper (n 155) 7–9 (noting that as long as the assumption holds that the likelihood of a firm exploring an approach to innovation is independent of firm size, a greater number of firms suggests that an industry will produce a greater amount of technological diversity. Hence, a more polycentric market structure will lead to the exploitation of beneficial approaches to innovation that otherwise would not have been explored. These authors therefore suggest that 'having a greater number of different minds (i.e., firms) evaluate the possible approaches to innovation, will diminish the chance that a beneficial approach to innovation will be overlooked'); Letina (n 110) 443, 441.

[164] Cohen and Klepper (n 155) 7.

[165] ibid 8; Gilbert, Farrell and Katz (n 162) 210–217. This argument draws on the seminal work by RK Sah and JE Stiglitz, 'The Architecture of Economic Systems: Hierarchies and Polyarchies' (1986) 76(4) *The American Economic Review* 716; RK Sah and JE Stiglitz, 'Committees, Hierarchies and Polyarchies' (1988) 98(391) *The Economic Journal* 451. For similar organisational arguments Nelson (n 153) 363.

[166] Farrell (n 159) 167–168.

[167] Gilbert et al. and Gilbert suggest that the relationship between market structure and innovation variety is comparable to the inverted U-shaped curve. For a similar argument on the relationship between rivalry and innovation efforts see Aghion et al. Gilbert, Farrell and Katz (n 162) 207; Gilbert (n 162) 480–481; P Aghion et al, 'Competition and Innovation: An Inverted-U Relationship' (2005) 120(2) *The Quarterly Journal of Economics* 701.

[168] Sah and Stiglitz (n 162) 106–107; Reynolds and Isaac (n 162) 526–527; Gilbert, Farrell and Katz (n 162) 195; Letina (n 110) 436, 442; Gilbert (n 162) 469; Kerber (n 110) 184–189.

horizontal merger may adversely affect the variety of approaches to innovation pursued within an industry.[169]

The sustainability benefits of polycentric innovation competition

Polycentric innovation competition leading to greater innovation diversity is particularly relevant in market contexts where sustainability is important, such as the agrochemical and agri-food sectors. First, polycentric innovation competition can enhance the technological resilience of agricultural and food-value chains by leading to the development of a wider range of plant varieties or alternative methods of agriculture and crop protection.[170] Studies on food security and biodiversity, for instance, suggest that diversification of crops, seeds, technology and sources of supply enhance food security because they make food systems less vulnerable to external variability shocks (e.g. climate, pest resistance or market volatility).[171] Consolidation, homogenization and intensification of the current modes of agriculture may increase short-term efficiency gains by reducing wasteful duplication or by promoting the currently most efficient production techniques. Yet, consolidation, homogenization and intensification can also make food systems more vulnerable to exogenous economic or environmental changes and lead to long-term failures.[172] Such shocks may be unmanageable under the technological capabilities of a consolidated agricultural sector. Technological diversity, however, could allow food systems to switch to alternative options, if a predominant technology (e.g. the use of genetically modified organisms) turns out to have devastating consequences for the environment, biodiversity or human health. Polycentric innovation competition, thus, can make food systems and value chains more resilient by creating technological 'option value',[173] and thereby enhance their technological flexibility.[174]

Second, polycentric innovation competition can bolster the long-term environmental sustainability of food systems by favouring the use of less intensive production methods and by reducing the contribution of agriculture to climate change and biodiversity degradation.[175] Various studies on biodiversity and evolutionary economics suggest that diversity and

[169] Cohen and Klepper (n 155); WM Cohen and S Klepper, 'A Reprise of Size and R & D' (1996) 106(437) *The Economic Journal* 925; Rubinfeld and Hoven (n 110) 72, 75; CK Robinson, 'Leap-Frog and Other Forms of Innovation: Protecting the Future for High-Tech and Emerging Industries through Merger Enforcement: Address by Constance K. Robinson Director of Operations and Merger Enforcement Antitrust Division U.S. Department of Justice Before the American Bar Association Chicago, Illinois June 10, 1999'; Kerber and Saam (n 150); Scherer and Comanor (n 153); Kerber (n 110).

[170] For the argument that technological change is a self-reinforcing process that constantly pushes the economy into a permanent state of disruption see B Arthur, *Complexity and the economy* (Oxford, Oxford University 2015) 5–6.

[171] ME Schipanski et al, 'Realizing Resilient Food Systems' (2016) 66(7) *BioScience* 600, 602–603, 605.

[172] CA Tisdell, 'Economics and the Debate About Preservation of Species, Crop Varieties and Genetic Diversity' (1990) 2 *Ecological Economics* 77, 87–88.

[173] For the notion of option value, BA Weisbrod, 'Collective-Consumption Services of Individual-Consumption Goods' (1964) 78(3) *The Quarterly Journal of Economics* 471; KJ Arrow and AC Fisher, 'Environmental Preservation, Uncertainty, and Irreversibility' (1974) 88(2) *The Quarterly Journal of Economics* 312.

[174] Kerber (n 110) 179, 183–185.

[175] Intergovernmental Panel on Climate Change (IPCC), 'Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems - Summary for Policy Makers' (2020) 30. Currently, the contribution of agriculture, forestry and other land use activities account for about 13% of the total CO_2 emissions ibid 10–15, 468–472. In general, food systems (including production, packaging, transport, distribution) account for about 21-37% of all total greenhouse gas emissions. ibid. Chapter 5 – Food Security' (2020) 476. See also OECD, 'OECD Agro-Food Productivity-Sustainability-Resilience Policy Framework: Revised Framework' (2020) TAD/CA/APM/WP(2019)25/FINAL. (considering that productivity, sustainability and resilience should be the key desired goals of all food and agricultural systems).

heterogeneity enhance the resilience, stability and sustainability of ecological and economic systems.[176] There is also a broad scientific consensus that biodiversity enhances the stability and resilience of ecosystems because a broader pool of genetic material or species with diverse characteristics enable ecosystems to swiftly respond to exogenous shocks and adapt to new circumstances.[177] Therefore, innovation diversity deriving from a polycentric competitive process can enhance biodiversity and biological stability, and thereby strengthen the sustainability of food systems.[178]

Third, polycentric innovation competition can strengthen the economic and social sustainability of agricultural and food value chains by enabling farmers to multi-source agricultural inputs, such as crop protection products, seeds or plant varieties. Diversification and multi-sourcing may protect farmers against exercises of market power by bolstering their bargaining power *vis-à-vis* large sellers of agricultural inputs, and by increasing their opportunities to diversify their sources of livelihoods. As a result, farmers could become more able to protect themselves against unforeseen changes in the upstream level of the agrochemical value chain.[179]

6. OPERATIONALISING POLYCENTRIC INNOVATION

This section identifies and discusses four options through which merger control could operationalise the notion of polycentric innovation competition. This notion is aimed at grasping the adverse effects of mergers not only on innovation output, but also on the direction, quality, and diversity of innovation. These options consist in: (i) using quality-related and sustainability-sensitive innovation metrics; (ii) analysing the industry-wide effects of horizontal mergers; (iii) using structural rules of thumb or presumptions; and (iv) protecting nascent competitors.

Option 1 – A quality-related and sustainability-sensitive innovation metrics

As already noted, the key question underlying the Commission's theory of harm in *Dow/Dupont* and *Bayer/Monsanto* is whether a merger leads to more or less innovation efforts and output. To answer this question, the Commission heavily relied on backward-looking and output-related metrics of innovation, and predominantly examined the impact of the mergers on directed innovation. The Commission's unilateral effects analysis, therefore, only measured the incentives of the firm to raise or lower their innovation efforts post-merger, without assessing the diversity, direction or quality of this innovation output.

To account for the quality-dimensions of innovation efforts, the Commission could have used quality-related and sustainability-sensitive innovation metrics. For instance, instead of measuring the AI output based on commercial success, the Commission could have weighed

[176] For an overview RR Nelson, 'Recent Evolutionary Theorising About Economic Change' (1995) 33 *Journal of Economic Literature* 48; CA Tisdell, 'Economic Competition and Evolution: Are There Lessons from Ecology?' (2004) 22(2) *Contemporary Economic Policy* 179, 184–191; CA Tisdell, 'Diversity and Economic Evolution: Failures of Competitive Systems' (1999) 17(2) *Contemporary Economic Policy* 156, 158–159; CA Tisdell, *Competition, diversity and economic performance: Processes, complexities and ecological similarities* (Cheltenham, U.K, Northamton, MA, USA, Edward Elgar 2013); Farrell (n 159) 168; Tisdell (n 172) 78. (conversely, a smaller gene pool will make it more difficult for ecosystems to adapt to and withstand exogenous shocks).
[177] KS McCann, 'The diversity-stability debate' (2000) 405 *Nature* 228; Kerber (n 110) 178–179, 184.
[178] Tisdell (n 172) 79.
[179] Régibeau and Rockett (n 159) 133–134.

this output with regards to its environmental impact (e.g. by constructing an environmental index of AIs and traits) or with regards to the degree of homogeneity or heterogeneity of the innovation efforts, paths or agricultural models (e.g. by constructing a diversity index of AIs and traits). Another option could be to attribute different weights to innovation paths depending on their impact on certain sustainability parameters.

Such quality-adjusted analysis – which would be more sensitive towards concerns related to the direction and diversity of innovation – would not necessarily marginalise, but only complement Commission's output-oriented unilateral effects analysis. Quality considerations could, for instance, play the role of a tie-breaker, if a merger is likely to generate anti-competitive and procompetitive effects of a similar order of magnitude and the analysis of its overall effects on prices or innovation output remains inconclusive. A relevant question in this regard is what the Commission would need to do if an output-based analysis points to the opposite direction of a quality-based analysis. If, for instance, a merger maximises innovation output but harms innovation diversity, what should be the enforcer's response? Should enforcers be entitled to block a merger that harms certain modes of sustainable agriculture even if there are strong indications that the said merger will lead to higher levels of output? Our response to these queries is that the notion of innovation diversity does not compel a specific trade-off on the part of the enforcer. Different enforcers might decide to attribute different weights to diversity-related (or quality-related) and output-related concerns. Yet, it is important to identify the existence of such trade-offs and grapple with them.

One might argue that in such situations enforcers would engage in impermissible value judgments and maintain that for this reason unilateral effects analysis should be exclusively focused on output. Yet, escaping value judgments and normative choices in EU competition law is not an option as this law is a relatively open normative system which allows for different interpretive struggles and cannot be applied without value judgments.[180] Both taking and not taking into account quality-related, sustainability-sensitive metrics in merger analysis involves a value judgment. In other words, focusing on output-related innovation competition and disregarding polycentric competition is already a value judgment (by omission) by the enforcer. Hence, instead of disguising their value judgments in legal and economic technocracy, enforcers could make them explicit in their decisions and substantiate them by transparent reasoning and sufficient evidence so that they can be re-assessed ex post and refined. Accordingly, when backed by cogent and compelling evidence, competition authorities could legitimately account for the adverse effects of a merger on innovation diversity, rather than simply sweeping them under the rug and relying, instead, on a purely output-oriented assessment of unilateral effects.

Option 2 – Taking structural effects seriously

A second, more direct way to account for the impact of mergers on polycentric innovation competition could be to attribute greater weight on their structural effects. In *Dow/Dupont* and *Bayer/Monsanto*, the Commission conceived competition as rivalry between firms whereby the innovation activity of one firm imposes immediate constraints or externalities on the profitability of the innovation activity of the other. Such an analysis focuses on directed innovation towards specific innovation targets and closely overlapping innovation paths where externalities arising from the business stealing effect of innovation efforts are high and the firms face a major incentive to internalise them post-merger. By contrast, an approach seeking

[180] S Makris, 'EU Competition Law as Responsive Law' (2021) 23 *Cambridge Yearbook of European Legal Studies* 228.

to protect polycentric innovation competition is less concerned about such immediate externalities that firms' innovation efforts impose on each other's profitability. Rather, it is attentive to the structural effects of mergers, i.e. how they may reduce the number of independent decision-making centres.[181] This approach highlights the importance of preserving a polycentric structure with a certain number of independent decision-makers whose innovation efforts do not necessarily impose strong or immediate externalities onto each other at the time of the merger. The openness and diversity of innovation paths is of essence in this respect.

Undoubtedly, certain structural effects were taken into consideration in *Dow/Dupont* and *Bayer/Monsanto* as the Commission did not confine its analysis to the transactions' impact on competition in specific innovation spaces but found that the mergers would also have an adverse effect on innovation competition at an industry-wide level. The Commission noted that pre-merger the parties were operating two of only a few competing global R&D organizations. After the merger, the parties would have the incentive to discontinue one of their two R&D centers to avoid cannibalization and duplication. Such discontinuation would significantly reduce the overall level of innovation competition.[182]

This focus on the industry-wide effect of mergers can at least in part accommodate concerns about the diversity and polycentricity of innovation, and should therefore play an even greater role in the Commission's analysis of innovation competition in future cases. Polycentric innovation competition is negatively affected if, for instance, each of the two merging parties operate pre-merger a R&D organisation capable of pursuing 10 parallel innovation goals/paths (i.e. 20 goals in total) and one of those independent centres is removed post-merger to avoid duplication and to "rationalise" R&D expenses.[183] The elimination of one independent R&D organisation may also significantly lessen the pressure of innovation competition on the non-merging players, who in turn might have fewer incentives to engage in more diverse innovation.

Such concerns could be dealt with, if more weight is attributed to a merger's structural effects on the direction, quality, and diversity of innovation. For example, if the authority establishes that a merger-induced reduction in the number of R&D centres or duplicative innovation efforts (i.e. features of the market structure) is likely to result in a reduction in the variety and diversity of innovation targets and paths, then it can assume that such a merger may have a negative impact on polycentric innovation competition.[184] Structural factors, such as the number of innovation centres and paths, their size, importance and variance, as well as R&D centre-specific market shares and HHI[185] thresholds could be used as diversity metrics. Such an analysis would enable the Commission to take into account certain IC-relevant sustainability concerns that go beyond the paradigm of output-maximising innovation competition.

[181] The externality that the innovation-decision making centres and paths are imposing on each other prior to the merger is not necessarily representative of their importance in ensuring the diversity of innovation paths.
[182] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 278, 1956.
[183] Note that this conclusion hinges on the assumption that the merging parties do not use the synergies arising from the integration of their innovation centres to pursue the same or even a higher number of innovation paths post-merger. At least the empirical evidence from previous consolidation waves both in the pharmaceutical and the agrochemical industry suggests that this will not necessarily be the case.
[184] Such an adverse structural impact on duplicative innovation projects has been found in Case No COMP/M.8677 *Siemens/Alstom* C(2019) 921 final paras. 1277–1281.
[185] HHI ratios, for instance, provide a useful tool to measure diversity of supply of innovation P Adajar, E Berndt and R Conti, *The Surprising Hybrid Pedigree of Measures of Diversity and Economic Concentration* (Cambridge, MA, National Bureau of Economic Research 2019); EH Simpson, 'Measurement of Diversity' (1949) 163(4148) *Nature* 688.

Option 3 – The independent technological choice filter

The structural analysis of a merger on polycentric competition does not necessarily have to take the form of a casuistic analysis of structural effects. An alternative option would be to introduce a structural rule of thumb or presumption against horizontal mergers in markets where there is considerable uncertainty about the direction, quality and diversity of innovation.[186] Rubinfeld/Hoven, for instance, argue that merger policy should preserve a larger number of firms and diversity in firm size in industries in which the best technological development or innovation strategy remains unpredictable.[187] Along similar lines, Farrell advocates in favour of a 'procompetition' presumption against mergers in complex markets where the adverse effects of industry concentration on innovation diversity are difficult, if not impossible, to prove.[188] In these markets, instead of a 'modern', effects-based analysis, a more "naïve", structural understanding of competition may be necessary to preserve the often uncertain benefits of polycentric innovation competition.[189]

There are various options as to how a structural rule of thumb or presumption that preserves 'ecodiversity' could be designed. One promising option, discussed by Kerber[190] and Lianos,[191] consists in transposing the so-called '4-plus rule' developed in the *US Antitrust Guidelines for the Licensing of Intellectual Property* and the *EU Transfer of Technology Guidelines* into merger control.[192] The latter suggest that 'Article 101 of the Treaty is unlikely to be infringed where there are four or more independently controlled technologies *in addition to* the technologies controlled by the parties to the agreement that may be substitutable for the licensed technology at a comparable cost to the user'.[193] According to the US Guidelines if 'four or more independently controlled entities *in addition to* the parties to the licensing arrangement possess the required specialized assets or characteristics and the incentive to engage in research and development that is a close substitute of the research and development activities of the parties to the licensing agreement' an antitrust problem is unlikely to arise.[194] Hence, both Guidelines establish a minimum number of alternative and independent technologies or research paths to be protected by competition law. This approach is clearly geared towards preserving a certain degree of meaningful innovation and technological diversity.[195]

The application of the 4-plus rule to merger control would provide competition authorities with a structural filter to assess the extent to which a merger can affect polycentric innovation

[186] Cohen and Klepper (n 155) 9.
[187] Rubinfeld and Hoven (n 110) 75–76, 86; FM Scherer and D Ross, *Industrial market structure and economic performance* (Boston, Houghton Mifflin 1990) 654.
[188] Farrell (n 159) 168–173.
[189] ibid 171–173.
[190] Kerber (n 110) 191–194.
[191] Lianos (n 29) 358–359.
[192] 1995 Antitrust Guidelines For The Licensing Of Intellectual Property (n 117) 22–23; 2017 Antitrust Guidelines for the Licensing of Intellectual Property (n 117) 24–25. 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
[193] Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements (n 193) para. 157. Note that according to these Guidelines if the licensed technology benefits from considerable network effects, alternative technologies are unlikely to offer a 'real' or 'viable' alternative and will impose only a 'limited constraint' upon the licensed technology.
[194] 2017 Antitrust Guidelines for the Licensing of Intellectual Property (n 117) 25 (emphasis added). The US Guidelines do not only account of existing technologies in the product/technology market (as their European equivalent), but also look further upstream at the number of independent research paths in research and development markets Kerber (n 110) 192.
[195] ibid 193.

competition and innovation diversity. Of course, the specific number could vary (e.g. 3 or 5) and the authority can arrive at such a policy decision after investigating the particular features of the specific market (e.g. innovation-related fixed/sunk costs, minimum efficient scale, network effects, common ownership). Such a rule of thumb can be used to estimate whether a merger is likely to lead to a reduction of the technological choice within a given industry or market and can be applied at three levels. First, it can be utilised at an industry level: if a merger leads to a reduction in the number of independent R&D organisations below the critical threshold, the merger could be considered as significantly reducing the choice between independent technologies. Second, it can be harnessed to assess whether within an innovation space a merger leads to a reduction in the number of alternative innovation paths below a critical threshold. Third, it can be applied, as under the *EU Technology Transfer Guidelines*, at the technology or product market level.

The role and weight attributed to such an X-plus rule could vary. It could function as a safe harbour akin to the HHI and market share ratios under the EU Merger Guidelines.[196] Such a safe harbour would be in line with the current EU case law, which clearly precludes any form of legal presumptions of (il)legality in merger control. [197] It would also be consistent with the original use of the 4-plus rule in the *EU* and *US Technology Transfer Guidelines*.[198] Another option could be to forge a rebuttable structural presumption of illegality under which the Commission would challenge any merger that reduces the number of independently controlled innovation paths below the critical threshold, and the merging parties would have to proffer evidence that the adverse effect on innovation diversity is counteracted. For example, the merging parties could rebut the said presumption by showing that the transaction will enable other innovation paths or generate specific efficiencies (e.g. economies of scale or scope in innovation or appropriability advantages associated with greater firm size).[199] This allocation of the evidential burden is in line with the principle of proof proximity which suggests that the evidential burden should lie on the party that is more likely to have access to the relevant evidence.[200]

One might argue that while the economic literature indicates some relationship between market structure and innovation diversity, this relationship is often ambiguous and might be affected by different trade-offs. As a consequence, a structural presumption could be over-inclusive and entail too many type I errors (i.e. prohibit innovation-enhancing or welfare-maximising behaviour). However, there is economic literature that points towards the existence of a qualified positive relationship between the number of firms and the variety of approaches to innovation,[201] and suggests that trade-offs between diversity and firm size emerge only if the

[196] Commission Guidelines on the assessment of horizontal mergers (n 93) paras. 17–21.
[197] Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* (n 53) para. 48; Case T-79/12 *Cisco v Commission* (n 51) paras. 46, 48. By contrast, a structural presumption against mergers leading to an undue level of concentration exists under the US merger regime *United States v. Philadelphia National Bank* 374 U.S. 321 (1963); SC Salop, 'The Evolution and Vitality of Merger Presumptions: A Decision-Theoretic Approach' (2015) 80(2) *Antitrust Law Journal* 269.
[198] According to these guidelines finding that an agreement falls within the safe harbour only suggests that it is unlikely to raise any competitive concerns, while finding that it falls outside of it, does not entail by any means that it is anticompetitive. 2017 Antitrust Guidelines for the Licensing of Intellectual Property (n 117) 25; Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements (n 193) para. 158.
[199] Farrell (n 159) 172.
[200] OE Williamson, 'Economies as an Antitrust Defense: The Welfare Tradeoffs' (1968) 58(1) *The American Economic Review* 18, 24; C Ritter, 'Presumptions in EU competition law' (2018) 6(2) *Journal of Antitrust Enforcement* 189, 206.
[201] Cohen and Klepper (n 169) 931–936, 940; Cohen and Klepper (n 155) 4–7.

innovation gains are difficult to appropriate.[202] On the basis of this literature, it is argued here that the proposed structural presumption could be limited to markets where there is a clear positive relationship between the number of firms and research projects undertaken, or where increased firm size does not entail appropriability advantages,[203] and where further merger-induced concentration is unlikely to generate economies of scale or scope.[204] Such a cautionary approach would limit the scope of the said presumption to markets in which the gains of polycentric innovation competition are most acute. It would also minimise the costs of reducing firm size and maximise the net benefit of innovation diversity.[205]

Such a structural presumption might seem at odds with the existing standard of proof, pursuant to which prohibiting a concentration requires showing that on the balance of probabilities it is more likely than not to significantly impede effective competition.[206] To challenge a merger under this balance of probabilities standard, the competition authority must demonstrate that the likelihood of the merger resulting in anti-competitive effects is equal to or exceeds 51%.[207] However, decision-theoretic literature points out that an optimal standard of proof should not only account for the likelihood of anti-competitive harm but also for its magnitude.[208] If, for instance, the magnitude of harm of a merger and the expected gains of intervention are disproportionately large, a less demanding standard of proof might be more appropriate.[209] Mergers reducing innovation diversity are capable of resulting in such a high-impact/low-probability harm.[210] Antitrust intervention might, in these cases, be warranted even if the posterior probability of anti-competitive harm is lower than 51% due to the broader implications that a reduction of innovation diversity may have (e.g. adverse effects on technological resilience, biodiversity and sustainability). Especially in markets characterised

[202] Gilbert (n 162) 466, 477–479, 481.

[203] The appropriability advantage of firm size is muted in the presence of strong IP protection and product (as opposed to process) innovation ibid 481. Cohen and Klepper (n 169) 943–944.

[204] The advantages of economies of scale in R&D may also be limited if the returns to innovation are not determined by pre-innovation sales and if firms can reap the returns to innovation through rapid expansion of their market share Cohen and Klepper (n 155) 7–9, 11; Cohen and Klepper (n 169) 947–948.

[205] Error costs are likely to be kept low because the presumption is rebuttable. Farrell (n 159) 172–173.

[206] Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* (n 53) para. 47; Case C-12/03 P *Commission v Tetra Laval* ECLI:EU:C:2005:87 para. 43; Case C-265/17 P *Commission v United Parcel Service* ECLI:EU:C:2019:23 para. 32; Case T-79/12 *Cisco v Commission* (n 51) para. 47; Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) para. 108.

[207] Opinion of Advocate General Kokott in Case C-413/06 P *Bertelsmann und Sony Corporation of America/ Impala* ECLI:EU:C:2007:790 paras. 209-211. See for a critical discussion A Kalintiri, *Evidence Standards in EU Competition Enforcement: The EU Approach* (London, Hart 2019) 91–94.

[208] CF Beckner, III and SC Salop, 'Decision Theory and Antitrust Rules' (1999) 67 *Antitrust Law Journal* 41, 60–63; SC Salop, 'An Enquiry Meet for the Case: Decision Theory, Presumptions, and Evidentiary Burdens in Formulating Antitrust Legal Standards' (2017) 17; ML Katz and HA Shelanski, 'Merger analysis and the treatment of uncertainty: Should we expect better?' (2007) 74(3) *Antitrust Law Journal* 537, 546.

[209] Imagine for instance that the Commission finds that a merger will reduce consumer welfare by 150 EUR and generate efficiencies of 100 EUR. Assume further that the probability of the expected harm to materialise is 45%. Under the balance of probability standard requiring that the merger be more likely than not (i.e., 51% or more) to harm competition, the Commission could not block the merger, even though the expected net benefit of intervention is positive and blocking the merger would minimise consumer harm. See also in this sense, Tommaso Valletti and Hans Zenger, 'Increasing market power and merger control' (2019) 5(2) *Competition Law & Policy Debate* 40, 44–45.

[210] Beckner, III and Salop (n 208) 61–62; SC Salop, 'An Enquiry Meet for the Case: Decision Theory, Presumptions, and Evidentiary Burdens in Formulating Antitrust Legal Standards' (n 208) 13, 17– 20; L Kaplow, 'Burden of Proof' (2012) 121(4) *The Yale Law Journal* 738, 772–786; L Kaplow, 'Likelihood Ratio Tests and Legal Decision Rules' (2014) 16(1) *American Law and Economics Review* 1, 13–20.

by 'fundamental uncertainty'[211] a balance of probability standard[212] or an even more demanding 'strong probability' standard, as the one advocated by the General Court recently in *CK Telecoms*,[213] may generate considerable type II errors.

The presence of uncertainty and complexity, thus, may justify a structural presumption based on whether, in case of doubt, it is more reasonable to err on the side of the preservation of a polycentric market structure and innovation diversity.[214] Such a 'precautionary' approach could carry some particular weight in cases – such as *Dow/Dupont* and *Bayer/Monsanto* – where competition and innovation concerns are intermingled with sustainability issues.[215] Leaving aside the particularities of its concretisation, an X-plus rule bears several advantages. One of them is that it escapes the behavioural strictures of the unilateral effects analysis, which requires a showing of closeness of competition between the innovation paths or technologies for inferring horizontal non-coordinated effects. In addition, this rule takes into consideration the substitutability between the innovation paths or technologies, and it allows enforcers to address a merger's adverse effects on more distant innovation paths. The 'independent technological choice' filter, thus, might serve as an additional tool to catch the broader implications of a horizontal merger on polycentric innovation competition. Furthermore, such a filter gives clear signals to the market players and its enforcement would remain predictable and consistent, while the relevant administrative, enforcement and error costs are likely to remain low. To these it should be added that such a rule constitutes a workable way to give effect to the precautionary principle which the Commission is required to integrate into its competition policy under Arts. 11 and 191 (2) TFEU and general principles of EU law.[216]

[211]Frank Knight's seminal dichotomy between uncertainty and risk draws a strict distinction between risk as 'measurable uncertainty' that can be captured by assigning probabilities to specific events or outcomes and (non-measurable) uncertainty to which no probabilistic value can be attributed. F Knight, *Risk, Uncertainty and Profit* (The Riverside Press Cambridge 1921) 20. Uncertainty (in the strict, Knightian sense) about the future development of markets would prevent competition authorities from assigning probabilities to various multiple scenarios and to pick, in keeping with the balance of probabilities standard, the most likely one. Such uncertainty is particularly relevant when it comes to innovation and technological development; it makes it hard to attribute specific probabilities to the harm resulting from an elimination of an innovation path and makes case-specific evidence unreliable. SC Salop, 'An Enquiry Meet for the Case: Decision Theory, Presumptions, and Evidentiary Burdens in Formulating Antitrust Legal Standards' (n 208) 3. See also Farrell (n 159) 170–172.

[212] Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* (n 53) para. 47; Case C-12/03 P *Commission v Tetra Laval* (n 206) para. 43; Case C-265/17 P *Commission v United Parcel Service* (n 206) para. 32*;* Case T-79/12 *Cisco v Commission* (n 51) para. 47; Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) para. 108.

[213] Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) para. 118.

[214] Farrell (n 159) 170–173. In arguing for a presumption in favour of diversity in the presence of uncertainty we draw a different conclusion from authors such as Petit and Teece who suggest that uncertainty characterising notably dynamic market environments may militate against the use of structural presumptions or filters. N Petit and DJ Teece, 'Innovating Big Tech firms and competition policy: Favoring dynamic over static competition' (2021) 30(5) *Industrial and Corporate Change* 1168, 1173, 1183, 1189, 1992; JG Sidak and DJ Teece, 'Dynamic Competition in Antitrust Law' (2009) 5(4) *Journal of Competition Law and Economics* 581, 611.

[215] For this reason, environmental economics literature advocates in favour of a 'safe minimum standard' decision-rule geared towards minimizing the maximum possible biodiversity loss resulting from a specific practice. This approach suggests that the optimal minimax loss strategy consists in preserving a species, unless it is proven that such preservation is not socially optimal. Thus it prefers to err on the side of preserving biodiversity. SV Ciriacy-Wantrup, *Resource conservation: economics and policies* (University of California Press 1968); RC Bishop, 'Endangered Species and Uncertainty: The Economics of a Safe Minimum Standard' (1978) 60(1) *American Journal of Agricultural Economics* 10, 11–12; Tisdell (n 172) 81–82.

[216] According to the precautionary principle in case of scientific uncertainty about the (irreversible) environmental risks, a decision-maker should defer to the anticipation and prevention of such risks. For a more detailed discussion of the role of the precautionary principle for EU competition law see J Nowag (n 6) 175–176, 255–256. In this context such a precautionary approach is not likely to undermine but instead to promote innovation and disruption.

Unlike option 1 (quality-adjusted assessment of innovation effects) and 2 (structural analysis of industry-wide effects), the introduction of a presumptive independent technological choice filter would most likely require a revision of the existing Merger Guidelines and the EUMR as the current case law seems to preclude any form of structural presumption under the EU merger rules. [217]

Option 4 – Protecting nascent competitors

The elimination of a nascent or smaller innovators (e.g. a small seed breeder producing traits for orphan crops) as a consequence of a merger may remove an 'important competitive force',[218] allow the merging or non-merging parties to reduce their innovation efforts, and, thereby, thwart output-maximising innovation competition. Furthermore, the elimination of such market players could be particularly harmful for the direction, quality and diversity of innovation even in the absence of a grave impact on innovation efforts and output.[219] Nascent competitors or mavericks may divert from the predominant technological paradigm and challenge incumbents by exploring fresh innovation paths.[220] Hence, their removal may reduce not only innovation efforts but also innovation diversity, and, thereby, diminish the available paths towards sustainable innovation.[221]

In this regard, it is not surprising that the notion of polycentric innovation competition urges enforcers to scrutinise not only mergers between two closely competing large incumbents but also mergers between distant competitors leading to the acquisition or foreclosure of smaller players by larger incumbents. The elimination of such nascent competitors could remove a product or an innovation project that could grow into a competitive threat and thereby reduce the existing innovation pathways. The same outcome could be achieved even when the target is not a nascent competitor but the merger allows the new entity to exclude, due to its increased market power, such important or nascent competitors. Consequently, the protection of nascent competitors is of paramount importance if merger control is to ensure polycentric innovation competition.

See in contrast A Portuese, 'Precautionary Antitrust: A Precautionary Tale in European Competition Policy' in K Mathis and A Tor (eds), *Law and Economics of Regulation* (Cham. Springer International Publishing 2021).

[217] Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* (n 53) para. 48; Case T-79/12 *Cisco v Commission* (n 51) paras. 46, 48. By contrast, a structural presumption against mergers leading to an undue level of concentration exists under the US merger regime *United States v. Philadelphia National Bank* (n 197); Salop (n 197).

[218] The Commission has regularly used the concept of an important competitive force to challenge mergers that gave rise to competition issues, even though the merging firms were not particularly close competitors Case No COMP/M.6992 *Hutchison 3G UK/Telefónica Ireland* C(2014) 3561 final paras. 206, 208, 451–456; Case No COMP/M.7018 *Telefónica Deutschland/Eplus* C(2014) 4443 final para. 348; Case No COMP/M.7612 *Hutchison 3G UK/Telefónica UK* C(2016) 2796 final paras. 318–326. See however for a stricter standard for finding an 'important competitive force' adopted by the General Court in the recent *CK Telecoms* ruling Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) paras. 170, 174, 216.

[219] SC Hemphill and T Wu, 'Nascent Competitors' (2020) 168 *University of Pennsylvania Law Review* 1879 (defining a nascent competitor as "a firm whose prospective innovation represents a serious threat to an incumbent" and arguing that "protecting such competition is a critical mission for antitrust law, given the outsized role of unproven outsiders as innovators and the uniquely potent threat they often pose to powerful entrenched firms"); Commission Guidelines on the assessment of horizontal mergers (n 93) para. 37. For a discussion of the use of the 'maverick firm' concept. J Bromfield and M Olczak, 'The Role of the Maverick Firm Concept in European Commission Merger Decisions' (2018) 14(2) *Journal of Competition Law & Economics* 179.

[220] Rubinfeld and Hoven (n 110) 72.

[221] Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2009, 2043.

In a recent study, Cunningham et al. analysed acquisitions of innovative targets by incumbents in the pharmaceutical industry and showed that some of these were 'killer acquisitions': the acquirer bought the innovative target solely to discontinue its project and pre-empt future innovation competition from emerging rivals.[222] On certain occasions, it might be more profitable for a firm to buy and shut down a nascent competitor's innovation project or product than suffering the expected losses of revenue resulting from the competitor's market entry or the losses from investing in new products that cannibalize the profitability of existing product lines. This is particularly likely when the target's product overlaps with the acquirer's existing product portfolio, and when the acquirer's market power is large.[223]

In a similar vein, Hemphill and Wu argue that protecting nascent competitors is a critical mission for antitrust law, 'given the outsized role of unproven outsiders as innovators and the uniquely potent threat they often pose to powerful entrenched firm'.[224] The acquisition of young firms with products or services whose competitive significance remains highly uncertain may harm innovation competition if they prevent the emergence of nascent competitors. The parties to such acquisitions might have minor or no current overlaps, or potential overlaps in existing or future markets. In such acquisitions the acquirer is not seeking to eliminate a product from the market but to control the product and, thereby, remove the competitive threat that it poses.[225] Hence, apart from the killer acquisitions – which entail the elimination of a product or the shut-down of an innovation project – nascent acquisitions also may harm potential competition and undermine innovation diversity.

The adverse effects of killer and nascent acquisitions on innovation have become a focal point of the current policy initiatives to address enforcement challenges in digital markets. Over the last decade, digital markets have experienced a steep and steady rise in the number of acquisitions by digital platforms.[226] Most of these deals escaped regulatory oversight, as they fell through the cracks of the turnover thresholds of existing merger regimes. Meanwhile, competition authorities have been reluctant to enjoin the handful of acquisitions of nascent and potential competitors that came under their scrutiny.[227] This attitude has led to a growing perception of under-enforcement of merger control towards nascent and killer acquisitions, notably in digital markets.[228]

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[222] Cunningham, Ederer and Ma (n 131). Some of the acquisitions of Monsanto during the 1980s and 2000s may be considered as killer acquisitions Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1305–1306.

[223] Cunningham, Ederer and Ma (n 131). Their model looks at acquisitions that occur when the innovative target firm's project is still under development, and, therefore, further development is necessary and costly and the ultimate project success is uncertain, and shows that an incumbent acquirer has weaker incentives to continue development than an entrepreneur if the new project overlaps with a product or project in the incumbent's portfolio.

[224] Hemphill and Wu (n 219).

[225] OECD, 'Start-ups, Killer Acquisitions and Merger Control – Background Note' (2020) 10.

[226] J Furman et al, 'Unlocking digital competition: Report of the Digital Competition Expert Panel' (2019) paras. 1.154.1.157, 3.44-3.45; Federal Trade Commission, 'Non-HSR Reported Acquisitions by Select Technology Platforms, 2010-2019: An FTC Study' (2021).

[227] ME/5525/12 *Anticipated acquisition by Facebook Inc of Instagram Inc*; Case COMP/M.7217 *Facebook/Whatsapp* (n 49). See also in this regard FTC v Facebook, Inc. 9 December 2020; E Argentesi et al, 'Merger Policy in Digital Markets: An Ex Post Assessment' (2021) 17(1) *Journal of Competition Law & Economics* 95.

[228] J Furman et al (n 226) paras. 3.42–3.108; J Crémer, Y-Ad Montjoye and H Schweitzer, 'Competition policy for the digital era' (2019) 110–124; Stigler Committee on Digital Platforms, 'Final Report' (2019) 53–54, 67, 86, 89–91; Australian Competition & Consumer Commission, 'Digital Platforms Inquiry: Final Report' (2019) 74–75, 80–83, 105–110; House of Representatives of the United States, 'Investigation of Competition in Digital

Both types of nascent and killer acquisitions pose a fundamental challenge to the EU merger control regime, as nascent innovative players often generate little to no turnover. As a result, their acquisition is often unlikely to meet the jurisdictional turnover thresholds under the EUMR[229] or the national merger regimes. To address this potential gap in the EU merger regime, the Commission has adopted two policy initiatives. On the one hand, to address concerns about start-up acquisitions in the digital sector, the EU Commission proposed a mandatory information obligation for acquisitions by powerful digital 'gatekeeper platforms' as part of the Digital Markets Act.[230] Under Art. 14 DMA (Art. 12 in the proposal), gatekeeper platforms will be required to inform the Commission of any acquisition of firms active in digital markets or in the collection of data regardless of whether it meets the jurisdictional turnover thresholds and notification requirements of Arts. 1 and 4 of the EUMR or national merger rules.[231] On the other, the Commission recently issued a Guidance on the referral mechanism of Art. 22 EUMR that enables Member States to refer mergers to the EU Commission that do not meet the EUMR's turnover threshold but affect trade between Member States and threaten to 'significantly affect competition within the territory of the Member State or States making the request'.[232] The goal of the Guidance is to bring nascent acquisitions that do not have 'Union dimension' within the purview of the Commission's merger review by encouraging and accepting notifications even from Member States that *do not* have a jurisdiction to review the merger under their national competition rules.[233]

The currently pending *Illumina/Grail*[234] merger is the first case in which the Art. 22 EUMR referral mechanism was used by the Commission to scrutinise the acquisition of a nascent innovator that fell short of the turnover thresholds of the EUMR. The acquirer, Illumina, is a leading genomics company active in the development of next generation sequencing ('NGS') systems for genetic and genomic analysis. The target, Grail, is a developer in the emerging market for the development and commercialisation of early cancer detection tests based on gene sequencing technologies.[235] The Commission accepted the Art. 22 EUMR referral of the merger by Belgium, France, Greece, Iceland, the Netherlands, and Norway observing that

Markets: Majority Staff Report and Recommendations' (2020) 11–15, 22–25, 38, 143, 145, 159–165, 392–395; Federal Trade Commission (n 226); European Commission et al, 'G 7 Compendium of approaches to improving competition in digital markets' (2021) paras. 4.14–4.17; OECD (n 225).

[229] Council Regulation (EC) No 139/2004 on the Control of Concentrations between Undertakings (n 46) Art. 1 (2) and (3).

[230] Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act) ('DMA Proposal'). COM/2020/842 final, Art. 12; Provisional final text of a Regulation EU 2022/XX on contestable and fair markets in the digital sector (Digital Markets Act). Dossier interinstitutionnel 2020/0374(COD), Art. 14.

[231] The designated gatekeeper platforms are required to provide information pertaining inter alia to the parties' worldwide turnover, fields of activity, the transaction value, and the nature and rationale of the transaction. The Commission will share this information with the national competition authorities which, in turn, can use this information to refer the merger for assessment to the EU Commission under Art. 22 EUMR. Provisional final text of a Regulation EU 2022/XX on contestable and fair markets in the digital sector (Digital Markets Act) (n 230) Art. 14 (1), (2) and (5).

[232] Council Regulation (EC) No 139/2004 on the Control of Concentrations between Undertakings (n 46) Art. 22.

[233] Commission Guidance on the application of the referral mechanism set out in Article 22 of the Merger Regulation to certain categories of cases [2021] OJ C 113/1 paras. 9–11, 15–16, 19–20. It remains to be seen whether Art. 12 DMA and the new Art. 22 EUMR Guidance constitute two alternative or complementary instruments to scrutinise nascent acquisitions. For the discussion of a joint use of Art. 12 DMA and the Art. 22 EUMR referral tool J-U Franck, G Monti and A de Streel, 'Options to Strengthen the Control of Acquisitions by Digital Gatekeepers in EU Law' (2021) TILEC Discussion Paper No. DP 2021–16 21.

[234] Case No COMP/M.10188 *Illumina/Grail*.

[235] European Commission, *Press release IP/21/4322 – Mergers: Commission starts investigation for possible breach of the standstill obligation in Illumina/ GRAIL transaction* (2021); Case No COMP/M.10188 Illumina/Grail (n 234).

Grail's competitive significance was not adequately captured by its turnover and that its acquisition had the potential to harm innovation competition in an emerging market.[236] When the parties publicly announced in the course of the Commission's in-depth review their intention to consummate the merger in violation of the stand-still obligation in Art. 7 EUMR, the Commission also imposed for the first time interim measures under Art. 8 (5) EUMR to avert any potentially irreparable detrimental impact on competition and prevent the irreversible integration of the two parties.[237]

The Commission's scrutiny of the *Illumina/Grail* merger followed the US Federal Trade Commission's (FTC) decision to challenge the merger. The FTC found that Illumina's next generation DNA sequencing technology platforms constituted an essential input used by Grail and its rivals in the development of novel multi-cancer early detection tests. Post-merger, Illumina, holding a dominant position in NGS platforms, would have the ability and incentive to foreclose Grail's rivals from accessing this critical input and, thereby, to suppress innovation in an emergent technology market that is poised to revolutionise the detection and treatment of cancer.[238] The Illumina/Grail merger, thus, illustrates that the elimination of nascent competitors does not always have to take the form of an acquisition of a distant competitor but may be the result of non-horizontal foreclosure effects.

The steps taken by the EU Commission under the DMA and Art. 22 EUMR suggest that the Commission will be able to scrutinise nascent and killer acquisitions that have the potential to undermine polycentric innovation competition by eliminating niche innovators or crowding out alternative and more sustainable innovation paths without there being a need for revising the EUMR. It remains, however, to be seen whether these procedural tweaks will suffice to enable the Commission to effectively vet such transactions.[239] It also bears noting that the Commission continues to be subject to the strict evidentiary standards for finding the elimination of actual or potential competition as laid down by the EU judiciary and set out in its Horizontal[240] and Non-horizontal[241] Merger Guidelines.[242]

The Commission's decisional practice provides reasons to believe that it possesses sufficient tools to address nascent acquisitions, such as *Illumina/Grail*, that may harm polycentric innovation competition by foreclosing downstream innovators. For instance, the Commission recently held that Google's acquisition of the wearable provider Fitbit may 'have a significant detrimental effect on competition in the digital healthcare sector'[243] on grounds that Google's

[236] European Commission (n 235). The Commission's use of the Art. 22 referral was recently upheld by the General Court in Case T-227/21 *Illumina v Commission* ECLI:EU:T:2022:447.
[237] European Commission, *Press release IP/21/5661 – Mergers: Commission adopts interim measures to prevent harm to competition following Illumina's early acquisition of GRAIL*; Case No COMP/M.*10493 Illuminal/Grail (Art. 8(5) procedure)*.
[238] *Illumina, Inc. and GRAIL, Inc. In the Matter of*. Docket No. 9401 paras. 11–16, 48–78. This complaint followed another challenge by the FTC and CMA of Illumina's acquisition of a direct potential competitor PacificBioSciences that would have removed an innovator producing a higher quality and cost-effective alternative to Illumina's alternative next-generation DNA sequencing technology *Illumina Inc./Pacific Biosciences of California, Inc. In the Matter of* 2019. Docket No. 9387 paras. 43–45, 57–76; *Anticipated acquisition by Illumina, Inc. of Pacific Biosciences of California, Inc*. Provisional findings report. 2019 paras. 8.1 – 8.338. This acquisition was eventually abandoned by the parties.
[239] See for a critical discussion J-U Franck, G Monti and A de Streel (n 233).
[240] Commission Guidelines on the assessment of horizontal mergers (n 93).
[241] Commission Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings [2008] OJ C 265/6.
[242] Commission Guidance on the application of the referral mechanism set out in Article 22 of the Merger Regulation to certain categories of cases (n 233) para. 15.
[243] Case No. COMP/M.9660 *Google/FitBit* C(2020) 9105 final para. 530.

control over Fitbit's user health data would enable Google to foreclose competing 'start-ups and small players […] that compete and contribute to innovation and diversification of the digital healthcare sector'.[244] In *Bayer/Monsanto* the Commission also addressed concerns that the merger would thwart nascent competitors that are active in different levels of the value chain and lead to the lock-in of farmers in integrated crop management ecosystems.[245] Such ecosystems[246] could offer all-inclusive data-driven digital tools to farmers; combine larger datasets and customer networks; preclude breeders of alternative, non-GM orphan traits; and inhibit firms from offering alternative crop protection solutions from reaching a minimum efficient scale.[247]

Despite these advances in the Commission's analysis, several substantive challenges pertaining the nascent/killer acquisition theories of harm remain. In particular, the Commission will have to develop an analytical framework to assess the impact of such acquisitions not only on innovation output (output-maximising innovation competition), but also on innovation diversity, quality and direction (polycentric innovation competition). From the perspective of output-maximising innovation competition, the Commission will have to assess the impact of the acquisition on the merged entity's incentive and ability to reduce innovation efforts and output. This exercise can take place within the framework of unilateral effects analysis.[248] In this regard, the Commission would have to understand the substitutability of existing products in the current market and between potential future products (e.g. these products can be complementary or even unrelated before becoming substitutes); avoid a 'nirvana' or a 'dystopian' counterfactual;[249] explain what features may make a firm a potential maverick or disruptive competitor,[250] and what could be the relevant evidence for assessing whether such an acquisition is anticompetitive; and determine the scope for efficiencies (e.g. development efficiencies or dynamic efficiencies).

The approach of the FTC and the CMA in *Illumina/Pacific Biosciences* can provide some useful inspiration on how to conduct the substantive assessment of killer acquisitions under the lens of the unilateral effects analysis. This merger also took place in the next-generation DNA sequencing market. The leading incumbent Illumina sought to acquire rival Pacific Biosciences (PacBio) which had a market share of only 2-3% but was one of the few firms that had managed to gain a foothold in the NGS market. The FTC brought an action to block Illumina's proposed acquisition of PacBio alleging that Illumina had sought to 'unlawfully maintain its monopoly in the U.S. market for next-generation DNA sequencing (NGS) systems by extinguishing PacBio as a nascent competitive threat', and thereby eliminate current and future competition.[251] The FTC relied on the facts that PacBio and Illumina consistently and routinely refer to each other as competitors, and to the fact that PacBio had made significant

[244] ibid para. 529. This concern was addressed by the parties' final Web Application Programming Interface (API) access commitment that seeks to guarantee continuous access to Fitbit's fitness and health data for competing digital healthcare providers ibid paras. 962–984.

[245] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 1274–1317.

[246] MG Jacobides and I Lianos, 'Ecosystems and competition law in theory and practice' (2021) 30(5) *Industrial and Corporate Change* 1199.

[247] Case No COMP/M.8084 *Bayer/Monsanto* (n 16) paras. 2442–2736 and access to data paras. 2715, 2736.

[248] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (n 93) paras. 24–38.

[249] J Yun, 'Examining Acquisitions of Nascent or Potential Competitors by Digital Platforms 2019: Prepared statement to the United States Senate Committee on the Judiciary Subcommittee on Antitrust, Competition Policy, and Consumer Rights, Hearing on Competition in Digital Technology Markets' (2019).

[250] Antitrust Division of the US Department of Justice/Federal Trade Commission – Merger Guidelines 2010 (n 124) section 2.1.5.

[251] *Illumina Inc./Pacific Biosciences of California, Inc. In the Matter of* (n 238).

technological advancements positioning it as an ever closer competitor to Illumina (which enjoyed a market share of more than 90% in the US NGS market).[252] In addition, the FTC found that market entry was extremely difficult and time consuming; and that the joint patent portfolio of the two firms would lead to the exclusion of any new entrants.[253] Thus, absent the merger – the FTC argued – Illumina would likely discount the prices of its systems, improve their quality, and develop innovative new products, while PacBio would continue to improve its system to reduce costs, increase throughput, and take market share from Illumina.[254] On this basis the, FTC considered that this acquisition would extinguish PacBio as a competitive threat, eliminate existing and future competition between the two companies, and further insulate Illumina's monopoly from PacBio's increasing competitive threat.[255]

Nevertheless, scrutinising such concentrations under the unilateral effects framework presupposes understanding innovation competition purely as an output-maximising device. It has been argued here, though, that the polycentric dimension of innovation competition should not be neglected. Hence, from the perspective of polycentric innovation competition, the Commission will have to deal with a different set of challenges if it wishes to tackle mergers that weaken or eliminate nascent innovators who pursue more remote and diverse innovation targets.

First, competition authorities would have to place 'greater emphasis on the loss of future potential competition between merging firms not currently operating as direct rivals, with a fuller explanation of how this can be assessed'.[256] As currently laid down in the Horizontal Merger Guidelines, the concept of potential competition limits the Commission's ability to impugn the acquisition of more distant nascent competitors that may have the most detrimental impact on innovation diversity. To challenge a merger based on its allegedly adverse effect on potential competition, the Commission is currently required to show that (i) the target 'already exert[s] a significant constraining influence' or that it will with a 'significant likelihood […] grow into an effective competitive force', and (ii) that the loss of this source of potential competition is not compensated by the competitive pressure of other actual or potential competitors post-merger.[257] The wording of the first condition suggests that for the Commission to intervene a certain degree of closeness between the incumbent and the target is required. Alternatively, the Commission will have to establish a 'significant likelihood' of the nascent competitor turning into an effective competitive constraint.

However, such strict conditions ignore that in certain circumstances (e.g. dominant incumbent and high barriers to entry) even the loss of a small constraint might amount to a substantial loss of competition and disproportionately harm consumers.[258] Hence, the Commission will have

[252] ibid paras. 4–6.
[253] ibid paras. 52–55.
[254] ibid paras. 68, 73.
[255] ibid para. 9. It should be noted that the firms failed to substantiate any merger specific efficiencies that would be passed on to the consumers and outweigh the harm caused by the acquisition. ibid paras. 77–78. In a similar vein, the CMA considered that the said merger would result in a substantial lessening of competition. *Anticipated acquisition by Illumina, Inc. of Pacific Biosciences of California, Inc.* (n 238) paras. 36–40.
[256] J Furman et al (n 226) 96; C Shapiro, 'Antitrust in a time of populism' (2018) 61 *International Journal of Industrial Organization* 714, 739–740.
[257] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (n 93) para. 60.
[258] Alternatively, the loss of a prospective small rival might be insignificant if the acquirer faces existing competition and other rivals can easily enter the market. See for instance *Anticipated acquisition by Roche Holdings, Inc. of Spark Therapeutics, Inc.* Decision on relevant merger situation and substantial lessening of

to update its approach to be able to discern whether it is likely that a nascent target can mature into a competitor in the absence of the merger and to what extent there could be specific and sufficient synergies deriving from such a concentration that would counteract or outweigh any potential anticompetitive effects.[259] For this purpose the Commission could place special emphasis on what would be the nature of the product or service innovation should the respective innovation projects be successful; how rare these characteristics could be; and to what extent existing or other potential rivals cannot replicate them.

Second, the assessment of the effects of the acquisition of nascent competitors on future polycentric innovation competition, namely on the quality direction and diversity of innovation, may require the Commission to adopt bolder counterfactuals than the one currently envisaged with respect to the assessment of the elimination of potential competition under the Horizontal Merger Guidelines.[260] Uncertainty about the development of future competition might preclude the Commission from establishing a counterfactual that shows that there is 'significant likelihood' that the target firm will grow into an effective competitive force. Under this standard it seems unlikely that the Commission would be able to challenge a nascent acquisition when the successful product market entry of the target is not the most likely amongst a range of plausible counterfactual scenarios.[261] The likelihood of the 'but for' scenario to occur and the magnitude of the relevant competition harm should play a role in the choice of the relevant counterfactual. Yet assigning probabilities to counterfactuals and choosing the most credible one is not an easy task. Acknowledging uncertainty and aiming for a transparent framework of assessment is, therefore, key in this regard.

What should also be noted is that the limited prospective timeframe[262] of the regular counterfactual analysis is unlikely to allow the Commission to challenge nascent acquisitions that undermine polycentric innovation competition. From the perspective of polycentric innovation competition, the mere pursuit of an independent innovation path increases the probability of greater variety of technological options in the future and, therefore, generates (net present) value for the society in itself, even when the actual probability of success is low. Therefore, a merger that reduces the probability of such future technological variety by eliminating an independent source of innovation efforts could harm polycentric innovation

competition 2019. ME/6831/19. Note also that enforcers could have a convenience bias (i.e., be overly optimistic about potential entry by third parties) and a pessimism bias with regards to the prospects of the target's entry. KPMG identified that in four out of the eight mergers the CMA probably made the wrong decision, which suggested a tendency towards inflated optimism about the likelihood of entry and expansion. See KPMG LLP, 'Entry and expansion in UK merger cases' (2017) 80–82.

[259] For instance, a nascent firm may be particularly good in developing a new product but not as good in diffusing its invention. Therefore, the existence of potential anticompetitive effects would depend on the features of the innovative activity (e.g. whether it involves a product patent or process patent). If, for instance, the merger gives the target better access to funding or an enhanced organisational capability and involves mainly process patents it is likely to generate efficiencies.

[260] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (n 93) paras. 58–60.

[261] This could be the case, for instance, when the success rate of the successful launch of pipeline products is contingent on a sequence of highly uncertain events *Facebook, Inc (now Meta Platforms, Inc)/ Giphy, Inc merger inquiry*. Final report. 2021 paras. 7.18 ff. This decision was recently upheld by the Competition Appeals Tribunal *Meta Platforms, Inc. v Competition and Markets Authority* [2022] CAT 26 paras. 91–129, notably 100–110; See also OECD (n 225) 23.

[262] The usual predictive timeframe of the prospective counterfactual analysis is 2-5 years Case No COMP/M.7932 *Dow/DuPont* (n 15) paras. 2032–2034.

competition, and thereby lead to consumer harm (understood on broad terms), even when there is significant uncertainty surrounding the eventual successful market entry of the target.[263]

A third issue that the Commission would have to deal with pertains to the requisite standard of proof for demonstrating the adverse effects of the killer or nascent acquisition on innovation competition. This issue is related to the problem of the counterfactual but it remains distinct. The current balance of probabilities[264] standard or the even stricter 'strong probability'[265] standard recently endorsed by the General Court would require the Commission to demonstrate anticompetitive effects with a likelihood of at least 51% or more. This strict standard may prevent the Commission from challenging acquisitions of nascent competitors whose future competitive relevance is shrouded in considerable uncertainty. One might therefore wonder whether the Commission will be able to effectively tackle nascent acquisitions, which are brought within the remit of its merger review through the Art. 22 referral mechanism and/or Art. 14 DMA, [266]without lowering the standard of proof. Such relaxation of the standard of proof for start-up acquisitions by incumbent digital platforms is currently envisaged in the UK. Under the proposed regulatory regime for platforms with strategic market status (SMS), the CMA would be empowered to use the lower and more cautious 'realistic prospect' standard of proof – currently reserved for the phase 1 analysis of 'conventional' mergers – instead of the regular 'balance of probabilities' standard that is used in its phase 2 merger assessment.[267] Decision theory[268] would support a similar lowering of the standard of proof under the EUMR for nascent acquisitions that have the potential to cause harm of a significant magnitude – for instance, by removing a nascent competitor that can significantly contribute to innovation diversity and sustainability – even if such harm is not the most likely outcome of the merger. Nonetheless, such a reform of the standard of proof would likely require a revision of the EU Merger Guidelines and the EUMR.

7. CONCLUSION

Even though Alfred Marshall, the founder of neoclassical economics, stressed the importance of diversity and variety as a driver of technological competition and progress, this process-based understanding of innovation competition is only captured to a limited extent by the mainstream legal and economic thinking on merger control.[269] The analysis of *Bayer/Monsanto* and *Dow/Dupont* mergers undertaken in this study suggests that the Commission conceptualised innovation competition on broad output-centred terms but anchored its analysis in a narrow understanding of consumer welfare. By focusing on innovation efforts and output, the Commission underplayed the impact that the said mergers might have on the quality, diversity and direction of innovation. This output-centred approach attributes insufficient

[263] Case No. COMP/M.7275 *Novartis/ GlaxoSmithKline Oncology Business* para. 108. This concern has played an important role in the CMA's recent decision to block the *Facebook/Giphy* merger *Facebook, Inc (now Meta Platforms, Inc)/ Giphy, Inc merger inquiry*. Final report. (n 261) paras. 7.17, 7.21, 7.153; Merger Assessment Guidelines (n 11) paras. 5.4 and 5.20.

[264] Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* (n 53) para. 47; Case C-12/03 P *Commission v Tetra Laval* (n 206) para. 43; Case C-265/17 P *Commission v United Parcel Service* (n 206) para. 32; Case T-79/12 *Cisco v Commission* (n 51) para. 47; Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) para. 108.

[265] Case T-399/16 *CK Telecoms UK Investments v Commission* (n 53) para. 118.

[266] A Christiansen and W Kerber, 'Competition Policy with Optimally Differentiated Rules Instead of per se Rules vs. Rule of Reason' (2006) 2(2) *Journal of Competition Law and Economics* 215.

[267] A new pro-competition regime for digital markets - Advice of the Digital Markets Taskforce paras. 4.149 – 4,153 and Annex F paras. 89–123.

[268] See literature discussed in footnotes 208 – 210.

[269] Marshall and Alfred, *Principles of economics: an introductory volume* (Macmillan 1920) 355.

weight to polycentric innovation competition whereby independent actors pursue multiple and diverse parallel innovation paths.[270] This form of innovation competition can neither be fully reduced to quantifiable metrics nor solely evaluated in terms of outcomes.

Consequently, by emphasising the output-related parameters of innovation competition and by neglecting the role of the quality, diversity, and direction of innovation in agrochemical markets, the Commission was not able to take into consideration all IC-relevant sustainability concerns. The said mergers raised certain sustainability concerns pertaining to their impact on environmental protection, biodiversity, food security and food safety. Some of these concerns could have passed the threshold test articulated by the Commission and endorsed in this paper, and be considered as falling within the ambit of the EUMR since they were the immediate result of a reduction of innovation competition triggered by the mergers. Had the Commission conceptualised innovation competition as *both* an output maximising device and a polycentric process, it would have been able to account for the potential adverse effect of industry consolidation on a broader range of IC-relevant sustainability parameters (i.e. not only the ones that are related to innovation efforts and output, but also the ones that are related to the diversity, quality and direction of innovation).

To address this shortcoming, this paper proposes a complementary understanding of innovation competition as a polycentric discovery process characterised by a diversity of parallel paths and independent decision-making centres. In addition, to operationalise this approach we explore four possible options. We argued that merger control can preserve polycentric innovation by placing a greater weight on quality-adjusted theories of harm; by focusing on the industry-wide effects of mergers; by using structural filters, and by protecting nascent competitors from killer acquisitions. These proposals are informed by the realisation that there is an intricate relationship between innovation, competition, and sustainability, and aim to enable merger control to account for the subset of all IC-relevant sustainability concerns. EU merger control does and should play a key role in ensuring a high level of and a wide variety of sustainable innovation. This being said, the relationship between competition and innovation remains complex and more theoretical and empirical research is necessary to obtain a better understanding of the various, often conflicting effects and trade-offs that a merger may have on the direction, quality, and diversity of innovation.[271]

[270] Kerber (n 110) 173–178. Hayek, Friedrich A. von (ed), *Individualism and Economic Order* (Chicago, University of Chicago Press 1948) 92–94. Hayek, Friedrich A. von (n 24) 319–320, 330.
[271] See for a similar conclusion Kerber (n 110) 196.